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Abstract

We exploit the introduction of an open data online platform - part of a transparency program initiated by the Italian Government in late 2014 - as a natural experiment to analyse the effect of data disclosure on mayors' expenditure and public good provision. First, we analyse the effect of the program by comparing municipalities on the border between ordinary and special regions, exploiting the fact that the latter regions did not participate in the program. We find that mayors in ordinary regions immediately change their behaviour after data disclosure by improving the disclosed indicators, and that the reaction depends also on their initial relative performance, a yardstick competition effect. Second, we investigate the effect of mayors' attention to data disclosure within treated regions by tracking their daily accesses to the platform, which we instrument with the daily publication of newspaper articles mentioning the program. We find that mayors react to data disclosure by decreasing spending via a reduction of service provision, resulting in an aggregate decrease in efficiency. Overall, mayors seem to target variables that are disclosed on the website at the expense of variables that are less salient.

JEL-Codes: H720, H790.

Keywords: open data, local government, media coverage, OpenCivitas.

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1 Introduction

Open data initiatives started spreading in the late 2000s on the grounds that the enormous amount of information collected by governments should be available to all citizens. As of 2021, the World Bank has counted more than 250 government open data initiatives in almost 50 developed and developing countries and more are launched every year (Petrov et al. (2014)). In Europe, open data initiatives are becoming increasingly relevant as monitoring tools in the public sector, growing especially among local and regional governments (EU Open Data Maturity Reports (2019)). Policy makers often argue that availability of data and an improvement in citizens' ease of access to, and utilization of, data could produce significant benefits. The World Bank for instance, which is actively urging governments to roll out more open data initiatives, suggests that "more information enable individuals, organizations and even governments themselves to innovate and collaborate in new ways".

Economic theory has a rather different and perhaps more nuanced perspective on the effect of disclosure of information on government performance, and especially on the performance of local governments. In a simple political agency setting with only one government and only one task, if voters have better information about outcome e.g. the quality of a good or service, this generally leads to higher quality of that service provided (Besley (2006)). However, when the agent i.e. the politician has several tasks, it is well-known that revealing information to the principal i.e. the voter about one of these tasks can lead to worse performance on others (Mani and Mukand (2007)).[1] For example, Lockwood and Porcelli (2013) shows that if information about the quality of service provision is made available to voters, this may lead to higher taxation and lower overall efficiency in service provision. Moreover, when the voters can compare their own local government to other similar ones, this will enable or accentuate yardstick competition. In this case, the response of local governments to disclosure will depend on how they are initially performing relative to other local governments.

There is also a growing empirical literature on the effect of data disclosure on the performance of governments, particularly for developing countries, as described in more detail in the next section. However, most of the case studies are for developing countries, and often involve experiments in the field rather than large-scale programs. Data disclosure programs in developed countries are much rarer; one exception is Comprehensive Performance Assessment, a scheme for local government in England (Lockwood and Porcelli (2013)).

In this paper, we study a data disclosure program for Italian local governments, called OpenCivitas. This program started in 2014, and eventually led to a website, accessible to

[1] This kind of result is well-known in the broader principal-agent literature where the agent has career concerns e.g. Dewatripont et al. (1999).

the public, with detailed information about expenditures and outputs of different kinds of services, as well as an overall index of efficiency on a scale of 0 to 10. This website is now updated annually.

There were two important features of OpenCivitas that we leverage for our study. First, this program was not implemented in the special regions of Italy[2]. Second, there was a testing phase of OpenCivitas from July to November 2014 where only mayors and other staff of municipal governments, not the general public, could access the website. This testing phase had the unique feature that all access events were recorded. In particular, we know the time (to the second) and date of access, and which specific information they accessed. Over this period, only data on expenditure were visible to mayors: in particular, the salient feature of the website was a 0-10 expenditure score, which was higher, the closer expenditure was relative to a standard spending assessment for the municipality.

In the first exercise, we exploit the exclusion of special regions from the OpenCivitas initiative. We use a standard difference in differences approach to identify the effect of OpenCivitas on public spending and efficiency indicators by comparing neighbouring municipalities located close to the borders of ordinary and special regions. We find that municipalities whose data was disclosed reacted by improving the published indicators and only those indicators. For example, current expenditures started to fall in 2014, as soon as the expenditure score was released on OpenCivitas. Moreover, these effects are quite large, with improvements of between 6% and 18% relative to the baseline. Similarly, waste recycling started to increase up to 20% in treated municipalities relative to the baseline.

We also extend this analysis to look for yardstick competition induced by OpenCivitas. The basic idea is that via the OpenCivitas website, badly-performing municipalities had the opportunity to "benchmark" themselves relative to both the national average score and the score for their region in service provision, and they could also anticipate that in the future, voters and the media would be able to do similar benchmarking. So, using standard arguments from the yardstick competition literature, it is reasonable to expect that municipalities below the regional or national means would make more effort to improve than other "treated" municipalities. We investigate this hypothesis via a triple-difference design, and we do find some evidence of yardstick competition due to data disclosure.

In the second exercise, we use the access events as a measure of the *attention* paid by mayors to OpenCivitas; the more often over the testing period the site was accessed, the greater the attention, and we would expect in turn that this would have a greater effect on fiscal policy, in particular expenditure. This analysis of the effect of attention on outcomes, using the the number of access events by a mayor on the webpage (*clicks* in

[2]Italy there are 15 ordinary regions and 5 special statute regions. The special regions are: Friuli-Venezia Giulia, Sardinia, Sicily, Trentino Alto-Adige, Val D'Aosta. More details in section 3

what follows), is really the distinctive contribution of this paper.

A simple cross-section OLS regression reveals that there is indeed, a negative relationship between the number of clicks by a mayor on the webpage and growth rates of expenditure over the period 2013-2015, the period during which OpenCivitas was introduced. However, it is very possible that these estimates are downward biased, as clicks are likely to be partly determined by unobservable mayor characteristics which also determine their spending choices. In particular, more conscientious mayors, or those with a stronger ethos of public service, plausibly both controlled expenditure more carefully, and also used the OpenCivitas website more.

To deal with the endogeneity issue, we collected data on all mentions of OpenCivitas in the print and online media over the testing period, and in particular the articles where particular municipalities are named in conjunction with OpenCivitas. Our analysis of the relationship between media coverage and access to OpenCivitas shows that mayors react mostly to mentions in the *national* media by accessing the website the following day. Using national media coverage as an instrument for daily clicks, we find first that expenditure does fall significantly, in line with what we would predict.[3] Specifically, we find that an increase in the number of clicks from zero to its mean value implies a percentage fall in growth relative to the control group of between 8% and 13%.

A next question is how this occurs; broadly, the government can deal with a decrease either by reducing output of services, or by increasing efficiency of operations. We find that output growth of treated municipalities fell by at least as much as their expenditure growth, and in line with this, efficiency actually decreased. This is consistent with what we would expect from the principal-agent literature, given that output and efficiency measures were not "visible" (i.e. not published on OpenCivitas) over the period of our data. Finally, it is worth noting that the absolute values of the coefficients in the IV regressions are much smaller than in the OLS regression, consistent with the hypothesis that the OLS coefficients are downward biased and thus overestimate the impact of OpenCivitas.[4]

As a final part of the intensive margin study, we investigate the broader effects of OpenCivitas on the revenue side of the municipal balance sheet. We find that while there is no effect of OpenCivitas on the growth in overall revenues, there is an interesting compositional effect; municipalities that pay more attention to OpenCivitas have lower growth in tax revenues and the property tax rate over the period 2013-2015, but *higher* growth in income from fees. One possible explanation for this effect on the composition of revenue is that mayors who are paying attention to OpenCivitas anticipate that when the website becomes public, *all* aspects of local government finance will come under greater

[3]To avoid further endogeneity issues, we only consider the mentions of other municipalities in the same province when constructing the instrument, as explained in Section 5.

[4]For example, from the OLS estimate, going from none to the average of 9.1 clicks over the period lowers per capita expenditure by 6.2%, an implausibly large figure.

scrutiny by the media; local property and income taxes are highly salient in Italy, as in many countries.[5]

Overall, our results indicate that mayors react immediately when data is disclosed, but only to improve the specific indicators which are visible, and this leads to a deterioration on the “invisible" margins of output and efficiency. This is very much consistent with the principal-agent literature, and suggests that to be effective, and avoid unintended consequences, data disclosure should not only cover nominal expenditures but all the variables representing the actual performance of the administration, and in particular the provision of public goods and services and crucially, spending efficiency.

The remainder of this paper is organised as follows. Section 2 discusses related literature, and section 3 provides the institutional background and more detail about the OpenCivitas initiative. Then, section 4 covers the comparison of treated and non-treated municipalities, which we call the extensive margin analysis. Section 5 covers the effect of mayors' attention to OpenCivitas, as measured by clicks, which we refer to as the intensive margin analysis. Finally, section 6 concludes.

2 Literature

There are several literatures related to the analysis in the paper. Most closely related are papers that study the effects on electoral outcomes and government performance of deliberate policy interventions, or randomised controlled trials, to increase voter information about past government performance. An early and important contribution was Ferraz and Finan (2008), who show that a random audit program of municipalities in Brazil, combined with publication of the audit results in the media, leads to much lower probabilities of re-election for those mayors audited and found guilty of corruption.

Similarly, Björkman and Svensson (2009) studies a randomized field experiment on community-based monitoring of public primary health care providers in Uganda. Community monitoring led to large increases in health care utilization and improved health outcomes. Banerjee et al. (2011) in a field experiment setting in India, investigate the effect of randomly handing out newspapers with report cards on politicians. The results show that having more information on politicians increases turnout, reduces vote buying and improves the vote shares of more efficient incumbents.[6] More recent papers taking an experimental approach include Kendall et al. (2015), Grossman and Michelitch (2018), Banerjee et al. (2020), and Cruz et al. (2021).

However, it is worth noting that almost all these papers study developing countries, and most of them focus only on electoral effects of information disclosure, e.g. changes in

[5]Bracco et al. (2019) find evidence for this revenue substitution effect in election years for Italian municipalities, when there is a direct electoral incentive to cut salient taxes.

[6]For a survey of this literature, see Pande (2011).

voting patterns, rather than changes in policy induced by disclosure. To our knowledge, the only paper that studies the policy consequences of a data disclosure program in an OECD country is Lockwood and Porcelli (2013), which studies Comprehensive Performance Assessment, a scheme for local government in England, using Wales as a control group. However, this scheme provided a simple summary statistic (a "star" rating) for local governments, whereas OpenCivitas provides much more detailed information on local government performance, as explained in Section 3.2. Finally, a unique feature of our study, compared to the rest of this literature, is that we have a measure of the *intensity of use* of the data disclosure scheme by the local government themselves.

A second related literature is that on the effect of media coverage *per se* on electoral outcomes and government performance. In this literature, the extent of media coverage varies not because of deliberate data disclosure policies, but rather because of some exogenous variation in media coverage across sub-national government jurisdictions due to e.g. staggered roll-out of radio or TV stations, geographical features that may impede radio or TV signals, etc. Early and influential papers in this vein include Besley and Burgess (2002), which looks at the effect of media on policy maker responsiveness to natural disasters in India, and shows that state governments act more promptly via public food distribution and calamity relief expenditure where newspaper circulation is high, and Strömberg (2004), which found that U. S. counties with many radio listeners received more New Deal relief funds. More recently, Eisensee and Strömberg (2007) study the effect of news coverage of natural disasters on U.S. international relief spending. Disasters that strike while other newsworthy events are happening get less media coverage, and therefore less political response (crowding out).[7] Other more recent papers using exogenous variations on media coverage include Snyder Jr and Strömberg (2010), Enikolopov et al. (2011), and Wang (2021). This literature relates to our paper because we use media coverage as an instrument for the intensity of treatment by the data disclosure.

Finally, there are a couple of papers looking at the effect of information on political behavior in the context of Italian municipalities. Repetto (2018) shows that a reform that required Italian municipalities to disclose their balance sheets before elections rather than after had the effect of mitigating the strategic behaviors of mayors by reducing the effect of the size of the political budget cycle. Drago et al. (2014) use an original dataset covering the presence of local news in medium-large Italian cities in the period 1993 to 2010 to evaluate the effects of newspaper entry and exit on electoral participation, and they show that newspaper entry increases the efficiency of the municipal government.

[7] They estimate that disasters happening during the Olympics are 5% less likely to make it in the news and 6% less likely to receive relief funds. On politicians actions during newsworthy events which distract the media see also Durante and Zhuravskaya (2018).

