

Something for Something: How and Why Direct
Democracy Impacts Service Quality
Online Appendix

November 17, 2017

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1 District-Level Data Set Construction

List of Fire Districts

To link direct democracy (the treatment) with revenue and response times (the outcomes), it is necessary to create a unique identifier for each fire district, a variable that will be present in each of the three data sets containing the one treatment and two outcomes.

The direct democracy variable was available at the level of counties (see summary in the main text), so this required matching district to counties. One complication is that some districts are contained in multiple counties; I eventually match each district to an individual county, and I discuss the process used in the “Direct Democracy” section below.

The remaining task is to match the Department of Revenue (DOR) data, which contains revenues by district by year, with the NFIRS data, which contains response times. The DOR data includes 843 unique districts, each matched to a single county; and the NFIRS data includes 1,245 unique fire departments, each matched to a single county. While one option was to match the NFIRS data, which includes county names, to the direct democracy data, which is at the county level, I chose instead to include only NFIRS observations that I could match to the state DOR data, for two reasons. First, many of the over 1,200 fire departments in the NFIRS data are not fire districts, but are municipal or county fire departments. Second, I sought to ensure that the samples used in the analysis did not differ due to the availability of different outcome variables.

I matched NFIRS and DOR districts “by hand,” that is by exporting lists of unique districts from each data set into a spreadsheet, alphabetizing each column, and putting the same districts – which I identified by name similarity and county location – on the same row. I dropped any districts that could not be matched, which resulted in 782 districts.

The remaining 22 districts (the number of districts used in the analysis is 760) are dropped because I was unable to match them to the list of districts from the GIS database. This ensures that all of the districts used in the analysis are depicted in Figure 1 in the main text. More importantly, this ensures that all districts used in the analysis have Census covariates available. As discussed

in the main text, these covariates were constructed by aggregating block group level data up to the district level, which necessitated the use of GIS data. I obtained these GIS data by filing an information request with the Illinois Department of Revenue.

Property Tax Revenue

As discussed in the text, I obtain these data from the web site of the Illinois State Comptroller. By default, the variable for annual changes in property tax revenues has a minimum of -100 percent, and an implausibly high maximum of over 11 million percent, for an average yearly change of about 1,200 percent. As a result, I code this variable as missing if the absolute change is greater than 50 percent – that is, if districts experience their revenues being cut in half, or increased by half. This does not cause significant amounts of missingness – the 95th percentile is 38 percent – and the results are robust to different cutoffs, as shown in Figure A1.

Total Revenues and Total Expenditures

The analysis in the main text focuses on property tax revenue, as the total revenue and total expenditure variables contain more measurement error. The maximum percentage change for unadjusted revenue is 1.9 million percent (mean of 1,800), and for expenditure it is 3.7 million (3,600). While 96% of the changes in property tax revenue have absolute values under 50 (reflecting either a drop or an increase by half of the previous year), 86% of the total revenue changes and just 69% of the expenditure changes have absolute values under 50. Figure A1 shows results using growth in total revenues and growth in total expenditures as outcome variables. The effect is evident for total revenues, though is less precisely estimated; there is no consistent sign for the impact on expenditure growth, but the confidence intervals are as wide as 15 percentage points even at the smallest cutoffs. The dashed lines in Figure A1 show the proportion of the sample that is included when using a given cutoff; these lines show that much more data is lost when excluding extreme observations on expenditure growth relative to the revenue variables.

In looking into the data, I determined that some of these implausibly large values are simply

due to errors where the levels of total revenue or expenditure were entered as zero or one dollar, which will artificially cause a large increase in the year following the mistake. However, I also found that some districts fail to separate out capital and operating expenditures. As Matsusaka (1995, 605) notes, capital spending “tends to be lumpy,” which “creates bubbles in the data that do not accurately represent the true flow of services provided by the expenditure.” All this is to say that conflating capital and operating expenditures will result in measurement error.

Response Times

These data come from a set of CD’s provided by the Department of Homeland Security. Each CD contains different years of NFIRS data. The data come in .dbf format, and are compressed as .zip files. I used a perl script to convert each year’s .dbf file to a comma-separated values file. Because the data are national, the original .dbf files are large and difficult to load; thus the perl script only extracts records from the .dbf file that are from Illinois.

The resulting .csv files consist of thousands of incident-level observations, per district, per year. Each incident contains, among other data, the time the call was made, the time of arrival, and the type of incident. Following convention (e.g., United States Fire Administration 2006), I construct response times as the difference in minutes between arrival time and call time. I drop incidents where the calculated response time was higher than 25 minutes; according to a Department of Homeland Security analysis of the same data, only .14% of incidents record a response time greater than 24 hours, and the vast majority of remaining observations have response times under 20 minutes (United States Fire Administration 2006).

Again following United States Fire Administration (2006), I keep only incidents classified as structure fires (incident type codes 100 through 199, or 10 through 19, depending on the version of the NFIRS data set). I then aggregate incidents to the district level by taking the median response time, by district, by year.

Direct Democracy

For assigning districts treatment status by year, I had to first match districts to the counties that adopted the PTELL reform. I then had to determine the year the reform would take effect.

Matching districts to counties was straightforward in most cases, as lists of districts from the IL Department of Revenue were already matched to unique counties. However, lists from the Census of Governments include multiple counties, and it is known that special district governments in general can span multiple counties (Berry 2009). Indeed, the IL Department of Revenue notes that PTELL impacts districts differently depending on whether they are contained in one or more counties (Illinois Department of Revenue 2012). In particular, the district will be forced to adopt referendums if (a) all counties in which the district is located hold, but do not necessarily pass, referendums to adopt PTELL, and (b) a majority of the district's assessed value is located in counties where the referendum passes.

Because it was not possible to determine proportions of assessed value in a given district located in a given county, I used land area as a proxy. That is, using GIS software, I determined, for each district located in multiple counties, the county in which a majority of the district's area is contained in. I then assigned this district as treated if the county is treated. I found that about one third of districts span multiple counties, though typically the vast majority of a district's area is included in one county. The results reported in the paper are robust to dropping these multiple county districts.

Regarding the year of impact, Illinois local governments levy taxes annually, but on a two-year cycle (Dye and McGuire 1997, 474; Illinois Department of Revenue 2014, 6). In the first year or the "assessment year," properties are assigned taxable values by the property tax assessor. In the second year, property taxes are billed and collected, based on the assessments calculated in the previous year. This implies that the decision to impose direct democracy will not impact revenues for two years. As the Department of Revenue explains to voters,

For taxing districts located entirely within a county, the PTELL applies to levies made after January 1 of the year immediately following a voter-approved PTELL referendum. For example, if voters approve a referendum in November 2011, districts in the

county will first be affected for the 2012 tax year, payable in 2013. (Illinois Department of Revenue 2012, 2)

In general, therefore, I lag the treatment year as displayed in Figure 1 by two years. The exceptions are the districts located in the six counties where direct democracy was not adopted by referendum, but rather wholly imposed by the state legislature. For these counties, the legislature's decision to switch took effect in the current assessment year, and not January 1 of the following year.

Covariates

I created district-level measures of Census demographics by overlaying a shapefile of Census block groups, pre-matched with block group-level demographic data, onto the shapefile of districts. I then aggregate the block group-level data to the district level. This process had to be performed separately for every decennial Census (1990, 2000, and 2010), because the geography of Census block groups changes every ten years. For non-Census years, I filled in missing values using linear interpolation.

Missing Data

In the final sample of 760 districts across 15 years (1995-2009), a balanced panel would consist of 11,400 observations. As shown in Table 1 in the main text, there are 10,328 observations with a non-missing value of revenue growth (or 9.4% missing) and 8,071 observations with a non-missing value of response time (29% missing).

For revenues, the major cause of missingness is the absence of any record in the original DOR database – 8% of 11,400 observations are missing in these data, which means the exclusion of outliers results in just an additional 1.4%.

For response times, the major cause of missingness is likely that departments voluntarily report information to the NFIRS database. As shown in Figure A2, an examination of the data by year reveals a spike in missingness in 2000 and 2001, when missingness rises from about 30% to up to 80% in 2001. Having checked the source data provided by the Department of Homeland Secu-

rity, it seems that only about 300 fire departments from IL are included in these years, which is considerably lower than other years.