3 Institutional Setting

3.1 Structure of Italian Local governments

Italy is a unitary Republic with three layers of sub-national government (Marattin et al. (2021)). First, the territory is divided in 20 regions, five of which have a special statute that gives them higher autonomy from the central government. The second layer comprises 93 Provinces (17 of which are within special regions) and 14 Metropolitan districts (4 of which are within special regions). The third and most important layer of the system is made up of municipalities (*Comuni*), which have a long and important historical tradition in Italy. Municipal governments are ruled by a city council and an executive committee appointed by the elected mayor (*Sindaco*). The council and the mayor are directly elected for a five-year term and are subject to a two-term limit.[8] There are a large number of municipalities, some of them very small. Specifically, there are 7,978 municipalities (1,351 of which are within special regions); 85% of all municipalities have less than 10,000 inhabitants, 75% less than 5,000, 24% less than 1,000 inhabitants, while only 6 cities have more than 500,000 inhabitants. In 2015, municipal spending comprised 6.8% of total current public expenditure, and they provide a wide range of essential public services: environment protection and waste management, social services to elderly and disabled people, childcare and nursery schools, school-related services (such as school meals and transportation), local police, maintenance of municipal roads, management of civil registries, town planning, culture, recreation, and economic development.

In our analysis, we focus on municipalities within normal-statute regions, as they share the same set of fiscal rules and participated in the OpenCivitas network. Municipalities in northern special regions are only used as control group in our difference-in-difference analysis. In particular, the current expenditure of all municipalities is fully financed by local taxes and fees plus horizontal (non earmarked) equalization grants, although the grant formula is different for municipalities in the special regions in the north of Italy.[9] Specific grants are exceptional and earmarked; they are a residual source of funding provided by the central or the regional government, in favor of municipalities with specific investment needs.

Municipalities' own fiscal revenues come from two main sources: first, local taxes, among which the most relevant are the Property Tax (called "ICI" until 2011 and "IMU" afterward), the tax on waste disposal (called "TARSU" until 2011 and "TARI" afterward), and the local income tax surcharge, and second, local fees related to road and traffic,

[8] The electoral system is different according to the population: in small municipalities (below 15,000 inhabitants) there is single-round plurality system; instead, in larger municipalities (above 15,000 inhabitants) there is a run-off system.

[9] Up to 2014, these grants were allocated based on historical expenditure; after that, a new equalization system based on the difference between standard expenditure needs and fiscal capacity has been gradually introduced, with the goal of completely replacing the previous method by 2030.

libraries, theaters and culture, burial services, and other services such as the occupation of public spaces, public billboards, certificates. According to the Italian Constitution, all local governments are subject to a balanced-budget constraint and a fiscal deficit is allowed only to finance capital expenditure.

3.2 Fiscal equalization and the OpenCivitas project of online data disclosure

In May 2009 (Law no. 42/2009) the Parliament introduced a plan for a new equalization system for local government grant funding, based on standard expenditure needs and fiscal capacity. A first step in implementing this new system was to calculate assessment of Standard Expenditure Needs (SENs) for all 6702 municipalities not in special regions. This was achieved by the end of 2013, at which point the Italian government produced the first wave of the SENs.

As part of this process, the Italian government decided to integrate the information provided by official sources (budget sheets, National Institute of Statistics, Ministry of Education, Land Registry Office, etc.) with new data collected via questionnaires sent to all municipalities. This questionnaire asked about expenditure and service levels for a number of different service categories, as described in detail below. From our point of view, the interesting feature of this data collection exercise is that besides the evaluation of SENs, the data collected through the questionnaires were used to produce a simple system of performance indicators, providing basic information on how each municipality uses its resources for the provision of the essential services. In the first wave of the analysis of the data, between 2014 and 2015, the main computed indicator was the gap between the standard and actual expenditure for each service.

After the computation of SENs and performance indicators, the Italian government decided to publish online the data collected through the questionnaires along with the system of performance indicators. This was done using an online portal named OpenCivitas. There were two stages to the publication of this data. First, OpenCivitas was opened on the 16th July 2014; on the same day, each municipality received an official e-mail from the Ministry of Finance advertising the new initiative. In order to test the system, for a period of just over four months, information was only visible to local administrators (the mayor and members of the council) who received a password to access the system. On November 18th 2014, the website was opened to the public, thus removing the need to sign in through credentials.

It is important to note a number of features of the testing phase. During this phase, the only performance indicators shown on the website were the following. There was information on the following categories of expenditure: total expenditure, central general services, local police, education, public roads and planning, waste management, and social care. For each category, the actual expenditure level and standard expenditure level for

any municipality were available to view.[10] In addition, for each category of expenditure, there was a score out of 10 for that municipality, which measured the difference between actual and standard expenditure - the larger this difference, the lower the score. Crucially for our purposes, OpenCivitas allowed each municipality compare its data with the data of other authorities. Moreover, each municipality could also benchmark its indicators against the national and the regional average levels. So, the information actually seen by those with access to OpenCivitas during this period would be as the one actually online except that only actual expenditure, standard expenditure and the expenditure score (out of 10) would be seen.[11]

Between July 16th and November 18th 2014, the access to the system was fully monitored, recording more than 63000 'access events' involving 13% of Italian municipalities. An access event occurs when the mayor or council member of one municipality opens the page of another municipality, or his own. It has been possible to track, for each access, which pages of the website each mayor viewed e.g. those relating to particular services, etc., and for how long they were viewed. For example, we know that the most visited web-pages concern the local police service. Figure 1 indicates which municipalities accessed OpenCivitas at least once during the testing phase. Every dot on the left-hand map indicates a municipality; every dot on the right-hand map indicates a municipality which accessed OpenCivitas at least once. It is clear that municipalities in the north and centre of Italy were more likely to make use of OpenCivitas than those in the south.

A feature of the testing period is that the launch of OpenCivitas on July 16th was publicised to the Italian media, and following that event, passwords to OpenCivitas were informally circulated to many media outlets. The result was that there were a large number of mentions of the scores of individual municipalities in the media during the testing period. We exploit this media coverage as explained in more detail in Section 5 below.

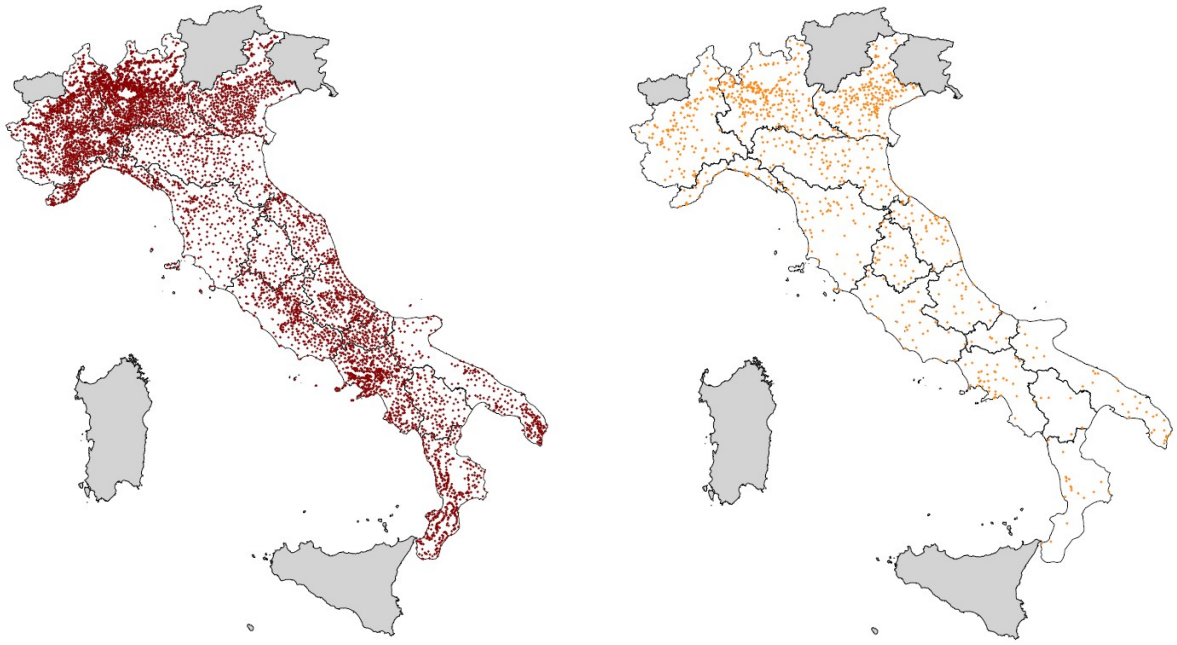
After the testing period, the website was opened to the public in in November 2014, but until 2016, only the expenditure indicators were available for viewing. Then, in at the beginning of 2016 for each type of service, a second output indicator was computed based on the gap between the standard and actual level of services delivered, where the measure used was some dimension of quality.[12] For example, for waste disposal, the quality indicator is the percentage of waste recycled. An aggregate index for all output was then constructed by taking a weighted sum of the individual indicators, weighted by expenditure shares, and then dividing by municipal population. We call this the

[10] Standard expenditure corresponds to the level of expenditure used to identify formula grants.

[11] To be precise, the expenditure score shown online now is reversed relative to how it was shown in 2014 i.e. a higher score now measures higher expenditure relative to the standard. Also, today, OpenCivitas site displays other indicators as explained below.

[12] The new set of indicators became available online in 2015.

Figure 1: Municipalities Active on the Website During the Testing Period



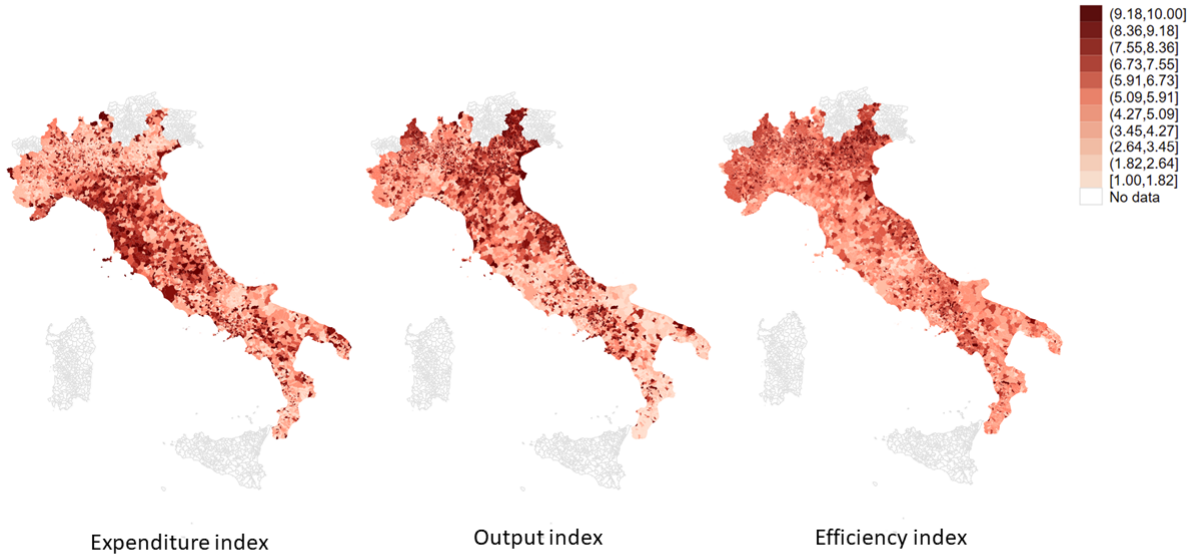
Note: The left-hand figure shows all municipalities in ordinary regions, and the right-hand figures shows all municipalities active on the OpenCivitas website. 'Special' regions, which did not participate in OpenCivitas, are indicated in grey.

output index in what follows.[13] Finally, the average between the expenditure and the output indices was used by the Italian central government to produce an overall index of municipal efficiency, as a score between 0 and 10. As an example, Figure 2 reports the three indices published in OpenCivitas in 2016.

The important point here is that these new indicators were *not* available to mayors during the testing period and it is very unlikely that mayors would have anticipated in 2014 that the public would be able to view these other indicators in the future. Thus, it is a reasonable hypothesis that in 2014, mayors would be focused on the "expenditure score" as described above.

[13]The standard level of services corresponds to the simple average of the level of services provided by municipalities in the same population bracket (local authorities have been divided into ten population brackets from those below 500 inhabitants to those above 100,000 inhabitants). The historical level of services is a composite indicator of the outputs produced in the essential municipal functions: number of users of the social care service, number of users of the ancillary education services, number of fines and controls carried out by local police officers, tons of urban waste recycled, number of authorisations and inspections for planning activities in the environmental and land management sector. Weights correspond to the level of expenditure employed in each service at the national level.

Figure 2: OpenCivitas indices (year 2013, published in 2016)



4 The Effect of OpenCivitas at the Extensive Margin

4.1 The Data Set

As stated in the introduction, our first approach to studying the effect of OpenCivitas is a difference-in-difference analysis of municipalities that were subject to the regime, compared to those that were not. To do this, we build a yearly panel for the 2010-2018 period which we use to compare municipalities in ordinary and special regions. The main challenge here is that for municipalities in the special regions, the additional data collected by OpenCivitas is by definition, not available. In order to make a meaningful comparison, we do need to exploit alternative measures.

Due to these data constraints, we have to focus on just two variables. The first measures service provision in waste disposal, i.e. the fraction of waste which is recycled, or waste recycling rate. This variable has the important advantage that it is *exactly* the measure of output for the waste disposal service that was made available on OpenCivitas in 2016, and so we would expect to see any data disclosure effects to appear strongly in this variable.[14] It should also be noted that waste disposal is very important, comprising around 50% of expenditure of municipalities on average, and even more for small

[14]This variable is from ISPRA, *Istituto Superiore per la Protezione e Ricerca Ambientale* (Superior Institute for Environmental Protection and Research) and was also published on OpenCivitas.it in 2016.

municipalities.

The second is a measure of current expenditure computed for both treated and control municipalities using data from Bureau Van Dijk's *Aida PA*, a company which collects balance sheets for several layers of Italian local administrative units. From these, we extracted data for different categories of expenditure, and we aggregated them according to the definitions of OpenCivitas categories so to mimic the computations originally performed during the program. The resulting variable is consistent across time and it is highly correlated with the expenditure variable that appeared, starting in 2014, on the OpenCivitas website.[15]

For the sake of comparability in terms of geography and cultural traits, we limit our analysis to the municipalities close to the border of two special regions, Trentino Alto-Adige and in Friuli-Venezia Giulia. We cannot use the two island special regions, Sicily and Sardinia, for obvious reasons, and we do not use the Val D'Aosta border due to the insufficient number of municipalities in the control group.

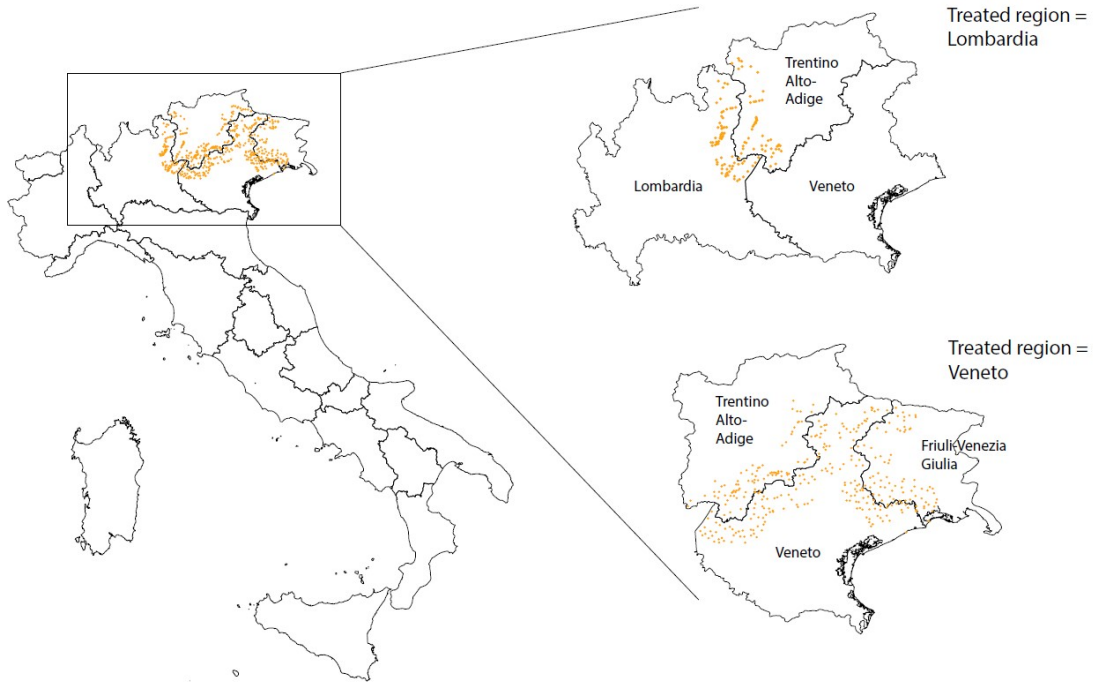
When constructing our dataset, we face a trade-off between proximity to the border and sample size. We set our baseline bandwidth to 20 kilometers from the border as this is the minimum which provides a large-enough sample in terms of statistical power. However, changing the bandwidth to any number between 15 and 25 kilometers does not affect our results (as reported in the Appendix A). Figure 3 shows graphically the two samples we exploit: first, we use the municipalities close to the border between Lombardy and Trentino Alto-Adige, with the latter being the control group. Second, we consider municipalities in Veneto as the treatment group and we compare them to border towns in Trentino Alto-Adige and in Friuli-Venezia Giulia, both special regions.

Finally, as we are studying municipalities in special regions, we are limited for what concerns control variables. We include the time-varying variables available which are municipal population, current and capital grants, which differ between ordinary and special regions[16]. Importantly for our identification throughout the paper, transfers from the central government do not depend on current expenditure or the expenditure score. Up to 2015, transfers were based on "historical expenditure" which in the period of analysis was calculated on 2012 levels. After 2015, central transfers depend on SENs, which mayors have no control over. This reassures us that none of the results is driven by mayors trying to maximize the grants they receive from the central government. In the estimation, we

[15]In particular, for municipalities in Lombardy and Veneto the correlation between per capita expenditure published in OpenCivitas and the new collected source of expenditure is, respectively, 0.85 and 0.75. The correlation is high but not perfect because the Italian Ministry of Finance collected OpenCivitas expenditure through a dedicated questionnaire asking each municipality to further reclassify expenditure items for the evaluation of standard expenditure needs.

[16]In particular municipalities in ordinary regions receive grants both from the central government and regional governments, instead municipalities in special regions receive grants only from regional governments.

Figure 3: Normal Regions (treated) vs Special Regions (control)



Note: The border between Piemonte and Val d'Aosta is excluded from the analysis as the sample of municipalities on the border is too small for statistical inference.

also include municipality and year fixed effects in all regressions, which should pick up most of the variation in unmeasured controls.

4.2 Econometric Specification

We estimate a difference in differences equation as well as the corresponding event study:

$$Y_{it} = \lambda_1 Post_t + \beta(Treat_i \times Post_t) + \mu X_{it} + \alpha_i + \delta_t + \nu_{it} \tag{1}$$

$$Y_{it} = \sum_{t=2010}^{2018} \beta_t(year_t \times Treat_i) + \mu X_{it} + \alpha_i + \delta_t + \epsilon_{it} \tag{2}$$

Here, Y_{it} are the outcome variables, which are the per capita current expenditure and the recycling rate in each year. Also, $Post_t$ is a dummy taking the value one from 2014 onwards and zero before. The choice of starting year reflects the fact that data disclosure to mayors started in July 2014, at which point mayors could still make changes to the budget for that year. Finally, $Treat_i$ is a dummy equal to one if municipality i is in a treated region, and zero otherwise. In equation (1), β is the treatment effect and in

equation (2) β_t are the dynamic treatment effects in the event study. Finally, α_i and δ_t are the municipality and year fixed effects, respectively, and X_{it} is the set of control variables, as discussed above.

4.3 Results

Table 1 reports the estimated β in equation (1), which is the effect of being in an ordinary region after 2013, on the two outcome variables. We consider the two borders separately.

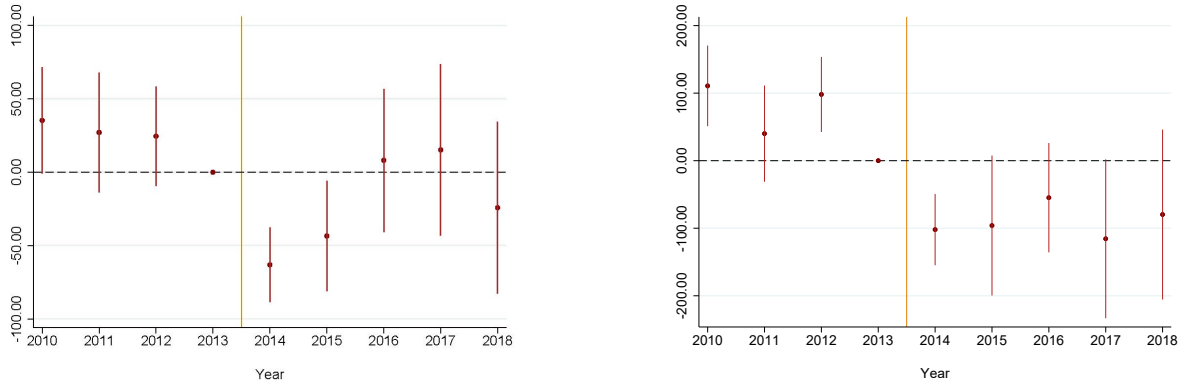
Table 1: Diff-in-Diff approach - OLS on per capita current expenditure and share of waste recycled

	(1)	(2)	(3)	(4)
	Veneto treated		Lombardy treated	
	Current expend.	Waste Recycl.	Current. Expend.	Waste Recycl.
Treatment effect	-42.5283**	0.0029	-152.0280***	0.0984***
	[19.510]	[0.009]	[47.422]	[0.018]
Control variables	Yes	Yes	Yes	Yes
Observations	1,804	1,804	671	671
R-squared	0.037	0.263	0.153	0.388
Municipalities	215	215	81	81

Notes: Standard errors are clustered by municipality. Time period is 2010-2018. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. Population of municipalities on the Veneto border is not significantly different between treatment and control group (mean 1600 inhabitants). Population of municipalities on the border between Lombardy and Trentino is statistically different but the magnitude of the difference is not cause for concern (mean population in the treatment group = 2500, in the control = 3500).

First, we note that municipalities in different treated regions react differently. Although coefficients have the same sign, magnitudes and significance vary across the two regions. In particular, mayors in Veneto seem to to react only by reducing current expenditure, while municipalities in Lombardy react by decreasing expenditure and increasing waste recycling. However, in both cases, the effects are quite large. In particular, municipalities in Veneto reduce expenditure by 42 euros per capita. The average value of the expenditure for Veneto is 678 Euro per capita, so this is a reduction of 6%. In Lombardy, municipalities dcrease expenditure by 152 Euro per capita and increase the share of waste recycled by 9.8% percentage points. For Lombardy, the average value of current expenditure is 807 Euro per capita, so this is a reduction of 18%; the average share of waste recycled is 0.50, so this is an increase of 20%.

Figure 4: Per Capita Current Expenditure



(a) Veneto (b) Lombardy

Note: Dynamic effects of data disclosure on per capita current expenditure by municipality and year. Coefficients and 95% confidence intervals. Time period is 2010-2018, with 2013 as the baseline omitted year. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. Standard errors are clustered by municipality.

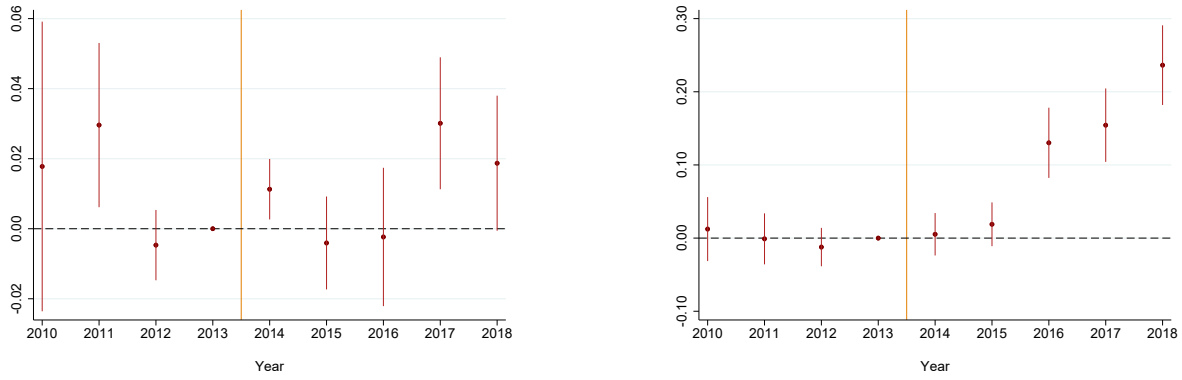
In order to further interpret these findings, we turn to look at the dynamic effects from the event study regressions. Figure 4 shows how current expenditure changed over time on the borders of Veneto and Lombardy respectively. First, we can see that in the first year after data disclosure, municipalities in both Veneto and Lombardy significantly reduced current expenditure. However, this effect was only temporary in Veneto, while it was more persistent in Lombardy. A final investigation shows that most of the expenditure reduction comes from the general administration function (more details are reported in the Appendix A.1).

Figure 5 shows the event studies for the recycling rates. When considering municipalities in Veneto as the treatment group, we find no strong evidence of a data disclosure effect. Mayors in Lombardy, on the other hand, react with a large and significant increase in recycling starting from 2016.

To understand the difference in reactions regarding recycling, we need to consider two facts: first, OpenCivitas featured an interactive tool for easy comparison between municipalities. Mayors simply had to choose the name of different municipalities -or regions- from a drop-down menu and the website would generate a numerical and visual comparison by producing tables and graphs. Second, Veneto was the best performing region in terms of recycling when the data was first available, whereas Lombardian municipalities were not performing well by national standards.[17] So, one interpretation of these results is that mayors in Lombardy might have been preoccupied with appearing inefficient relative to their neighbours in Veneto. In other words, Opencitivas may have triggered some yardstick competition. We investigate this further in Section 4.4 below.