Because the primary analysis in this paper is differences in differences, missingness only introduces bias to the extent that it covaries with selection into the treatment of direct democracy. Table A1 presents cross-sectional and panel regressions showing the relationship between missingness and other variables. Panel (a) compares mean differences between district-years that are missing outcome data and those that are not. For each variable given in each column, I regress that variable on an indicator for missingness, as well as year fixed effects, which gives a time-adjusted difference in means. District-years with missing revenue are 6.1% less likely to occur in districts that switched over this period (standard error of 3%). However, missingness on response times is no more or less likely to occur in switching districts. The major predictors of missingness are population and income: larger, wealthier districts are less likely to have missing data.

It is probably the case that any predictor of missingness is relatively stable within districts. Consistent with this conjecture, panel (b) of Table A1 shows that, when I replicate the panel regressions shown in the main text using missingness indicators as outcomes, there is no effect of switching to referendums on missingness. Additionally, Figure A3 I repeats the “placebo” analysis shown in the main text using indicators for missingness as outcome variables. This figure shows that districts that switch to direct democracy are no more or less likely to have missing values than districts that do not switch, whether this comparison is performed before or after the switch occurs.

Figure A1: Robustness of effect on property tax revenue growth, total revenue growth, and total expenditure growth to alternative cutoffs.

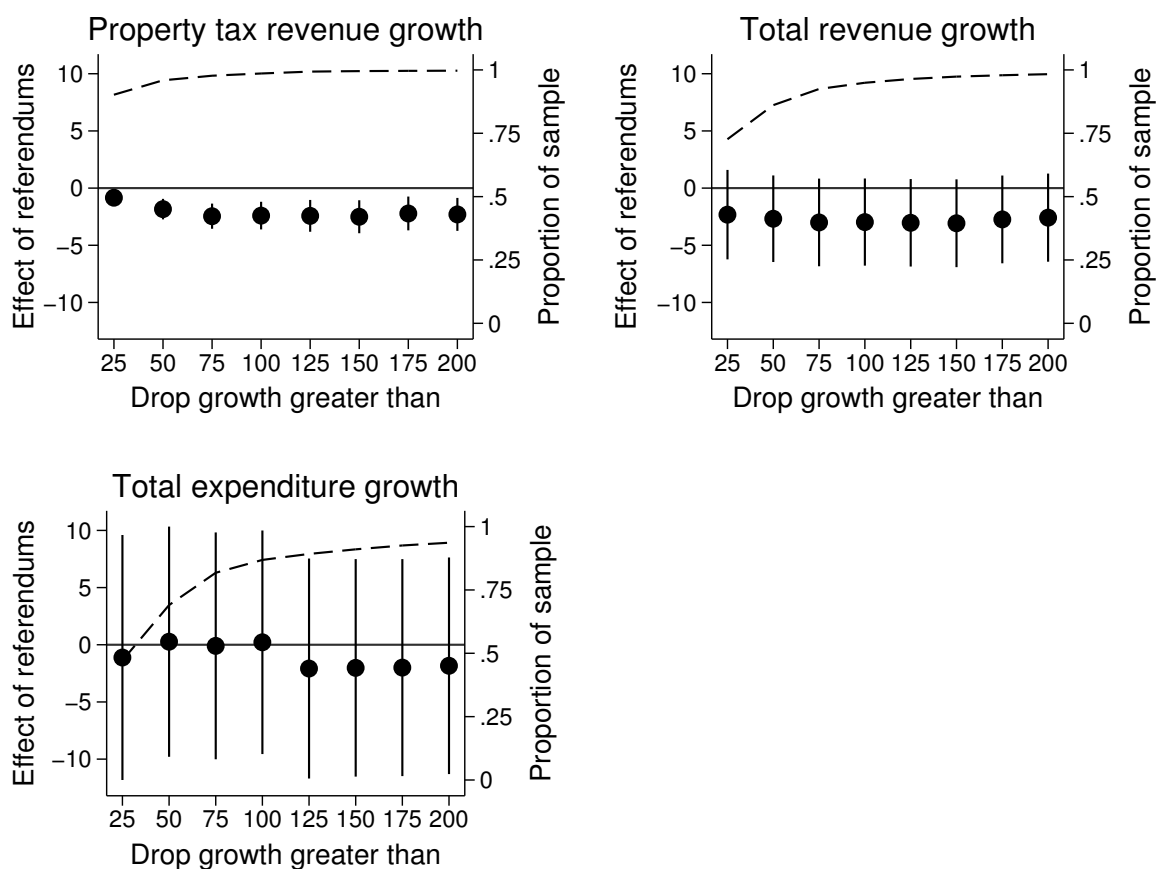


Figure A2: Missingness by outcome variable by year.

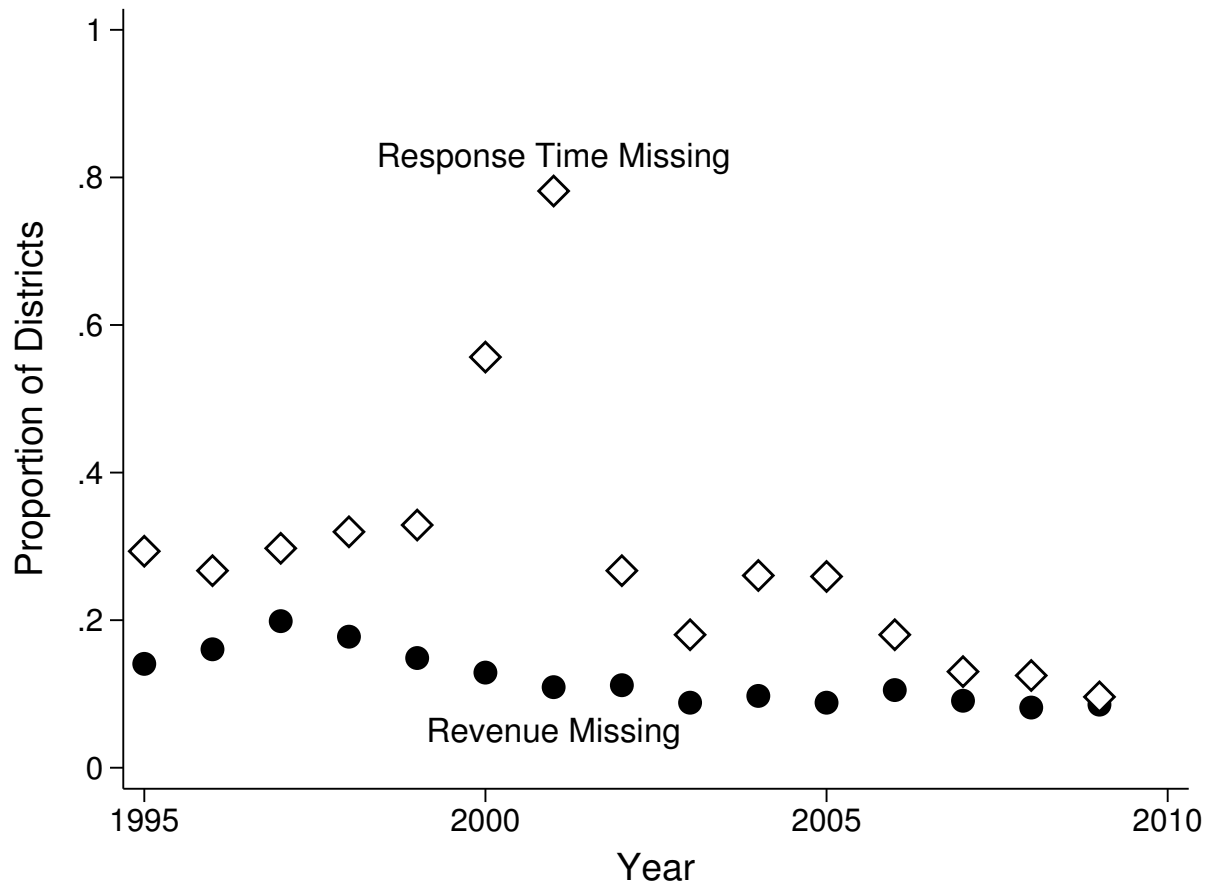


Table A1: Predictors of missingness.