[17]They were recycling on average 50% of all the waste produced, worse for instance than Campania and Sardegna.

Figure 5: Waste Recycling



(a) Veneto

(b) Lombardy

Note: Dynamic effects of data disclosure on waste recycling by municipality and year. Coefficients and 95% confidence intervals. Time period is 2010-2018, with 2013 as the baseline omitted year. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. Standard errors are clustered by municipality.

Finally, the dynamics in figure 5 further reinforce the finding that mayors react quickly to data disclosure, and they only react to the data as it is directly published. In late 2014 the government published expenditure data only, while in 2016 all the output data was added, with a particular emphasis on recycling rates[18]. Although the initial expenditure data also included spending in waste recycling, it seems evident from these dynamics that recycling rate did not improve after the first wave of publications (the 2015 coefficient is not significantly different from zero), but rather after the specific output data was published. This seems to indicate that mayors were more inclined to improve outputs only when these outputs were made public. In Appendix A we report additional event studies for both expenditure and waste recycling, including municipalities within different border bandwidths of 15km and 25km distance, and the results remain qualitatively the same. Moreover, as a further robustness check, Figure A.2 in Appendix A shows that the effects on waste recycling in Lombardy are not driven by a reduction in the total amount of waste produced.

4.4 Yardstick Competition

As already noted in the Introduction, one possible effect of OpenCivitas is that via the OpenCivitas website, badly-performing municipalities had the opportunity to "benchmark" themselves relative to both the national average score and the score for their region in service provision. Of course, such badly performing municipalities will have anticipated that when OpenCivitas went public, the media and ultimately the voters would also be able to make such comparisons, and would draw inferences about the competence

[18]Recycling rates were highlighted on the website when these data were first published.

of their mayors relative to the national or regional average. Formal models of how voters draw such inferences and then reward or punish the incumbent are well-known in the fiscal federalism literature e.g. Besley and Case (1995). So, it is reasonable to expect that municipalities below the regional or national means would make more effort to improve than either other "treated" municipalities.

We investigate this via a triple-difference design, using the extensive margin dataset. Specifically, for both per capita current expenditure and recycling rate variables, we estimate an augmented version of (1), where we interact *treat*, *post*, and *treat* × *post* in specification (1) with a dummy variable D equal to one if the municipality is below either the national or regional mean score for the relevant variable. If yardstick competition is present, we would expect the coefficient on the "triple diff" term *treat* × *post* × *dummy* to be negative in the case of current expenditure, and positive in the case of waste recycling.

The results for per capita current expenditure and waste recycling are given in Tables 2 and 3 respectively. In Table 2, we do see some evidence of yardstick competition on expenditure for municipalities in Veneto. There, it seems that the effect of OpenCivitas works partially through the effect on initially under-performing municipalities at national level.

In Table 3, the evidence for a yardstick competition effect in waste recycling is also ambiguous. There is evidence of a yardstick competition effect only in Lombardy, where municipalities below the regional and national average improved their recycling rates by an additional 10 percentage points. In contrast, in Veneto, municipalities below the national average actually deteriorated relative to those above.

5 Effect of OpenCivitas at the Intensive Margin: Effects of Mayors' Attention to Data Disclosure

5.1 The Data

In this section, we study the effect of mayors' attention to the OpenCivitas initiative on fiscal outcomes for "treated" municipalities in the standard regions. The outcomes that we study are the following. First, we look at the percentage change between 2013 and 2015 in per capita expenditure in Euros per capita. Also, we look at the percentage change in the composite output indicator and the absolute variation of OpenCivitas efficiency index (as defined in Section 3.2 above), which takes on values in $[-9, 9]$ given that the index takes values in $[1, 10]$. Descriptive statistics for these variables are given in the first section of Table 4 below.[19]

[19]The reason why we do not use the OpenCivitas aggregate expenditure and output scores (i.e. the items actually visible to mayors on the website) is that because the scores are not fully comparable

Table 2: Heterogeneous Effects by Ranking (D=1 if Expenditure pc > Average)

	(1)	(2)	(3)	(4)
	Current Expenditure			
	Veneto		Lombardy	
Reference Group	Nation	Region	Nation	Region
post	11.6661	11.7658	214.0169***	215.3757***
	[22.067]	[22.058]	[37.110]	[37.388]
post x treat	-12.3962	-35.8062*	-151.6096***	-177.0695***
	[17.509]	[18.442]	[47.671]	[44.232]
post x treat x D	-32.4059***	-17.0959		46.7512
	[9.371]	[17.933]		[37.760]
Observations	1,805	1,805	671	671
R-squared	0.079	0.079	0.188	0.194
N. Municipalities	215	215	81	81

Notes: Standard errors are clustered by municipality. Time period is 2010-2018. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. The triple diff in diff coefficient for Lombardy is not present when using the whole nation as a reference group as all the municipalities in the region are above the average expenditure per capita and hence the triple interaction is perfectly collinear with the diff in diff coefficient.

The basic idea is that if a mayor rarely or never accessed the OpenCivitas website during the testing period, they are unlikely to be aware of their expenditure score and thus by definition, are unlikely to take action to improve it. Conversely, a municipality that made use of the website to compare its score with other municipalities is more likely to try and improve its score. In other words, the effect of OpenCivitas initiative is likely to vary with the *intensity* with which mayors made use of the OpenCivitas website, hence the use of the terminology "intensive margin". In particular, we expect that more frequent access to the website (higher clicks) is more likely to be associated with reduction in expenditure. Moreover, if expenditures decrease, this can be achieved either by increasing efficiency or reducing service levels; as the efficiency index was not made public until 2016, we expect, following standard economic arguments, that this reduction in expenditure will be implemented by reducing services, which will show up as a reduction in the output index.

To test these hypothesis, we use our data on accesses by mayors. In particular, the Ministry of Finance collected second-by-second observations of every action taken by mayors on the website ($\sim$ 63,000 single events) during the testing period July-November 2014. For each click, the data reports the username of the account, the exact timing of the click and what information was accessed through the click. Descriptive statistics for

between 2015 and 2013 due to a change in the methodology that the Italian government adopted to estimate standard expenditure and standard outputs that are reference points for the scores. In Section 5.4 we show that are results are robust to using the scores rather than the variables considered here.

Table 3: Heterogeneous Effects by Ranking (D=1 if Recycling Rate < Average)

	(1)	(2)	(3)	(4)
	Recycling Rate			
	Veneto		Lombardy	
Reference Group	Nation	Region	Nation	Region
post	0.1610***	0.1598***	0.2042***	0.2016***
	[0.011]	[0.011]	[0.017]	[0.017]
post x treat	0.0020	-0.0009	0.0607***	0.0575**
	[0.009]	[0.009]	[0.022]	[0.025]
post x treat x D	-0.0413***	0.0104	0.1013***	0.0927***
	[0.011]	[0.012]	[0.031]	[0.033]
Observations	1,804	1,804	671	671
R-squared	0.429	0.428	0.628	0.621
N. Municipalities	215	215	81	81

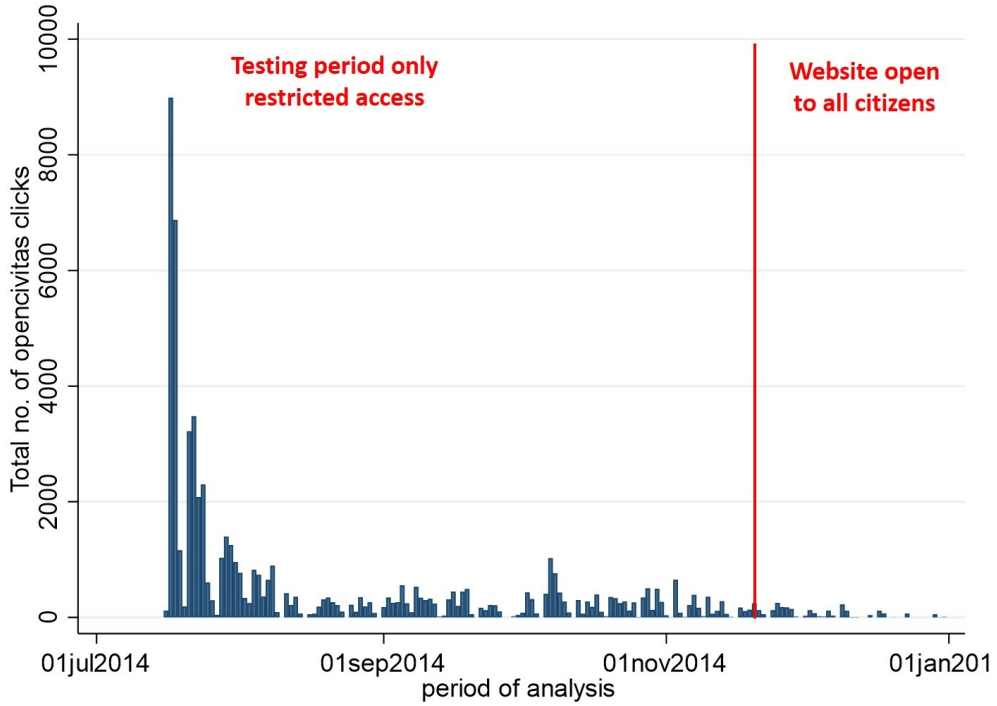
Notes: See Table 2.

clicks are given in the second section of Table 4 below. The distribution of clicks by day is shown in Figure 6 below. It is clear that there were two peaks in mayors' clicks, the first when OpenCivitas was open to mayors, and second, when it was opened to the general public.

So, in principle, we could regress fiscal outcomes on some summary measure of these clicks data e.g. total or average number of clicks during the testing period. The problem with this approach is of course, that clicks might be correlated with the error term. Indeed, several unobserved characteristics of the mayors -such as management skills or even just passion for job or personal anxiety- could be causing both the amount of clicks and expenditure and output choices.

In order to address this concern, we construct an instrument based on media coverage of OpenCivitas. We collected all the Italian newspaper articles (print and online) mentioning OpenCivitas over the testing period. In total, 234 articles were published over the period in national, local and online newspapers. For print newspapers, the text of each relevant article was digitalized through Optical Character Recognition. This corpus was then used to compute the daily number of times a municipality is mentioned in the news in an article discussing the program. Overall, municipalities were mentioned 1334 times in relation to OpenCivitas. Around 40% of mentions came from national paper articles, 40% from the web and the remaining 20% from local papers. Mentions indicate that a journalist is referring to one or more specific municipalities when discussing the data disclosure program. Table 4 reports descriptive statistics for all mentions of OpenCivitas ("media coverage") and also for mentions in local, national, and web outlets. In what follows, we use mentions in the national press only as they are more likely to be salient

Figure 6: Raw data - Mayors' website visits (Clicks)



to mayors.[20]

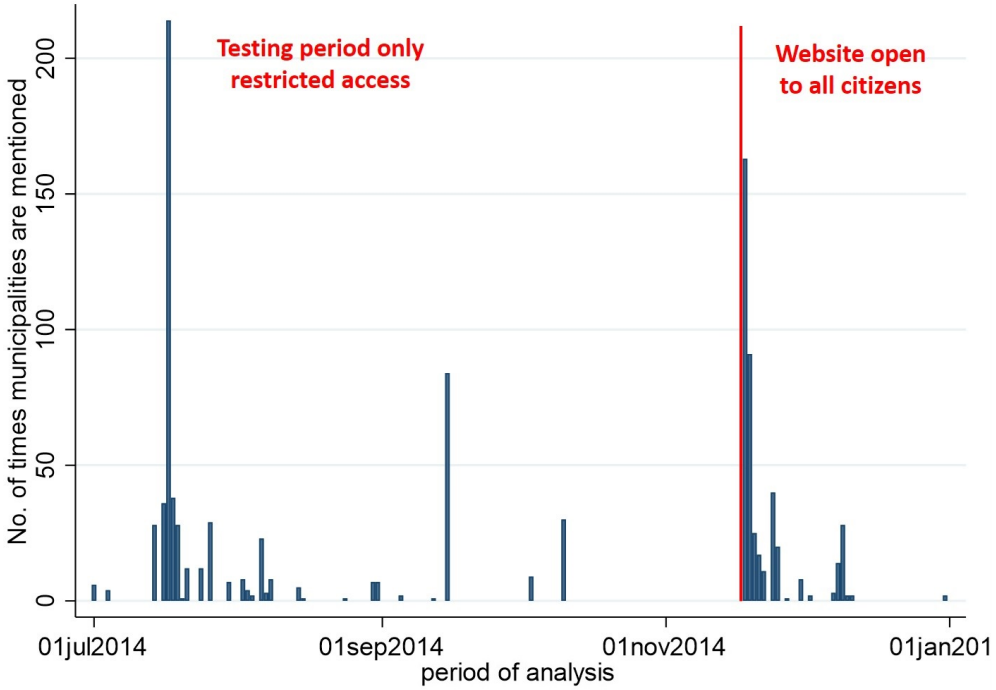
We then construct a variable $N_{i,t}$ from the corpus of articles, where $N_{i,t}$ is the number of times on day t that municipality i is mentioned, where t is the number of days since the launch of OpenCivitas. Figure 7 shows the sum of $N_{i,t}$ across t, i.e. the total number of daily mentions in this set of articles. It is clear that there were two peaks, the first when OpenCivitas was open to mayors, and second, when it was opened to the general public.