(a) Cross-sectional correlates of missingness.										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Switched	Population	Share 65 and older	Share white	Median income	Switched	Population	Share 65 and older	Share white	Median income
Missing revenue	-0.06* (0.03)	-0.30*** (0.06)	0.26 (0.25)	-1.70 (1.25)	-2.52*** (0.74)					
Missing response time						-0.01 (0.02)	-0.25*** (0.05)	0.36* (0.17)	-0.41 (0.71)	-2.22*** (0.63)
Constant	0.30*** (0.02)	9.38*** (0.03)	13.49*** (0.13)	95.06*** (0.33)	50.50*** (0.48)	0.30*** (0.02)	9.41*** (0.04)	13.42*** (0.14)	94.94*** (0.31)	50.79*** (0.55)
Standard deviation (non-missing)	0.46	0.90	3.49	9.96	12.86	0.46	0.92	3.60	9.64	13.26
Standardized difference	-0.13	-0.33	0.07	-0.17	-0.20	-0.01	-0.27	0.10	-0.04	-0.17

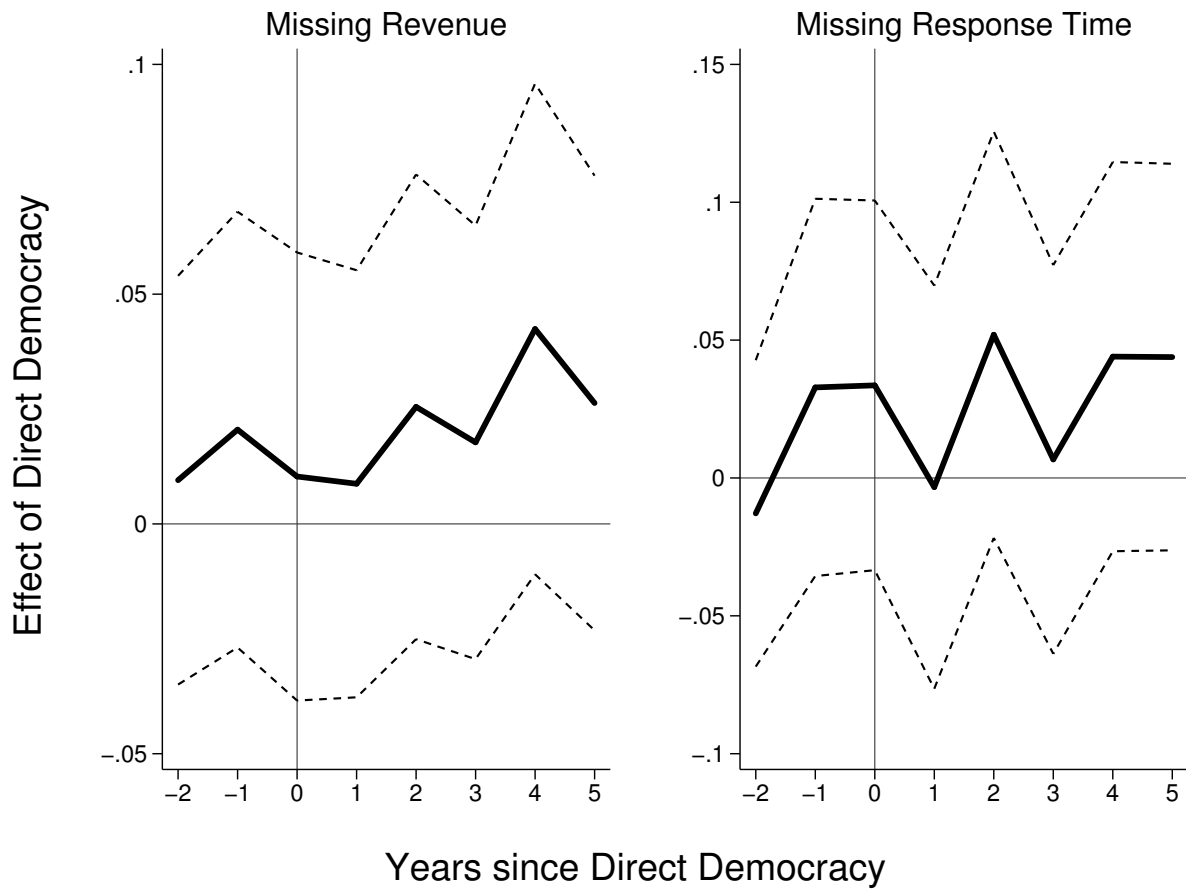
A10

(b) Panel regressions of missingness on referendums.

Missing Property Tax Growth						Missing Response Times			
	(1)	(2)	(3)	(4)	(5)	(6)			
Direct Democracy	0.02 (0.02)	0.02 (0.02)	0.02 (0.02)	0.02 (0.02)	0.02 (0.02)	0.02 (0.03)			
Observations	11,400	11,400	11,400	11,400	11,400	11,400			
Year FE	Y	Y	Y	Y	Y	Y			Y
County FE	Y	Y	Y	Y	Y	Y			Y
Covariates		Y	Y	Y		Y			Y
Clustering	District	District	County	District	District	District			County
E[Y Untreated]	0.13	0.13	0.13	0.31	0.31	0.31			0.31

Notes: In panel (a), there are 11,400 observations, all specifications include year fixed effects, and errors are clustered at the district level. * p<0.05, ** p<0.01, *** p<0.001

Figure A3: Testing for impacts of direct democracy on missingness.



2 Precinct-Level Data Set Construction

Precinct List, Demographics, and Number of Fires

The analysis presented in Table 2 and Figure 4 in the main text is conducted at the precinct level. The analysis involves linking precinct-level measures of the number of fires, election results, and demographics across multiple data sets.

I began with the list of 11,560 unique precincts included in a GIS shapefile available from the Harvard Election Data Archive (HEDA; Ansolabehere and Rodden 2011). These data are current for the 2008 election. While precincts are redrawn every ten years, the majority of fire tax referendums in my sample occur between 2002 and 2012, the years for which these precincts are accurate. The results are robust if I discard observations before 2002 and after 2012.

I matched this list of precincts to precinct-level election results manually, comparing the precinct names in the GIS data set to the names of precincts in the election results data. Fortunately, both the GIS data and the election data were sorted by county.

For the precinct-level median family income and share 65 and older variables, I matched the GIS precinct list to demographic data by overlaying a shapefile of Census block groups, pre-matched with block group-level demographic data, onto the shapefile of precincts, and then aggregating the block group-level data to the precinct level. For the precinct analysis, income and the share 65 are from Census year 2010, and do not vary over time. For population and race, I use variables included with the HEDA data, which are also from 2010.¹

I matched the GIS precinct list to the fire data using a similar process: I overlaid maps of fires onto a map of precincts, and summed the number of fires within each precinct, by year.

¹The Illinois HEDA data do not include a codebook. The sums of population by state and county are most similar to the 2010 Census counts; for example, in my data, total population across all precincts is 12.76 million, and the Census 2010 count statewide is 12.84 million. I prefer the HEDA counts to the block-group aggregated counts, as they require no further aggregation and should be less prone to measurement error.

This process is more difficult than aggregating the Census data, because the fire incidents are not pre-matched to Census block groups, though they are matched to Census tracts (the next largest geographical category in the Census above block groups) and to address. Rather than use tracts, which are so large that they sometimes contain multiple precincts, I ran each of thousands of incident addresses into a geocoding algorithm using the Data Science Toolkit (<http://www.datasciencetoolkit.org/>).²

For the analysis in Figure 4 and Table 2, I only use the number of fires from 2009. As shown in Figure A2 above, this is the year with the least missingness, so I take it to be the most representative and accurate year of the NFIRS data. Results are consistent when using other years, or when taking an average number of fires across all years; see Section 8 in this Appendix.

Precinct-Level Election Results

As part of a broader research project on fire districts in Illinois, in late 2012 I began assembling original election data from these districts by making requests to Illinois counties for all relevant election results from the years 1985 to 2012. Many of these records came in paper form, and were scanned into PDF's. Other counties had their most recent data in a machine-readable electronic format, but each county uses a different records system. Still other counties performed the scanning themselves.

For this paper, I am interested in precinct results from districts which held votes to increase taxes to fund fire protection. I thus began with a list of such elections, by district and by year, from the IL Board of Elections. This yielded 141 unique elections, but not the vote share and not the precinct-level results. I then searched my data base of election results for the precinct-level results relevant to each of the 141 elections. I was able to gather all the precinct-level data for 97 of these

²See Enos (2016) and the relevant Supporting Information a similar use of geocoding to generate precinct-level data. However, rather than geocoding data using an API, the Data Science Toolkit can be downloaded and run locally as a virtual machine, which means there are no quotas and no need for Internet access.

elections, some of the precincts for 12, and for none of the precincts in only 32 cases.