The basic idea behind the construction of the instrument is that the mayor of municipality i is more likely to click i.e. access OpenCivitas on day t if $N_{i,t}$ or possibly a lag of $N_{i,t}$ is larger. Of course, the problem with this strategy is that media coverage could be endogenous to the performance of the municipality e.g. some policy of the mayor to improve service delivery, for example, or simply the personal profile of the mayor herself.

We deal with this in two ways. First, because we have daily data on media coverage (as explained in more detail below), we can look at the effect of lagged media coverage on clicks to avoid the problem of reverse causality. Second, as an additional precaution, we construct an instrument for clicks by mayor i by using media coverage of municipalities *other* than i in the same province as i. Specifically, we define an instrument $M_{i,t}$ which is the sum of stories in the media on day t that refer to some municipality j in the

[20]If we use the total number of articles (national, local and web) results are similar, but less precisely estimated, consistent with the lower salience of the other types of article.

Figure 7: Daily Media Coverage of OpenCivitas, N_i

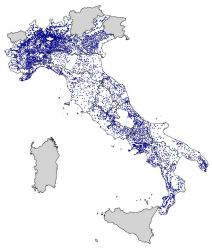


province where i is located, *except* those stories where municipality i is also mentioned. For example, if a story mentions both i and some other j, then this story is not included when calculating $M_{i,t}$. In this way, we can deal with the possible endogeneity of media coverage. In the first stage, we will experiment with both lags and leads of $M_{i,t}$.

Figure 8 shows the extent of province-level coverage over the period. A blue dot indicates a municipality which is covered, according to the definition of $M_{i,t}$. Only two provinces, Reggio-Emilia and L'Aquila, are not covered by any news related to OpenCivitas in national media coverage.

Finally, the last part of this dataset comprises municipality and mayor characteristics, political controls, and fiscal data for the year 2014. These obviously do not vary on a daily basis and are thus time-invariant. We collect characteristics of each municipality from the Ministry of Interior (MINT) and the Italian National Statistical Office (ISTAT) for the year 2014. These characteristics include population, share of population over 65 (over 75), degree of urbanization, elevation, income and property tax rates, average declared income of citizens, transfers from the central government. We collect characteristics of each mayor in 2014 from MINT: age, education, party affiliation and description of their job before becoming a mayor. Many mayors were elected in May 2014, 2 months before the introduction of the website. For municipalities which held elections in 2014, we use

Figure 8: Main Instrument - Province National media coverage



data for the new mayors. Political controls are from MINT and include the following: years from the next/last election, dummies for whether the mayor is term-limited, the mayor's margin of victory and the turnout in the European elections of 2014. Descriptive statistics for these variables are shown in the bottom panel of Table 4.

5.2 Estimation Strategy

Because of the particular nature of our data, we use a non-standard approach to instrumental variable estimation. In particular, all our outcome and control variables do not change over the small window of time we are analysing, while our first stage relies on the daily variability in clicks and media coverage. Given the nature of this data it is impossible to run a standard 2SLS estimation. So our approach relies on constructing an exogenous measure of predicted clicks leveraging the daily variation of our data, and then use this measure as an instrument. In particular, our approach is the following: we use the daily panel to estimate a linear panel data model for our "first stage" of clicks on media coverage. We then collapse the predicted values for clicks at the municipality level, by summing over all the days for each municipality. We use this constructed measure of clicks as an instrument in a cross-sectional "second-stage" regression of the outcome variables on predicted clicks, where we bootstrap the standard errors.

We turn now to our regression equations. First, as a baseline, we run a cross-section OLS regression of the following form :

$$Y_i = \alpha_i + \beta Clicks_i + \gamma X_i + \delta Z_i + \nu_i \tag{3}$$

Here, Y_i is the outcome variable as described above (change in expenditure per capita, the output index, or the efficiency index). Also, $Clicks_i$ is the sum of daily clicks for municipality i over all values of t. Finally, X_i and Z_i represent mayor and municipality characteristics respectively, as described in Section 5.1 above.

However, as already discussed, $Clicks_i$ is likely to be endogeneous i.e. correlated with unobservable municipal and mayor characteristics, as captured by ν_i. To deal with this,

we use a two-stage procedure as follows. We first estimate an equation which explains daily clicks in terms of lagged daily media coverage i.e.

$$Clicks_{it} = \beta^{FS} M_{i,t-1} + \psi Pop_i + \eta X_i + \lambda Z_i + \theta_i + \mu_t + \epsilon_{it} \tag{4}$$

Table 4: Descriptive Statistics

Variable	Observation	Mean	Std. Dev.	Min	Max
Outcome variables - 2015-2013 percentage variation					
Current expenditure	5,999	3.54	24.20	-86.46	129.23
OpenCivitas Composite output	5,657	1.64	53.77	-99.73	319.91
OpenCivitas Performance score	6,170	-0.06	2.06	-7.60	8.20
OpenCivitas access variables and Media coverage variables					
Clicks (OpenCivitas # access)	792,540	0.0644	2.2964	0	403
Clicks (sum over the period)	6660	9.0747	54.467	0	2550
Media coverage (# articles)	792,540	0.0014	0.0666	0	17
Local (# articles)	792,540	0.0003	0.0217	0	5
National (# articles)	792,540	0.0005	0.0296	0	6
Web (# articles)	792,540	0.0005	0.0422	0	17
Municipal Controls					
Current expenditure (2013 euro per capita)	6,618	594.69	319.24	22.19	1204.45
Fiscal equalization (2015 euro per capita)	6,618	-0.67	2.22	-9.03	10.38
Property tax basic tax rate (2014)	6,495	8.83	1.08	4.60	10.60
Property tax reduced rate (2014)	6,495	4.29	0.74	0.00	6.00
Tax return income (2014 euro per capita)	6,609	11,924	2,980	2,875	38,190
Resident population (2014 thousands)	6660	7.570	42.432	0.030	2617.175
% Population 0-2 (2014)	6,619	2.48	0.73	0.00	6.98
% Population 3-14 (2014)	6,619	10.54	2.21	0.00	18.09
% Population over 65 (2014)	6,619	23.17	5.80	5.56	63.10
% Population over 75 (2014)	6,619	12.23	4.28	2.38	43.90
Urbanization degree (2014)	6,618	1.66	0.69	1	3
Altitude levels (2014)	6,618	2.92	1.54	1	5
Mayoral Controls					
Just elected mayors (dummy)	6,501	0.590	0.492	0	1
Middle electoral cycle (dummy)	6,501	0.106	0.308	0	1
Term limit (dummy)	6,498	0.224	0.417	0	1
Margin of victory of incumbent mayor (%)	5,943	0.22	0.19	0.00	0.98
Turnout Euro14 election (%)	6,498	64.57	14.07	13.67	99.11
Center-Left council majority (dummy)	6,501	0.083	0.276	0	1
Mayor with university degree (dummy)	5,928	0.464	0.499	0	1
Mayor age (years)	6,412	50.42	10.64	19	86

The dataset includes 6660 municipalities over 126 days.

We estimate (4) with two different approaches. First we use the within-group estimator, treating θ_i as a municipal fixed effect (FE model) that does not need any particular assumption about the possible correlation between $M_{i,t-1}$ and θ_i. However, this approach prevents us from including time-invariant regressors. Therefore, we estimate the same model using the feasible GLS estimator treating θ_i as a random effect (RE model), which

allows us to include covariates that are fixed over time (such as population and other municipal controls). However, we need to assume the absence of correlation between $M_{i,t-1}$ and θ_i to obtain unbiased estimates of β^{FS}. From Table 6, we can see that the estimates for β^{FS} for the two approaches are very similar.[21] We prefer the RE specification as doing so allows us to have the same set of included instruments in both the first and second stage. This makes our estimation closely match a conventional 2SLS.

Having estimated (4), we then construct the sum of the fitted values from (4), i.e. $\widehat{Clicks}_i$. Then at the second stage, we estimate:

$$Y_i = \alpha + \beta^{IV} \widehat{Clicks}_i + \mu X_i + \eta Z_i + \xi_i \tag{5}$$

The approach just described is in line with a standard IV approach, except that dataset at the first stage is a daily panel, and at the second stage, a cross-section. The reason for this non-standard approach is that it allows us to examine the dynamic relationship between media coverage and clicks. The advantage of such strategy is that it best captures the correct sources of variability in the data, as opposed to alternative strategies. For instance, collapsing clicks and media coverage initially and then running a standard 2SLS estimation would cause the loss of all the information on the causal effect of newspapers on clicks. Indeed, when we do so, we find a first stage coefficient of the opposite sign. Note also that our procedure does *not* suffer from the "forbidden regression" problem (Wooldridge (2010)), as the second stage equation (5) is linear in $Clicks_i$: in particular, our estimate β^{IV} will be consistent.

The main limitation of our approach is that, even though we have a second instrument of municipal population[22] with the RE specification, we cannot test for instrument validity because the different structure of data between first stage (a daily panel) and the second stage (a cross-section on yearly data). In Section 5.4 and in more detail in Appendix B, we discuss an alternative approach: rather than running first and second stages separately, we run a $2SLS$ regression directly on the daily panel. As outcome and control variables are time-invariant, we cannot include municipality fixed effects. The resulting "between" estimator provides very similar results, as discussed in that Section. Moreover, this robustness check allows us to run formal over and under-identification tests on our instruments to support the validity of our instruments.

[21] A formal Hausman test also confirms that we can assume the absence of correlation between $M_{i,t-1}$ and θ_i.

[22] Total resident population is correlated with clicks but not with the percentage variations of our outcome variables.

5.3 Main Results

We first consider the OLS regression on the cross-section. The dependent variables are the percentage change between 2013 and 2015 in expenditure and output per capita, as well as the variation in the 0-10 scale of the efficiency index. All specifications include region fixed effects. Table 5 shows that the number of clicks is negatively correlated with all the dependent variables, but the coefficients shrink and lose significance once we add the controls.

Table 5: OLS - data collapsed at municipal level

Dependent Variables	(1) Expenditure	(2) Output	(3) Performance	(4) Expenditure	(5) Output	(6) Performance
# of Clicks	-0.6813**	-1.6127**	-0.0824*	-0.3545	-1.3750	-0.0458
	[0.274]	[0.668]	[0.043]	[0.272]	[0.854]	[0.039]
Regions Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Municipal Controls	No	No	No	Yes	Yes	Yes
Mayoral Controls	No	No	No	Yes	Yes	Yes
Observations	5,995	5,654	6,170	5,278	5,334	5,463
R-squared	0.044	0.016	0.055	0.054	0.028	0.070

Notes: Robust standard errors in parenthesis. Expenditure and Output represent the % variation between 2013 and 2015 in per capita terms. Clicks are collapsed at the municipal level by summing over the 126 days of the panel. Municipality controls include share of population over 65, degree of urbanization, elevation, income and property tax rates, average declared income of citizens. Mayoral controls include age, education, party affiliation and description of their job before becoming a mayor. Mean # Clicks = 9

Table 6 reports the results for variants of the first stage as in equation (4). In columns 1 to 3 we use lags and leads of a municipality's own mentions in a national newspaper, $N_{i,t}$ as variation in explaining the OpenCivitas website. In columns 4 to 6 we use our preferred definition of mentions $M_{i,t}$. To give a complete picture, in Table 6 we also include several leads and lags of newspapers mentions to show that clicks follow article publications. In column 7, we exclude the insignificant leads and lags.

The positive and significant coefficients on coverage at time $t-1$ indicate that mayors pay attention to the website the day after a related article is published and not subsequently. This is reassuring, as it is consistent with the plausible scenario where mayors are accessing OpenCivitas in response to recent articles. One additional article mentioning the OpenCivitas project *and* the name of the municipality at $t-1$ increases the average number of clicks at date t by around 2. When the media coverage relates *only* to other municipalities in the province, mayors on average increase their accesses the next day by around 0.08. The coefficients in this case are smaller -this is due to the much higher frequency of province mentions for the same number of clicks- and more significant.

Table 6: First Stage analysis - National media coverage daily panel

Dep. Var.: # of Clicks	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	News variable is $N_{i,t}$			News variable is $M_{i,t}$			
News [t-2]	0.0362	0.0931	0.0560	-0.0214	-0.025	-0.0281	
	[0.426]	[0.412]	[0.441]	[0.014]	[0.014]	[0.016]	
News [t-1]	2.1118**	2.1661**	2.2455**	0.0835***	0.0797***	0.0944***	0.0172***
	[1.058]	[1.047]	[1.115]	[0.024]	[0.024]	[0.026]	[0.005]
News [t]	0.9436	1.0179	0.9917	0.0103	0.0027	0.0025	
	[1.094]	[1.115]	[1.184]	[0.024]	[0.024]	[0.026]	
News [t+1]	-0.0975	-0.0250	-0.1023	0.0123	0.0116	0.0129	
	[0.446]	[0.447]	[0.481]	[0.014]	[0.014]	[0.015]	
News [t+2]	0.4930	0.5666	0.5343	0.0191	0.0185	0.0192	
	[0.791]	[0.793]	[0.845]	[0.022]	[0.022]	[0.025]	
Resident population		0.0249**	0.0121		0.0263**	0.0142	0.0108
		[0.012]	[0.008]		[0.012]	[0.009]	[0.008]
Days dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional dummies	No	No	Yes	No	No	Yes	Yes
Municipal and Mayor Controls	No	No	Yes	No	No	Yes	Yes
Panel data estimator	FE	RE	RE	FE	RE	RE	RE
F(2, 5179)							11.12
Observations	619,380	619,380	534,378	616,105	616,105	534,358	643,532
Number of code	6,660	6,660	5,746	6,625	6,625	5,746	5,746

Notes: Standard errors are clustered at the municipality level. The panel covers 126 days. In the RE specifications, municipality controls include share of population over 65, degree of urbanization, elevation, income and property tax rates, average declared income of citizens. Mayoral controls include age, education, party affiliation and description of their job before becoming a mayor.

Our actual first stage specification is given by column 7. In this specification, the F-statistic for the joint significance of both instruments is over 10 and, by the usual rule of thumb, we can rule out a weak instrument problem. We then take the fitted values of clicks and sum them over time for each municipality. The variable obtained in this way is then used to estimate (5). The results are shown in Table 7.

From Table 7, we see that if total clicks increases by 1 during the period of analysis, expenditure per capita decreases by an additional 0.033-0.048 percentage points between 2013 and 2015, while output per capita decreases by an additional 0.188-0.208 percentage points. Given that the total number of daily clicks over the whole period is on average 9.1 (Table 7), these coefficients translate in an average differential decrease of around 0.30-0.47 percentage points for expenditure and 1.71-1.91 percentage points for output between pre- and post- data disclosure. These effects seem small, but it must be remembered that the average increase in expenditure over this period was only 3.54%, and the average increase in the output index over this period was only 1.64%. So, if we compare a municipality that had no clicks with a municipality that had the average number of clicks, the second municipality on average has a growth in expenditure between 8% and 13% lower than the first, and the second municipality on average has a growth in output between 11% and 13% lower than the first.

These results suggest that the disclosure of expenditure data caused a reduction in

Table 7: IV regression (second stage) - Cross-section with predicted clicks collapsed at municipal level, model with Province National media coverage instrument

Dependent Variables	(1) Expenditure	(2) Output	(3) Performance	(4) Expenditure	(5) Output	(6) Performance
# of Clicks	-0.0484***	-0.2080***	-0.0037***	-0.0332**	-0.1883***	-0.0044***
	[0.013]	[0.042]	[0.001]	[0.014]	[0.064]	[0.001]
Regions Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Municipal Controls	No	No	No	Yes	Yes	Yes
Mayoral Controls	No	No	No	Yes	Yes	Yes
Observations	5,219	4,919	5,398	5,219	4,919	5,398

Notes: Bootstrap standard errors in parenthesis with 1000 replications. Expenditure and Output represent the % variation between 2013 and 2015 in per capita terms. Clicks are instrumented by province mentions in the national news. Municipality controls include share of population over 65, degree of urbanization, elevation, income and property tax rates, average declared income of citizens. Mayoral controls include age, education, party affiliation and description of their job before becoming a mayor. Mean # Clicks = 9

local spending by the mayors who paid attention to the program, but this came at a cost in terms of provision of public goods and services, for which data were not disclosed before 2016. Throughout the paper, we refer to a decrease in expenditure as an improvement since this reduction is associated with an improvement in the municipal performance. Column 6 shows the overall effect on the $0-10$ efficiency score, which is a function of expenditure and output efficiency. The effect is not large in magnitude as the improvement in expenditures scores partially offsets the decrease in output, although it is significant at 1%. The average effect of clicks on the efficiency on performance is -0.04 points ($9.1\ X\ -0.0044$).

5.4 Robustness Checks

Here, we report a number of robustness checks. First, we re-run IV regressions using the actual OpenCivitas expenditure and output scores as dependent variables, which strictly speaking are not comparable across the two years, as explained above. Table B.1 of the Appendix B reports the IV results of the intensive margin analysis using the change in the scores between 2013 and 2015 as dependent variables. The results are qualitatively in line with our main regressions based on percentage variation in expenditure and output. In particular, Table B.1 shows that between 2015 and 2013, both expenditure and output, relative to their standard levels, decreased.

As a second robustness check, we run the same specification (4,5) where we redefine the "click" variable by limiting the number of accesses to the ones related to the municipality *own* data, excluding all clicks aimed at checking other municipalities' scores. So, in the specification, we are allowing the mayors to adjust their fiscal policy only in response to

what they learn about their municipality. The results are shown in Table B.2, and are in line with our baseline model. However, the magnitude of the estimated coefficients is larger. This is due to the lower frequency of own clicks. On average, during the testing period (from July to November 2014), the total number of *own* daily clicks was 0.4 per municipality, much lower than 9.1 registered considering all types of clicks. So, following the procedure in Section 5.3, we multiply the coefficients in Table B.2 by 0.4 to get the average effect of Opencitivas on outcomes. According to this calculation, we estimate an average drop in expenditure between 0.4% and 0.6% , followed by an average output contraction between and 2.52% and 2.76%, and a final drop of 0.06% in performance. These percentages are slightly larger, but line with, those estimated in our baseline model.

As a final robustness check, we estimate the main second-stage regression directly on the daily panel. Estimating the model in this way comes with benefits as well as drawbacks. First, it allows us to implement a standard 2SLS regression which in turn, allows us to run over-identification tests. Specifically, we use population as an additional instrument, since it is correlated with clicks but plausibly does not affect outcome variables (expenditure, output, and performance variation after the introduction of OpenCivitas)[23]. However, as our outcome and control variables are time-invariant over the period of analysis, this means that we cannot include municipality fixed effects. The results of this robustness check are reported in Table B.3 and discussed in more details in the Appendix B. In the table, we also report the Cragg-Donald Wald F statistics which refuses the null hypothesis of weak instrument and the Sargan statistics that does not reject the null of valid instruments corroborating the robustness of our identification approach.

5.5 Spillover Effects on Other Fiscal Variables

Here, we investigate the broader effects of OpenCivitas on the revenue side of the municipal balance sheet. We saw that moving from no attention to OpenCivitas (no clicks) to the average level of attention (9.1 clicks) caused expenditure growth between 2013 and 2015 to fall by between 8% and 13%. The question now arises as to whether this was reflected in a fall in the growth of revenue for municipalities. Table 8 reports estimates of the effect of clicks on the percentage change of both total revenue and in various components of revenue between 2013 and 2015. These are IV estimates, where the number of clicks is instrumented by lagged daily media coverage as explained in Section 5.2.

We find that while the attention to OpenCivitas seems to have no effect on total

[23]Output and performance scores are independent from population by construction. The percentage change in total expenditure per capita between 2013 and 2015 was not induced by population size, and the correlation between these variables being close to zero reassures us about this. Additionally, throughout the paper we remove the few very large cities from the sample, the "outliers". As discussed, the vast majority of Italian municipalities is very small and after controlling for geographical and demographical characteristics we find no argument in support of a possible role of population in determining difference in expenditure percentage variation over the period of our analysis.

revenue, there is a significant effect of OpenCivitas on the *composition* of revenue.[24] In particular, total revenues from local income and property taxes fall, as does the property tax rate, whereas income from fees rises. These effects are clearest in Columns 2-4; the effects become less precisely estimated (but still significant at 10% in two cases), when municipal and mayoral controls are included in Columns 6-8.

One possible explanation for this effect on the composition of revenue is that mayors who are paying attention to OpenCivitas anticipate that when the website becomes public, *all* aspects of local government finance will come under greater scrutiny by the media. Local property and income taxes are highly salient in Italy, as in many countries, and therefore attentive mayors may have decided to not increase these taxes as much as they otherwise would have done, and rely on less salient fee income. Indeed, Bracco et al. (2019) find evidence for this revenue substitution effect in election years for Italian municipalities, when there is a direct electoral incentive to cut salient taxes.

Finally, it should be noted that although these coefficients are comparable in magnitude to the effects on expenditure in Table 7, over the period 2013-2015, at the national level, there were substantial increases in tax revenues, and decreases in fees, due to a property tax reform. In particular, tax revenue rose by 32%, fees fell by 11,6%, and property tax rate rose by 2.7%. So, the effect, expressed as a *percentage* of the change over 2013-2015, of moving from no attention to OpenCivitas to the average level of attention is generally smaller on these variables than on expenditure, with the exception of the property tax rate. For example, using the estimate in column 6 regarding taxes, we see that the percentage effect of moving from no attention to OpenCivitas to the average level of attention is to reduce growth in tax revenue by only $(0.06 \times 9.1)/32 = 1.7\%$. This is as expected, given that OpenCivitas did not include information from the revenue side.

[24] Revenue from taxes and fees are roughly equal for Italian municipalities: in 2013, they were 213 and 250 Euros per capita respectively.

Table 8: Fiscal revenues analysis, IV regression (second stage) - Cross-section with predicted clicks collapsed at municipal level, model with Province National media coverage instrument

Dependent Variables	(1) Total rev.	(2) Taxes	(3) Fees	(4) Property tax rate	(5) Total rev.	(6) Taxes	(7) Fees	(8) Property tax rate
# of Clicks	0.0133	-0.0300*	0.0603***	-0.0155***	0.0188	-0.0601*	0.0398*	-0.0064
	[0.009]	[0.016]	[0.023]	[0.004]	[0.013]	[0.034]	[0.023]	[0.005]
Regions Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipal Controls	No	No	No	No	Yes	Yes	Yes	Yes
Mayoral Controls	No	No	No	No	Yes	Yes	Yes	Yes
Observations	6,053	5,993	5,978	5,935	5,378	5,327	5,314	5,265

Notes: Bootstrap standard errors in parenthesis with 1000 replications. Total revenues represent the % variation between 2013 and 2015 of total municipal revenues (excluding grants). Taxes represent the % variation between 2013 and 2015 of property tax and local income tax. Fees represent the % variation between 2013 and 2015 of a wide rage of user charges for local services such as elderly residential care, school meals and nurseries. Property tax rate represent the % variation between 2013 and 2015 of the ordinary tax rate. Clicks are instrumented by province mentions in the national news. Municipality controls include share of population over 65, degree of urbanization, elevation, total 2014 per capita expenditure, average declared income of citizens. Mayoral controls include age, education, party affiliation and description of their job before becoming a mayor. Mean # Clicks = 9.1

6 Conclusions

Data disclosure is a policy tool which could become increasingly effective both as a driver of transparency and as a source of information for researchers to conduct policy evaluation. In this paper we investigated the impact of the open data platform OpenCivitas on public spending on two different margins. First, we analyse the effect of data disclosure itself, by comparing municipalities which were part of the program to ones which were not. Second, we compare municipalities which were all subject to the disclosure, according to the differential attention to the program exhibited by the mayors. In order to account for unobservable variability in mayors' skill and carefulness, we instrument the number of their accesses to the platform using two layers of exogenous variation. We predicted clicks through the staggered daily publication date of newspaper articles which mentioned OpenCivitas in connection with other municipalities in the province, but not the municipality itself.

The results we found are consistent across the two margins. On the extensive margin, an event study showed a timing of improvement consistent with a focus only on what was "visible" in OpenCivitas. Specifically, we found that treated municipalities on average improved their spending indicators immediately after the first wave of disclosure on spending, and that they increased public good provision only after that data on output was published, two years later. We also find some evidence of heterogeneity in response to to OpenCivitas; a triple-difference estimation shows that municipalities below the regional or national make more effort to improve "visible" indicators than other treated

municipalities.

On the intensive margin, we find that greater attention to OpenCivitas is associated with a fall in the expenditure index over the period when only that index was visible, i.e. 2013-15. We find that over this same period, output growth of treated municipalities fell by at least as much as their expenditure growth, and in line with this, efficiency actually decreased. So, as with the extensive margin event study, there was an improvement only in the visible spending indicator. Importantly, in the intensive margin analysis where we can directly compare the effects of the program on public and undisclosed parameters, we find that the reduction in public good provision has more than offset the improvement in spending behaviour, resulting in a overall worsening of the performance scores.