Figure A4 plots these proportions by year. The height of each individual bar is the total number of district-level elections occurring that year, and the shaded regions represent the number of elections for which none, some, or all precinct-level results were obtained. Figure A5 aggregates the data to the district level, mapping districts that switched to referendums over this period (lightest gray), those that held referendums over this period (according to the Board of Elections data) but for which I was unable to obtain any precinct data (medium gray), and those for which I was able to obtain some or all precinct-level data (darkest gray).

I matched precinct-level election results to the GIS data by exporting lists of unique precincts from each data set and finding precincts with similar names located in the same county. Once the election results are linked with the GIS data, they can then be linked relatively easily to the demographic and fire count data.

Missing Data

As the availability of election results (and hence missingness) is due to whether a district's election results are available from a county, I conduct an analysis of missingness at the district level. There are 99 unique districts in my data set of fire referendums, and I am able to match 81 of these to my demographic data. Some districts held more than one referendum over this period; thus, the total number of observations in this analysis is 117.

Table A2 shows differences in means on population, age, race, and income between districts where all precinct-level election returns are obtained (*Any elections missing* = 0) and those with some or all precinct-level election results missing (*Any elections missing* = 1). These differences in means are computed using regressions of each covariate on the *Any elections missing* indicator variable. There are no substantive or statistically significant differences between districts with and without missing precinct data.

Figure A4: Precinct-level election results availability by year.

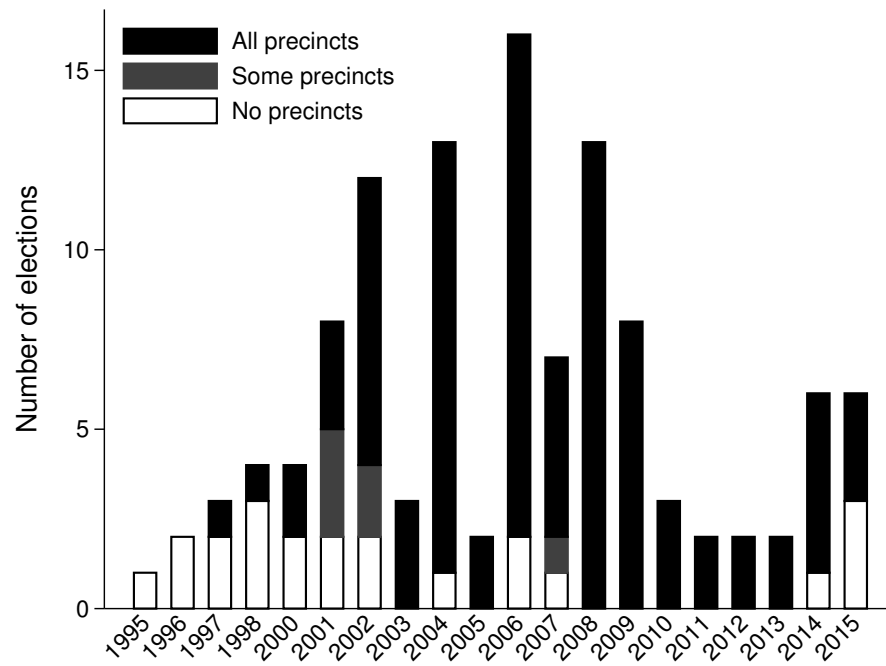


Figure A5: Precinct-level election results availability by district.

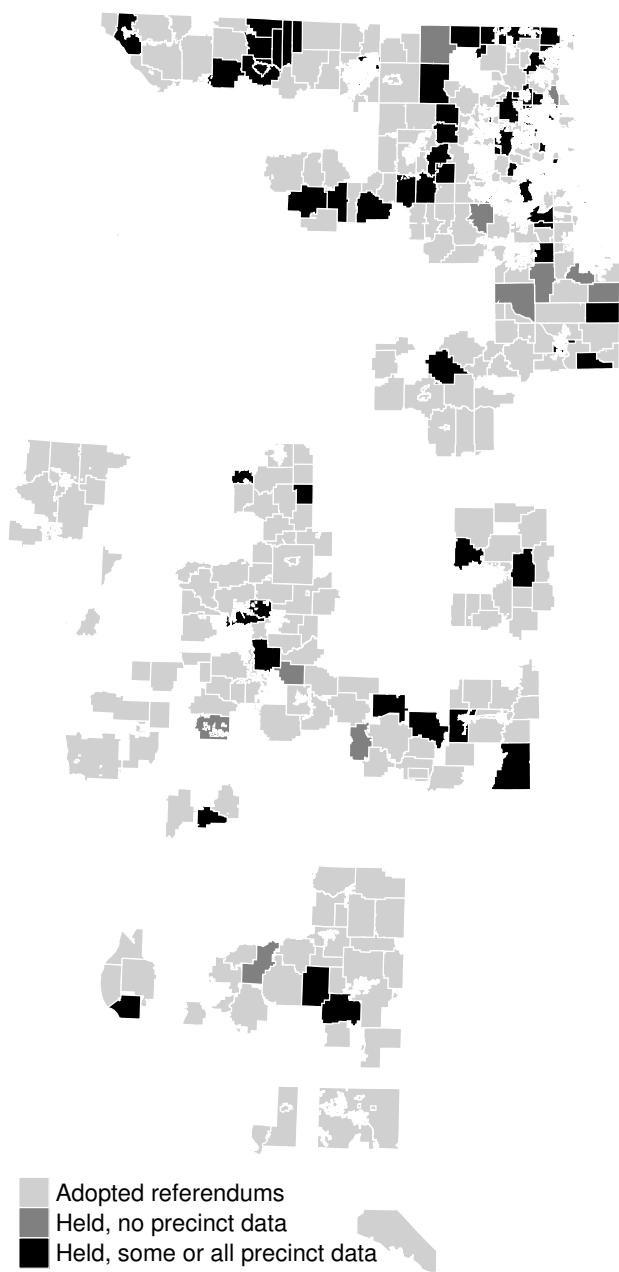


Table A2: Predictors of missingness on precinct-level election returns.

	(1) Population	(2) Share 65 and older	(3) Share white	(4) Median income
Any elections missing	0.31 (0.23)	-1.44 (1.02)	-1.71 (3.36)	1.68 (3.97)
Constant	9.76*** (0.14)	11.16*** (0.54)	94.90*** (0.80)	57.04*** (1.88)
Standard deviation (none missing)	0.98	3.78	5.97	13.63
Standardized difference	0.32	-0.38	-0.29	0.12

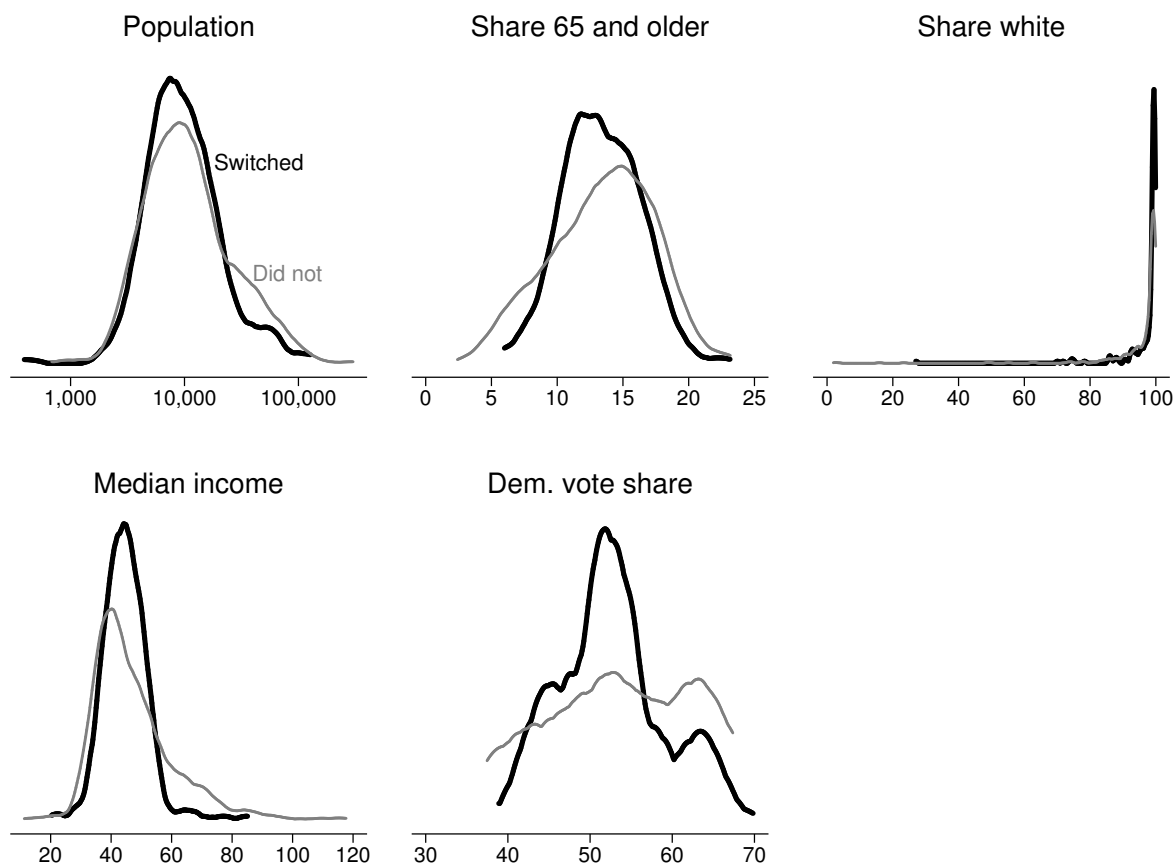
Notes: There are 117 observations (district-elections) in each column. Standard errors are clustered at the district level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3 Differences Between Switchers and Non-Switchers

In this section I show comparisons in terms of densities (generated using kernel density plots) as well as means (generated using regressions of each observable variable on an indicator for switching over the sample period). Figure A6 compares densities, showing a great deal of similarity in terms of population, the share 65 and older, and the share white. These comparisons are performed using a single year of data (so the sample size is 760 districts), and use measures from 1990 (vote share is from 1992). Switching districts do appear slightly wealthier in terms of median income, and the distribution of Democratic vote share (using the county-level vote for president in 1992) is slightly more conservative in switching districts, and also less variable compared to non-switching districts.

In terms of mean differences, shown in Table A3, switching districts are 1.2 percentage points whiter (standard error of 0.6 points), about \$2,600 less wealthy (standard error of \$780), and are located in counties that are 1.21 points less Democratic in 1992 (county-clustered error of 1.95 points). In terms of standardized differences (scaling the differences by the standard deviation in the non-switching districts), the largest is median income, at 0.19 standard deviations.

Figure A6: Differences between switchers and non-switchers on observable characteristics.



Notes: This figure shows kernel density plots for each of five observable variables, both for fire districts that switched over the sample period (black) and districts that did not (gray). Population is on a log scale, and income is in thousands. All variables are measured in 1990 and at the district level, except Democratic vote share which comes from the 1992 presidential election and is at the county level.

Table A3: Differences between switchers and non-switchers on observable characteristics.

	(1) Population	(2) Share 65 and older	(3) Share white	(4) Median income	(5) Dem. vote share
Switched	-0.11 (0.06)	-0.06 (0.26)	1.21* (0.61)	-2.64*** (0.78)	-1.21 (1.95)
Constant	9.30*** (0.04)	13.42*** (0.17)	95.88*** (0.41)	47.37*** (0.59)	53.70*** (1.55)
Standard deviation (non-switchers)	0.88	3.94	9.54	13.67	8.76
Standardized difference	-0.12	-0.02	0.13	-0.19	-0.14

Notes: Cell estimates are coefficients from regressions of each covariate on an indicator for switching over the sample period, with robust standard errors in parentheses. Standard errors are clustered at the county level in column (5), as Democratic vote varies only at the county level. Because each regression includes only one independent variable, the constant is simply the mean among the districts that did not switch. The footer to the table shows the standard deviation among the non-switchers, as well as the standardized difference in means (the coefficient on Switched divided by the standard deviation). There are 760 observations in each regression, and the unit of analysis is the fire district. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4 Predictors of Response Times

It is difficult to identify the impact of revenue on service performance, given that most of the variation in revenue is endogenous. Nonetheless, here I report some simple regressions of response times on property tax revenues. I present several specifications: first, a regression that includes only revenues (thus only using cross-sectional variation); second, a regression that adds population, the share elderly, the share white, and median income as covariates; third, a regression that adds year fixed effects to control for time trends; fourth, a regression that adds district fixed effects; and finally, a regression that uses referendums as an instrument for property tax revenues. In all specifications, I scale the revenue growth variable by 1.8 percentage points. This means that the estimates reported here may be easily compared to the effect of referendums on revenue in the main text. I show the results in Table A4.

These regressions show that, as expected, revenues and response times are negatively related. However, the point estimates in the OLS regressions are generally very small and imprecise, implying that a 1.8 percentage point shift in revenue growth (the magnitude of the impact of referendums on revenue reported in the main text) leads to at most a decline of 0.02 minutes (or 1.2 seconds). When using referendums as an instrument, however, the estimated effect of a 1.8 point change in revenue growth is estimated to be 0.5 minutes, similar to the effect of referendums on response times reported in the main text. (The F-statistic on referendums is 9 in the first stage; I omit the first stage regression output as it is essentially the same as the regression of revenues on referendums shown in the main text.) These regressions also show that districts with higher populations, more elderly residents, and higher incomes generally see lower response times.

Table A4: Relationship between revenues and response times.

	(1)	(2)	(3)	(4)	(5)
Property Tax Growth (Percent)	-0.021*** (0.006)	-0.003 (0.006)	-0.001 (0.005)	-0.001 (0.005)	-0.490* (0.210)
Population		-0.603*** (0.110)	-0.661*** (0.111)	-0.107 (0.405)	0.757 (0.680)
Share 65 and older		-0.001 (0.022)	-0.084*** (0.022)	-0.032 (0.050)	-0.021 (0.062)
Share white		0.012 (0.010)	0.029** (0.010)	0.038 (0.023)	-0.020 (0.040)
Median income		-0.024*** (0.006)	-0.029*** (0.006)	0.001 (0.019)	-0.018 (0.025)
Constant	7.504*** (0.079)	13.354*** (1.698)	12.771*** (1.746)	4.484 (4.672)	4.291 (6.704)
Observations	7,249	7,249	7,249	7,249	7,249
Year FE			Y	Y	Y
District FE				Y	Y
Estimator	OLS	OLS	OLS	OLS	2SLS

Notes: Standard errors clustered at the district level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5 Better Firefighting Technology?

An increase in response times might not be problematic if it coincides with improvements in firefighting technology, including detection. In this section I report regressions where the logged number of fires per 1,000 district residents is the outcome. If changes to referendums coincide with changes in technology – such as better detection – then we should see a drop in the number of fires once referendums are adopted.

The top panel of Table A5 reports estimated effects of referendums on the number of fires. The point estimates, while negative, are close to zero and statistically insignificant. The transformed predictions, shown in the footer, show the estimates amount to a difference of, at most, 0.1 fires per 1,000 persons under direct democracy.

The bottom panel of Table A5 replicates the results for revenues and response times in the main text, but with the number of fires included as a control. Because these regressions include the subsample with no missingness on either outcome, the sample size is reduced to about 7,300. The effects on revenue are essentially the same as in the full sample, indicating a drop in revenue of about 1.7 points. The effects on response times are even more similar to those reported in the text.

Table A5: Predicting and adjusting for the number of fires.

(a) Log fires per 1,000 persons as the outcome variable.

	Structure Fires (Logged)		
	(1)	(2)	(3)
Direct Democracy	-0.04 (0.02)	-0.03 (0.02)	-0.03 (0.03)
Observations	8,099	8,099	8,099
Year FE	Y	Y	Y
County FE	Y	Y	Y
Covariates		Y	Y
Clustering	District	District	County
E[Y Untreated]	1.61	1.60	1.60
E[Y Treated]	1.50	1.52	1.52

(b) Replicate district result adjusting for log fires per 1,000 persons.