Overall, these results highlight how data disclosure can become a relevant policy instrument, especially at the local level. In particular, open-data initiatives can generate non-negligible incentives towards specific spending behaviour inducing local authorities to modify their decision about the allocation of public funds. Therefore, central governments should carefully consider data disclosure among the effective set of tools they can exploit to boost the efficiency in the provision of local services. However, as our results suggest, data disclosure can be double-edged: if the intervention is not carefully designed, the aggregate effect on efficiency can be negative. What is the optimal design of such interventions, however, is not straightforward and requires further research. The sources of information regarding the local administration are numerous and it could be tricky to identify where there could be negative spillovers. Nevertheless, this paper provides a clear indication that data disclosure should be as comprehensive as possible, so to maximize the chance that local politicians will increase their level of effort, rather than moving it away from undisclosed activities. In conclusion, additional future research should also deal with how data disclosure can influence election outcomes and financial stability, which are beyond the scope of this paper.

References

Banerjee, A., Enevoldsen, N. T., Pande, R., and Walton, M. (2020). Public information is an incentive for politicians: Experimental evidence from delhi elections. Technical report, National Bureau of Economic Research.

Banerjee, A., Kumar, S., Pande, R., and Su, F. (2011). Do informed voters make better choices? experimental evidence from urban india. *Unpublished manuscript*.

Besley, T. (2006). *Principled agents?: The political economy of good government*. Oxford University Press on Demand.

Besley, T. and Burgess, R. (2002). The Political Economy of Government Responsiveness:

Theory and Evidence from India*. *The Quarterly Journal of Economics*, 117(4):1415–1451.

Besley, T. and Case, A. (1995). Incumbent behavior: Vote-seeking, tax-setting, and yardstick competition. *The American Economic Review*.

Björkman, M. and Svensson, J. (2009). Power to the people: evidence from a randomized field experiment on community-based monitoring in uganda. *The Quarterly Journal of Economics*, 124(2):735–769.

Bracco, E., Porcelli, F., and Redoano, M. (2019). Political competition, tax salience and accountability. theory and evidence from italy. *European Journal of Political Economy*, 58:138–163.

Cobb, R. W. and Elder, C. D. (1983). *Participation in American politics: The dynamics of agenda-building*. Johns Hopkins University Press.

Cook, F. L., Tyler, T. R., Goetz, E. G., Gordon, M. T., Protess, D., Leff, D. R., and Molotch, H. L. (1983). Media and agenda setting: Effects on the public, interest group leaders, policy makers, and policy. *Public opinion quarterly*, 47(1):16–35.

Cruz, C., Keefer, P., and Labonne, J. (2021). Buying informed voters: New effects of information on voters and candidates. *The Economic Journal*, 131(635):1105–1134.

Dearing, J. W., Rogers, E. M., and Rogers, E. (1996). *Agenda-setting*, volume 6. Sage.

DellaVigna, S. and Kaplan, E. (2007). The fox news effect: Media bias and voting. *The Quarterly Journal of Economics*, 122(3):1187–1234.

Dewatripont, M., Jewitt, I., and Tirole, J. (1999). The economics of career concerns, part ii: Application to missions and accountability of government agencies. *The Review of Economic Studies*, 66(1):199–217.

Drago, F., Nannicini, T., and Sobbrio, F. (2014). Meet the press: How voters and politicians respond to newspaper entry and exit. *American Economic Journal: Applied Economics*, 6(3):159–88.

Durante, R. and Zhuravskaya, E. (2018). Attack when the world is not watching? us news and the israeli-palestinian conflict. *Journal of Political Economy*, 126(3):1085–1133.

Eisensee, T. and Strömberg, D. (2007). News droughts, news floods, and us disaster relief. *The Quarterly Journal of Economics*, 122(2):693–728.

Enikolopov, R., Petrova, M., and Zhuravskaya, E. (2011). Media and political persuasion: Evidence from russia. *American Economic Review*, 101(7):3253–85.

Ferraz, C. and Finan, F. (2008). Exposing corrupt politicians: the effects of brazil's publicly released audits on electoral outcomes. *The Quarterly Journal of Economics*, 123(2):703–745.

Grossman, G. and Michelitch, K. (2018). Information dissemination, competitive pressure, and politician performance between elections: A field experiment in uganda. *American Political Science Review*, 112(2):280–301.

Helfer, L. (2016). Media effects on politicians: An individual-level political agenda-setting experiment. *The International Journal of Press/Politics*, 21(2):233–252.

Iyengar, S. and Reeves, R. (1997). Do the media govern? politicians, voters and reporters in america. *Electoral Studies*, 3(16):429.

Kendall, C., Nannicini, T., and Trebbi, F. (2015). How do voters respond to information? evidence from a randomized campaign. *American Economic Review*, 105(1):322–53.

Kingdon, J. W. and Stano, E. (1984). *Agendas, alternatives, and public policies*, volume 45. Little, Brown Boston.

Leff, D. R., Protess, D. L., and Brooks, S. C. (1986). Crusading journalism: Changing public attitudes and policy-making agendas. *Public opinion quarterly*, 50(3):300–315.

Lockwood, B. and Porcelli, F. (2013). Incentive schemes for local government: Theory and evidence from comprehensive performance assessment in england. *American Economic Journal: Economic Policy*, 5(3):254–86.

Mani, A. and Mukand, S. (2007). Democracy, visibility and public good provision. *Journal of Development economics*, 83(2):506–529.

Marattin, L., Nannicini, T., and Porcelli, F. (2021). Revenue vs Expenditure Based Fiscal Consolidation: The Pass-Trough from Federal Cuts to Local Taxes. *International Tax and Public Finance*, page Open access.

McCombs, M. E. and Shaw, D. L. (1972). The agenda-setting function of mass media. *Public opinion quarterly*, 36(2):176–187.

McCombs, M. E. and Shaw, D. L. (1993). The evolution of agenda-setting research: Twenty-five years in the marketplace of ideas. *Journal of communication*, 43(2):58–67.

Mortensen, P. B. and Serritzlew, S. (2006). Newspapers and budgeting: The effects of media coverage on local expenditure decisions. *Scandinavian Political Studies*, 29(3):236–260.

Olken, B. A. (2007). Monitoring corruption: evidence from a field experiment in indonesia. *Journal of Political Economy*, 115(2):200–249.

Pande, R. (2011). Can informed voters enforce better governance? experiments in low-income democracies. *Annu. Rev. Econ.*, 3(1):215–237.

Petrov, O., Lal Das, P., Kumagai, S., and Ojha, S. (2014). Open data in development - what and how data4impact. *DATA4IMPACT Workshop*.

Protess, D. L., Leff, D. R., Brooks, S. C., and Gordon, M. T. (1985). Uncovering rape: The watchdog press and the limits of agenda setting. *Public Opinion Quarterly*, 49(1):19–37.

Reinikka, R. and Svensson, J. (2004). The power of information: Evidence from a newspaper campaign to reduce capture.

Repetto, L. (2018). Political Budget Cycles with Informed Voters: Evidence from Italy. *The Economic Journal*, 128(616):3320–3353.

Sevenans, J., Walgrave, S., and Joanna Epping, G. (2016). How political elites process information from the news: The cognitive mechanisms behind behavioral political agenda-setting effects. *Political Communication*, 33(4):605–627.

Snyder, J. M. and StrÃ¶mberg, D. (2010). Press coverage and political accountability. *Journal of Political Economy*, 118(2):355–408.

Snyder Jr, J. M. and Strömberg, D. (2010). Press coverage and political accountability. *Journal of Political Economy*, 118(2):355–408.

Soroka, S. N. (2002). Issue attributes and agenda-setting by media, the public, and policymakers in canada. *International Journal of Public Opinion Research*, 14(3):264–285.

Standaert, S. (2015). Divining the level of corruption: a bayesian state-space approach. *Journal of Comparative Economics*, 43(3):782–803.

Strömberg, D. (2004). Radio's impact on public spending. *The Quarterly Journal of Economics*, 119(1):189–221.

Van Aelst, P. and Walgrave, S. (2016). Political agenda setting by the mass media: Ten years of research, 2005–2015. In *Handbook of public policy agenda setting*. Edward Elgar Publishing.

Walker, J. L. (1977). Setting the agenda in the us senate: A theory of problem selection. *British Journal of Political Science*, 7(4):423–445.

Wang, T. (2021). Media, pulpit, and populist persuasion: Evidence from father coughlin. *American Economic Review*, 111(9):3064–92.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.

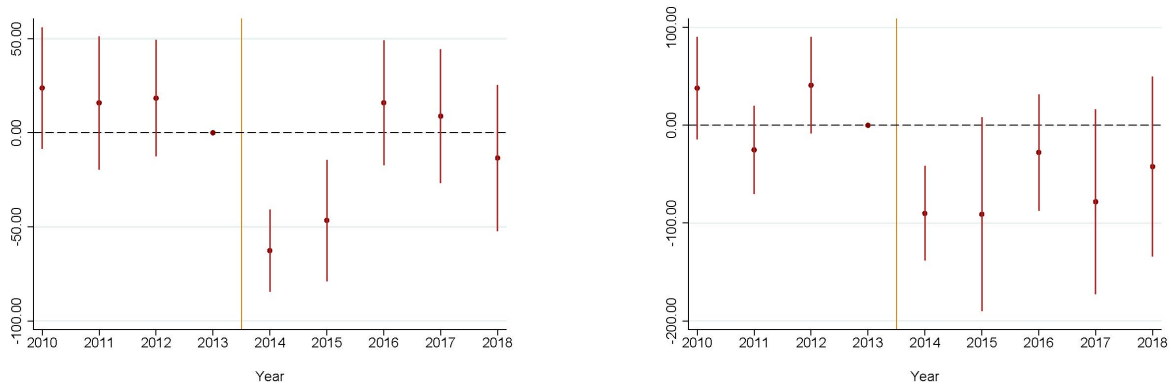
Appendices

A Diff-in-Diff Robustness

A.1 Composition of Expenditure Reduction

We run the event study regressions on the single items of expenditure in order to understand the origin of the cuts which made the decrease in aggregate spending possible. We find no evidence of any decrease in any of the OpenCivitas categories except for *Administration*, which seems to capture the whole variation for both Lombardy and Veneto. Additionally, the pre-trends in the graph for Lombardy reassure us about the validity of the main result.

Figure A.1: Expenditure in Administration



(a) Veneto

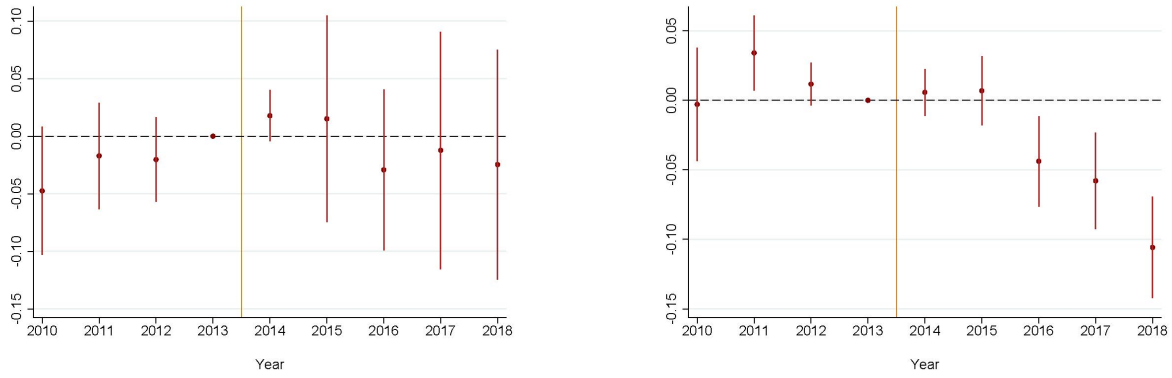
(b) Lombardy

Note: Dynamic effects of data disclosure on administration expenditure per capita. Coefficients and 95% confidence intervals. Time period is 2010-2018, with 2013 as the baseline omitted year. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. Standard errors are clustered by municipality.

A.2 Total Waste in Lombardy

As a robustness check for the analysis on recycling rates, we check whether the results for Lombardy are not driven by a reduction in the total amount of waste produced. Table A.2 shows that the amount of waste produced was not different between the treatment and the control group neither before or after the treatment and that the amount of waste which went to the landfills actually decreased after 2016.