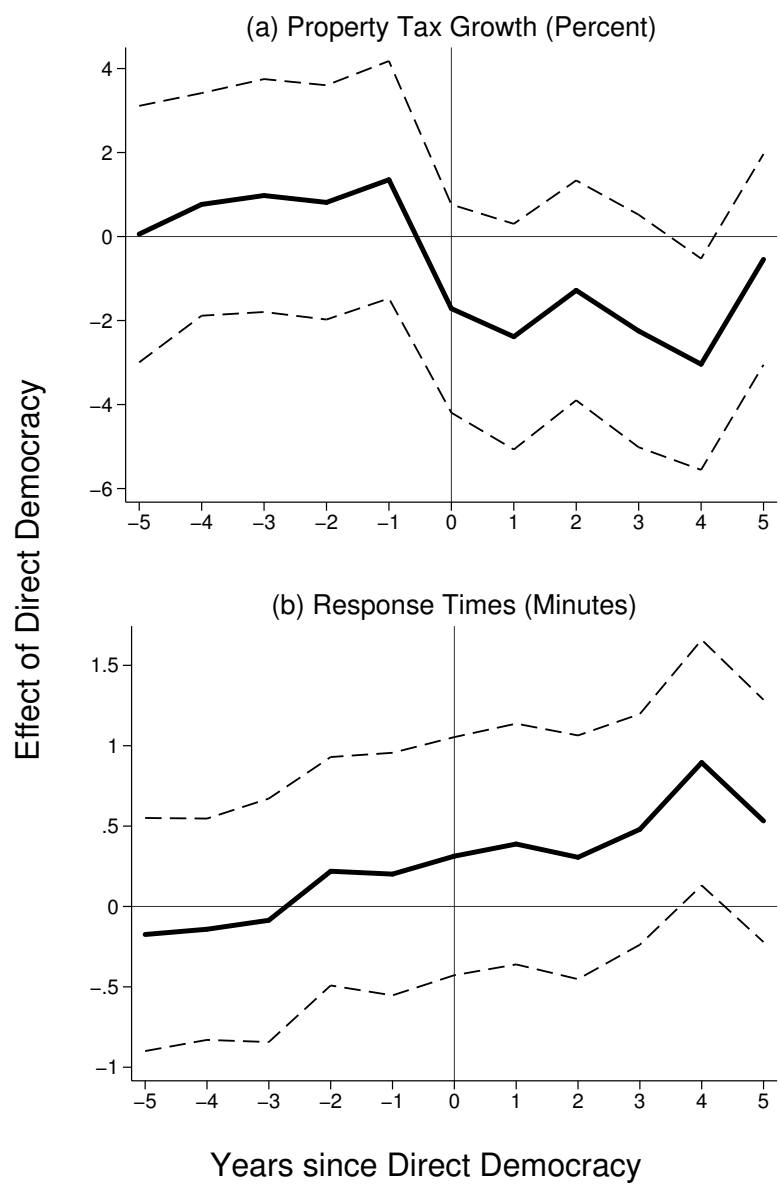
	Property Tax Growth (Percent)			Response Times (Minutes)		
	(1)	(2)	(3)	(4)	(5)	(6)
Direct Democracy	-1.74** (0.61)	-1.73** (0.61)	-1.73* (0.73)	0.46** (0.15)	0.45** (0.15)	0.45** (0.17)
Observations	7,265	7,265	7,265	8,099	8,099	8,099
Year FE	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Covariates		Y	Y		Y	Y
Clustering	District	District	County	District	District	County
E[Y Untreated]	4.83	4.83	4.83	7.60	7.60	7.60

Notes: Standard errors clustered at the district level. * p<0.05, ** p<0.01, *** p<0.001

6 Alternative Window for Dynamic Panel Estimates

The dynamic panel estimates in the main text use two years of pre-treatment data and five years post-treatment. My choice of the number of pre-treatment years relative to post-treatment years is driven by the fact that I have much more data in the post-treatment years. My district data run 1995-2009, and most of the switches have occurred by 2000. Thus, I have many more districts that are five or more years post-treatment than I do districts that are five years pre-treatment. For these reasons, I prefer the -2 to +5 window and continue to use it in the main text. However, I replicate the results using the -5 to +5 window in Figure A7 below.

Figure A7: Dynamic panel estimates using a five-year window



7 Press Accounts of Impact of Referendums

I searched for news coverage of referendums using the Newsbank³ database, limiting results to newspapers in Illinois. My search terms included: “PTELL” AND “fire district”; “PTELL” AND “fire protection district”; “fire protection district” AND “response time”; “referendum” AND “inflation” AND “response time”; “referendum” AND “inflation” AND “fire district”. Given most of the hits on Newsbank were limited to the northern part of the state, I did a second pass using the same terms on Google, adding the term “Illinois” to all searches. Using these terms and databases, I identified 33 articles discussing 36 unique cases of a fire district considering a property tax increases; some of these cases involved the same district over multiple years, so the number of unique districts in this analysis is 28. Figure A8 maps the counties where district-referendums were covered in these stories, with shadings reflecting the number of unique district-referendums found per county. Table A6 provides more details on each article reviewed.

Several common themes emerged in these accounts. First, many districts pointed to increases in call volumes, populations, and operating costs that had occurred since their tax rate was last increased; however, the state law (PTELL) had prevented them from increasing revenues to meet these costs. For instance, to explain a proposed 1994 referendum, officials in the Lake Zurich Rural district (Lake County) point to “compounded growth” in population but not revenue (Costello 1999); in 1995, officials in Winfield District (DuPage county) note growing operating costs (Johnson 1995); and Monee district (Will County) officials point to population growth and rising call volumes to explain a 1997 referendum (Herald-News 1997). Officials in Pingee Grove and Countryside district (Kane County) in 2006 noted that there had not been a major tax increase since the 1970s, even though demand had increased substantially since (Adkins 2006). Overall, about 55% of these accounts mentioned growth in costs and demand as a reason for proposing the tax referendum.

Second, it was pointed out several times in these articles that property taxes are districts’ only

³See <http://www.newsbank.com/>.

revenue source. A supporter of a referendum in Plainfield district (Will County) in 2004 notes districts rely only on property taxes, and (unlike some municipalities) lack the power to impose a sales or income tax (Hernandez 2004). Casas (2017) notes, in an account of a referendum in Fox River and Countryside district (Kane County), that property taxes are districts' only revenue source, as does Zabell (2001c) in an account of a referendum in Lockport Township district (Will County). The potential problem of the utter reliance on the property tax under a fiscally constraining referendum regime has not gone completely unnoticed by state legislatures. In a discussion of Barrington Countryside district (Lake County), Robeznieks (2001) quotes a state legislator to the effect that districts have always been funded by local property taxes, and this is unlikely to change any time soon. Officials in Shelbyville district (Shelby County) were fortunate enough to receive some funds from a grant secured by a state legislator, but this legislator promised these funds would probably not be renewed (Mosley 2000). Zabell (2001a) notes that the state legislature did move to create a dedicated state fund for fire districts in 1999, but that the governor vetoed this effort, seeing it as an attempt by districts to bypass the tax cap.