Figure A.2: Lombardy - Waste



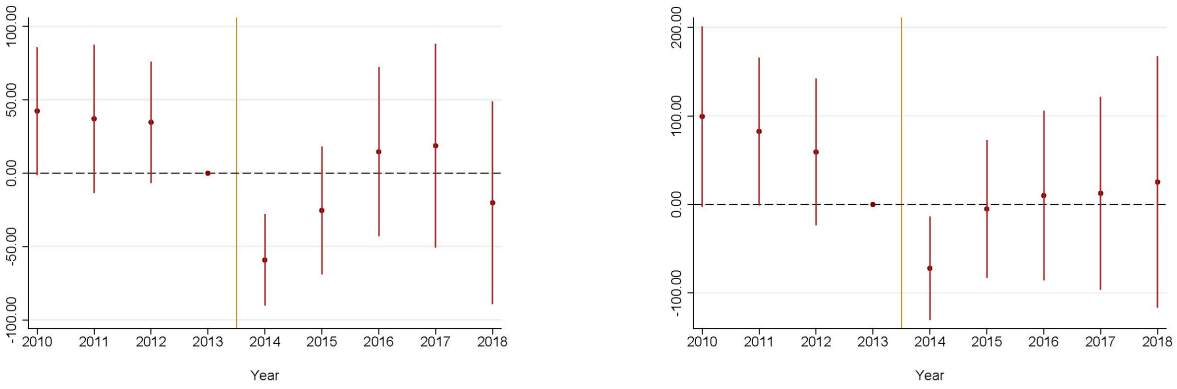
(a) Lombardy - Total Waste (tons)

(b) Non Recycled Waste (tons)

Note: Dynamic effects of data disclosure on total waste per capita. Coefficients and 95% confidence intervals. Time period is 2010-2018, with 2013 as the baseline omitted year. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. Standard errors are clustered by municipality.

A.3 Different Bandwidths

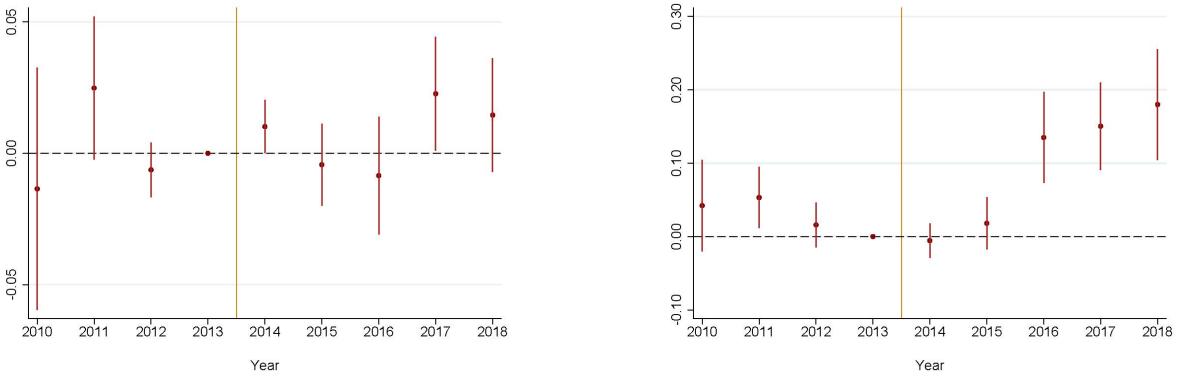
Figure A.3: Current Expenditure - 15 km bandwidth



(a) Veneto (b) Lombardy

Note: Dynamic effects of data disclosure on current expenditure by municipality and year. Coefficients and 95% confidence intervals. Time period is 2010-2018, with 2013 as the baseline omitted year. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. Standard errors are clustered by municipality.

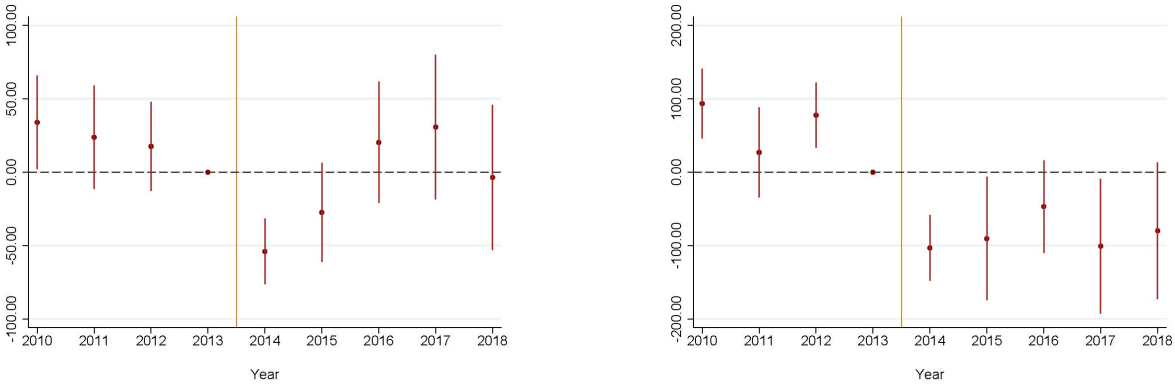
Figure A.4: Recycling Share - 15km bandwidth



(a) Veneto (b) Lombardy

Note: Dynamic effects of data disclosure on the recycling share by municipality and year. Coefficients and 95% confidence intervals. Time period is 2010-2018, with 2013 as the baseline omitted year. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. Standard errors are clustered by municipality.

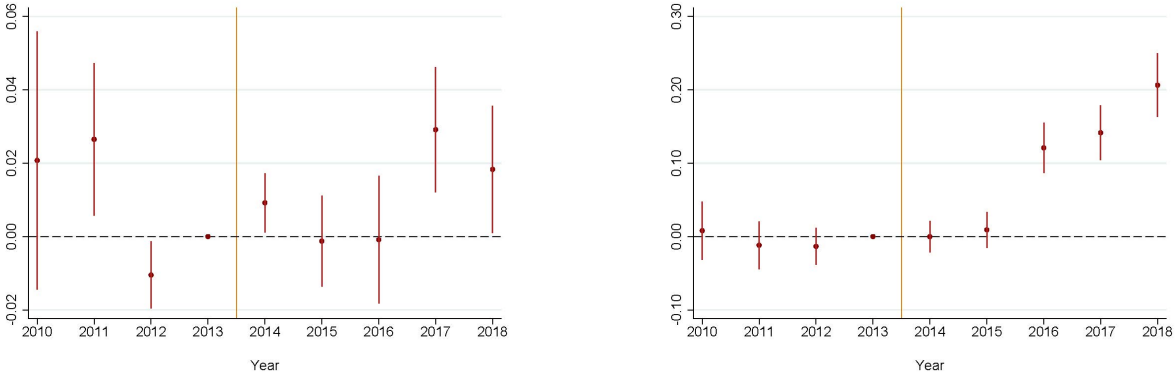
Figure A.5: Current Expenditure - 25 km bandwidth



(a) Veneto (b) Lombardy

Note: Dynamic effects of data disclosure on current expenditure by municipality and year. Coefficients and 95% confidence intervals. Time period is 2010-2018, with 2013 as the baseline omitted year. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. Standard errors are clustered by municipality.

Figure A.6: Recycling Share 25km bandwidth



(a) Veneto (b) Lombardy

Note: Dynamic effects of data disclosure on the recycling share by municipality and year. Coefficients and 95% confidence intervals. Time period is 2010-2018, with 2013 as the baseline omitted year. Within estimator with municipality and year fixed effects. Controls: population, current grants, capital grants. Standard errors are clustered by municipality.

B Intensive Margin Analysis- Robustness Checks

OpenCivitas expenditure and output indices

Table B.1: IV regression (second stage) on OpenCivitas expenditure and output indices - Cross-section with predicted clicks collapsed at municipal level, model with Province National media coverage instrument

	(1)	(2)	(3)	(4)
Dependent Variables	Expenditure	Output	Expenditure	Output
# of Clicks	-0.0082***	0.0027	-0.0083***	-0.0069***
	[0.001]	[0.002]	[0.002]	[0.002]
Regions Dummies	Yes	Yes	Yes	Yes
Municipal Controls	No	No	Yes	Yes
Mayoral Controls	No	No	Yes	Yes
Observations	6,571	6,553	5,717	5,703
R-squared	0.050	0.058	0.059	0.073

Notes: Robust standard errors in parenthesis. Expenditure and Output represent the variation in OpenCivitas expenditure and output indices between 2010 (displayed in 2014) and 2015 (displayed in 2017). Clicks are collapsed at the municipal level by summing over the 126 days of the panel. Municipality controls include share of population over 65, degree of urbanization, elevation, income and property tax rates, average declared income of citizens. Mayoral controls include age, education, party affiliation and description of their job before becoming a mayor. Mean # Clicks = 9

Table B.2: IV regression (second stage) - Cross-section with predicted clicks regarding municipal own performance collapsed at municipal level, model with Province National media coverage instrument

Dependent Variables	(1) Expenditure	(2) Output	(3) Performance	(4) Expenditure	(5) Output	(6) Performance
# of Clicks	-1.5905***	-6.9771***	-0.1253***	-1.0982*	-6.3055***	-0.1511***
	[0.401]	[1.285]	[0.028]	[0.657]	[2.038]	[0.040]
Regions Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Municipal Controls	No	No	No	Yes	Yes	Yes
Mayoral Controls	No	No	No	Yes	Yes	Yes
Observations	5,995	5,654	6,170	5,219	4,919	5,398

Notes: Bootstrap standard errors in parenthesis with 1000 replications. Expenditure and Output represent the % variation between 2013 and 2015 in per capita terms. Only clicks regarding municipal own performance, clicks are instrumented by province mentions in the national news. Municipality controls include share of population over 65, degree of urbanization, elevation, income and property tax rates, average declared income of citizens. Mayoral controls include age, education, party affiliation and description of their job before becoming a mayor. Mean # Clicks = 0.4

Alternative IV Strategy - Daily Panel 2SLS

In order to alleviate concerns regarding the non-standard nature of our main IV specification which estimates the first stage on a panel and the second stage on a cross-section, we consider an alternative 2SLS estimation strategy where we estimate a version of equation (B.1) directly on the daily panel. In particular, we estimate the following model:

$$Y_i = \alpha_i + \beta Clicks_{it} + \mu X_i + \eta Z_i + \epsilon_i \tag{B.1}$$

As in the main specification, Y_i represents the outcome variable relative to expenditure, output (provision of public good) and overall performance. All these variables are measured as percentage changes between 2013 and 2015, and so there is in fact no time variation in Y_i. $Clicks_{it}$ is instrumented with $M_{i,t-1}$ and we also include population in the set of excluded instruments. This allows us to test for overidentification. In all the specifications we include day and region fixed effects. Finally, X_i and Z_i represents mayor and municipality characteristics respectively as described in section 5.2 above.

Although implicit in this model, the coefficients and all the details of the first stage estimation are the same as in section 5.3. Table B.3 reports the coefficients of our baseline 2SLS estimation where the number of clicks is instrumented by province coverage. Moreover, in the table, we also report the Cragg-Donald Wald F statistics, in all specification above the critical values, which allows us to refuse the null hypothesis of weak instrument and the Sargan statistics that does not reject the null of valid instruments corroborating the robustness of our identification approach.

Table B.3: IV regression - Two-Stage-Least-Square on daily panel, model with Province National media coverage instrument

Dependent Variables	(1) Expenditure	(2) Output	(3) Performance	(4) Expenditure	(5) Output	(6) Performance
# of Clicks	-12.8289***	-30.1539***	0.0734	-9.3783***	-30.1953***	0.0656
	[1.471]	[4.194]	[0.053]	[1.471]	[5.083]	[0.060]
Regions Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Days Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Municipal Controls	No	No	No	Yes	Yes	Yes
Mayoral Controls	No	No	No	Yes	Yes	Yes
Cragg-Donald Wald F stat.	38.255	25.535	68.379	25.109	16.726	47.542
Sargan stat. Chi-sq(1) P-val	0.6636	0.0463	0.0070	0.7577	0.1922	0.0659
Observations	671,440	633,248	682,304	584,528	550,928	604,576

Notes: Robust standard errors in parenthesis. Expenditure and Output represent the % variation between 2013 and 2015 in per capita terms. The panel covers 126 days. Clicks are instrumented by National Province Coverage. Municipality controls include share of population over 65, degree of urbanization, elevation, income and property tax rates, average declared income of citizens. Mayoral controls include age, education, party affiliation and description of their job before becoming a mayor. Mean # Clicks = 0.06

Results from the estimation of this model are very similar to what we obtained with the non-standard IV estimation. However, the coefficients are very large; this is because of the lack of municipality fixed effects. This causes all the effect of the clicks to come from a single day, and hence the large coefficients. However, we can interpret the coefficients in a way which is equivalent to our main specification.

Specifically, note from Table B.3 that if the number of *daily* clicks increases by 1, expenditure per capita decreases by an additional 9 percentage points between 2013 and 2015, while output per capita decreases by an additional 30 percentage points. Given that the average number of clicks per day is 0.06, this translates in an average decrease of around 0.5 percentage points for expenditure and 1.8 percentage points for output. So, with this conversion, for expenditure and output the sign of the coefficients is the same as in our main specifications, and magnitudes are very similar. However, the coefficient for the overall performance is much smaller and not significantly different from zero. The reason is that this specification is qualitatively different, because it does not aggregate predicted clicks at the municipality level: the coefficients come from the comparison of different measures, i.e. $Cov(\sum_{t\in T} \widehat{Clicks}_{it}, y_i) \neq Cov(\widehat{Clicks}_{it}, y_i)$.