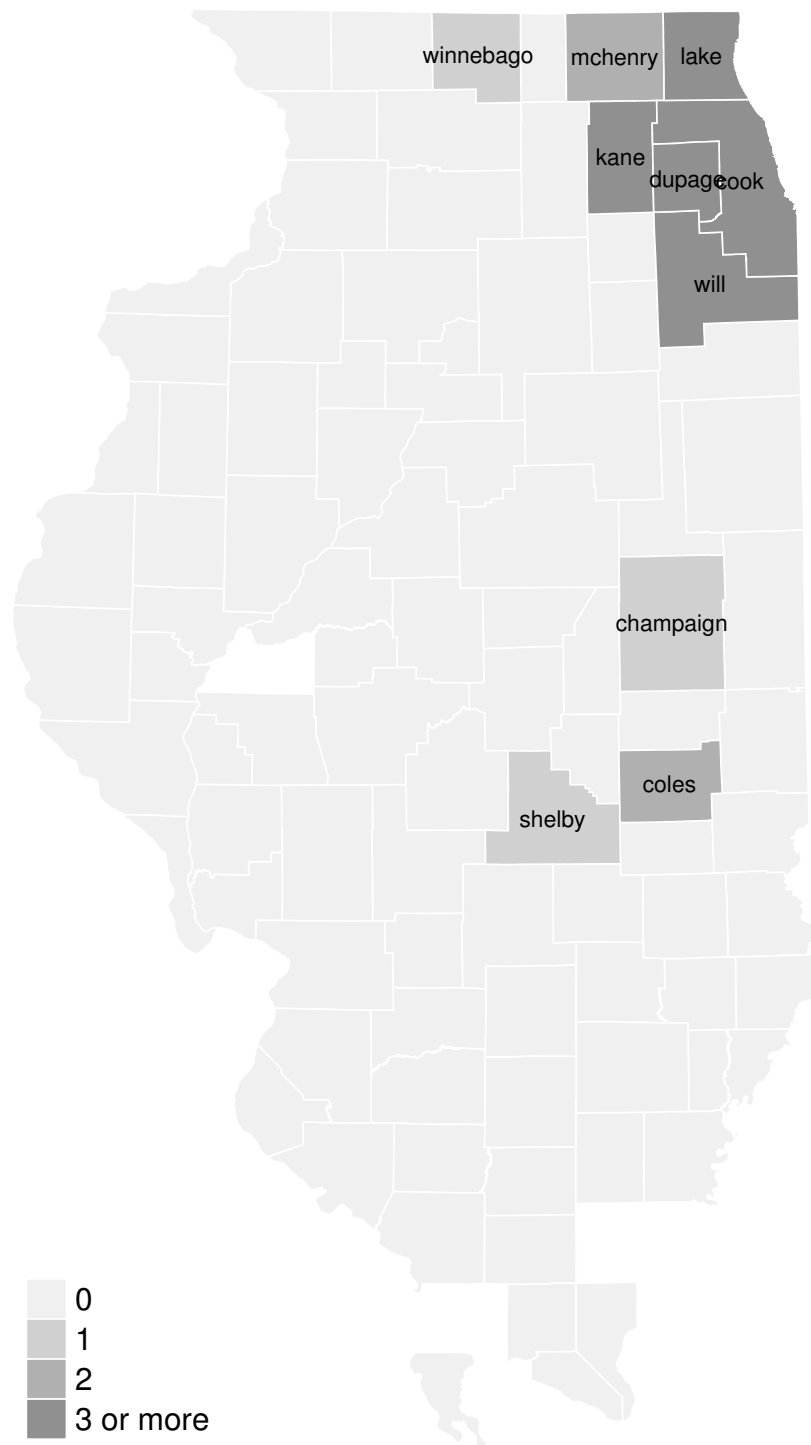
Third, the referendums are typically said to be needed to staff stations for more hours, build or staff new stations, and upgrade or replace aging equipment. Officials in Homer Township district (Will County) note that a third firehouse had recently been built, but the district could not afford to staff it without a tax increase (Zabell 2001a). Sugar Grove district (Kane County) seeks to use the funds to "keep four people in the station at all times instead of just two," and to convert contracted on-call employees to full-time (Pierce 2004). Officials in Hampshire district (Kane County) propose a referendum to be able to staff their station 24 hours a day (Edwards 2005). Also mentioned is the need to replenish staff in the wake of recent cuts. For instance, in Palos district (Cook County), the referendum was said to be needed in part due to a recent reduction in staff by six part-time positions. Aside from staff, the need to upgrade old equipment or acquire new equipment is also frequently mentioned. All in all, the need to use referendum funds to hire staff or pay for equipment was mentioned in 83% of these accounts.

As a brief aside, districts often characterize themselves as operating on a very lean budget.

Firefighters in Cooks Mills district (Coles County) held a pancake cookout to fund the cost of new pagers (Meeker 2011); in Bartlett district (Cook County), firefighters went without air conditioning and heat in the firehouse, made plumbing repairs themselves, and fought fires wearing safety equipment well past the recommended service date (Peterson 2017).

Fourth, a link is often made between referendum passage and response times. District officials will argue that, without the funds to adequately staff stations, response times will necessarily increase. In Frankfort district (Will County), Zabell (2001b) notes passage of the referendum would mean “the fire district will be able to use its third station ... and respond to at least some emergencies more rapidly than it does now.” Lake Zurich district’s (Lake County) fire chief notes that “the best way to keep response times low is to have staff on hand to answer calls” (Robeznieks 2001). Edwards (2005) reports that response times in Hampshire district (Kane County) are slowest overnight, because the district lacks the funds to staff the station at night and firefighters must respond from their homes. In total, 30% of accounts made a link between response times and referendums.

Figure A8: Map of counties for districts included in press coverage analysis.



Notes: Shadings indicate the number of unique district-referendum stories found per county.

Table A6: Press accounts of tax referendums.

Year	District	County	News/Opinion	Notes	Source
1994	Lake Zurich Rural	Lake	News	More funds should lead to faster response times 'Compounded growth' in population but not revenue Funds would be used to build and staff additional stations	Costello (1995)
1995	Winfield	DuPage	News	Funds needed to meet growing operating costs Funds needed to buy new truck and for operations	Johnson (1995)
1997	East Joliet	Will	News	Chief says 'already down to the bare bones' Staffing should reduce response times	Herald-News (1997)
1997	Monee	Will	News	Growth around district has boosted number of calls Funds needed to have stations staffed overnight	Herald-News (1997)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
				'trying to maintain our expenditures vs. our income,' says fire chief	
1998	Oakbrook Terrace	DuPage	News	A failed referendum may result in service cuts Funds requested to fund life support ambulance service Operating costs have increased more than inflation	Sanchez (1998)
1999	Glenside	DuPage	News	No increase since 1978 Without an increase, services will be cut, says chief Number of calls has increased, but taxes can't without voter approval	Edman (1999)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
2000	Plainfield	Will	Opinion	Funds will be used to hire staff; more staff will reduce response time Towns have annexed district property, shrinking tax base State legislator recently secured grant for district, but won't last	Hernandez (2000)
2000	Shelbyville	Shelby	News	Referendum funds to be used to buy a ladder truck Fire board president says district living 'hand-to-mouth' District struggling financially under state tax cap; cut training budget 75% as population and costs increased	Mosley (2000)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
2000	South Elgin and Countryside	Kane	News	Recent referendum passage allows district to cover insurance and operation costs and keep up with maintenance	Gadola (2000)
2000	Oakbrook Terrace	DuPage	News	Funds requested to fund advanced life support for paramedics State legislator notes districts have always been funded by local taxes, and legislature unlikely to provide alternative revenue source	McCoppin (2000)
2001	Barrington Countryside	Lake	News	Growth in calls led district to put tax referendum on ballot	Robeznieks (2001)
2001	Homer Township	Will	News	Calls are 'skyrocketing' but funds are not State legislature tried to fund districts with state funds in 1999, but governor vetoed	Zabell (2001a)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
				Funds to be used to staff new station Number of calls to employees increased 1/3 in past 10 years, but taxes frozen	
2001	Lockport Township	Will	News	Passage would reduce response times Solely dependent on property taxes for revenue Passage would reduce response times	Zabell (2001c)
2001	Frankfort	Will	News	Call volume increased by about 300 per year Funds needed to operate third station, hire more staff, and decrease response times Funds needed to staff new station	Zabell (2001b)
2001	Lake Zurich Rural	Lake	News	Best way to reduce response times is to have more staff on hand	Robeznieks (2001)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
				Officials point to big increase in service calls as need for more operating dollars	
2002	Burlington	Kane	News	Funds needed to comply with state mandate to have staff on call five days a week, and pay for rising insurance costs Call volume has increased	Smith (2002)
2002	Elburn	Kane	News/Opinion	Funds to be used to add full-time workers to volunteer force	Aguilar (2002); Daily Herald Editorial Board (2002)
2002	Fox River Grove	McHenry	News	Funds to be used to pay for new ambulances, equipment replacement and repair, salaries and training	Daily Herald (2002)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
2002	Cary	McHenry	News	Funds to be used to pay for ambulance expenses, buying new heart monitors, and training costs	Daily Herald (2002)
2002	Barrington Countryside	Cook	News	Funds to be used to eliminate operating deficit, build and staff third station, and reduce response times	Daily Herald (2002)
2002	Warren- Waukegan	Lake	Opinion	Call volume and cost of operations increase at rate higher than inflation	Friedl (2002)
2002	Lincoln	Coles	News	Officials blame loss of territory and need to replace equipment as reason to request tax increase for first time in several years Calls have increased 270 percent in past 10 years, but revenues frozen	Fopay (2002)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
2004	Plainfield	Will	Opinion	Districts rely only on property tax and can't impose sales or income tax Money to be spent on new fire house and staff Passage would keep four people at station at all times instead of two	Hernandez (2004)
2004	Sugar Grove	Kane	News	Funds needed to pay for more full-time employees and updated equipment	Pierce (2004)
2005	Hampshire	Kane	News	Response times are lower when department is staffed Money needed to staff station 24 hours a day	Edwards (2005)
2006	Pingee Grove and Countryside	Kane	News	No tax increase since mid-1970s, while demand has multiplied	Adkins (2006)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
				Funds to be used to improve equipment and increase staffing in remote part of district	
2007	Winfield	DuPage	News	Funds needed to hire three new full-time firefighters and shore up district finances	Komperda (2007)
2007	Bartlett	Cook	News	Additional station and staffing due to recently passed referendum should make services adequate Candidate says services are 'barely adequate,' with 'minimum staffing' at two stations and long response times Q and A with candidates for district board of trustees	Daily- Herald (2007)
2008	Winfield	DuPage	News	No major increase since 1988, but call volume has tripled since	Komperda (2008)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
				Currently operating with a shortfall	
				Three previous referendums have failed	
2011	Cooks Mills	Coles	News	Raise money from fundraisers (pancake breakfasts and pork chop cookouts); used to buy equipment	Meeker (2011)
				Firehouse runs on 22,000 a year, but expenses rising every year	
				Blame PTELL and a shrinking tax base for fiscal stress	
2011	St. Joseph-Stanton	Champaign	News	Funds to be used for new station and equipment upgrades	Maberry-Daniels (2011)
				District has had to cut six part-time positions and has not replaced trucks or ambulances	

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
2012	Palos	Cook	News	Has also closed one of two fire stations during shifts when not enough staff	Lafferty (2012)
2015	North Park	Winnebago	News	Funds would have been used for staff and equipment	WREX (2015)
2017	Bartlett	Cook	News	Firefighters living without air conditioning/heat, make plumbing repairs themselves, and used worn out protective gear. Currently using reserves to pay for gas and electricity. Rising costs and deferred needs driving request for increase	Peterson (2017)
2017	Hampshire	Kane	Opinion	Funds to be used for two extra firefighters (up from four) and a paramedic engine	Daily Herald Editorial Board (2017)

Table A6: Press accounts of tax referendums (continued).

Year	District	County	News/Opinion	Notes	Source
				District officials claim adding staff would reduce response times by half More calls in last year than in any year in district's history	
2017	Fox River and Countryside	Kane	News	Only source of revenue is property taxes Claims district will close, response times increase, within two years if referendum fails Equipment becoming obsolete and needs to be replaced; have two firefighters per engine but safety standard is four	Casas (2017)

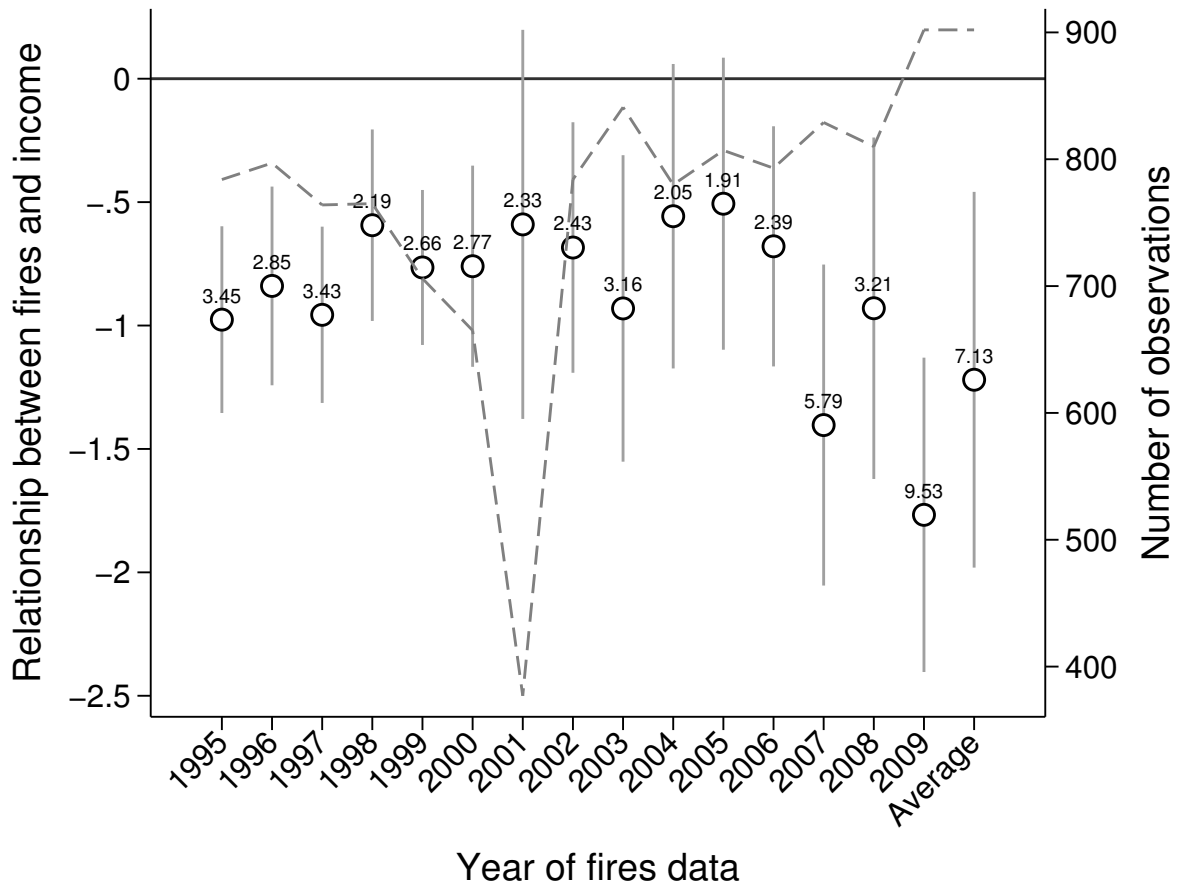
8 Using Alternative Years for Number of Fires

The precinct-level analysis in the main text uses structure fire data from 2009 only (the district analysis uses response time data from 1995-2009). In this section I show the relationship between the number of fires and income, shown in Table 2 in the main text, replicates when using other years. Figure A9 plots coefficients repeating the regression in Table 2, column 1 when using different years of structure fire data. The numbers above each point show the implied ratio of the number of fires between poorest and richest precincts. For instance, using the data from 2009 implies the poorest precincts are about 9 times as likely to experience a structure fire. The dashed line and right vertical axis plots the number of observations available in each year (the variation is solely due to whether the fire counts are missing or not in each precinct in each year).

The final point estimate presents results when averaging over the number of fires from 1995 to 2009. Note this average is conducted by summing across all years, treating missing observations as zeros, and dividing by the total number of years with non-missing data in each precinct. For example, if a precinct was missing data for all years but 2008 and 2009 (to take an extreme and purely hypothetical case), the average would be $[(\text{number of fires in 2008}) + (\text{number of fires in 2009})] / 2$. The replacement of missing values with zeroed when constructing the average is simply to allow Stata to sum the non-missing observations within precincts.

Figure A9 shows the results are qualitatively similar regardless of the year used. The relationship is always negative, and is only statistically insignificant in three years: 2001, the year with the least data available (see the discussion of missing NFIRS data in Section 1 of this Appendix), 2004, and 2005. The ratio of poor-to-rich fires varies from 2 to 9, implying that poor precincts are 2 to 9 times as likely to experience fires; the ratio using the average is about 7.

Figure A9: Robustness of income-fire relationship to alternative years of data.



Notes: Points are estimates from regressions of logged number of structure fires per 1,000 persons on log median family income in 2000. Estimates are computed at the precinct level with district-clustered standard errors. Vertical lines span 95% confidence intervals. The dashed line and right vertical axis show the number of observations in each year. The numbers appearing above each point represent the estimated number of fires among the poorest precincts divided by the estimated number among the wealthiest precincts. The “average” coefficient denotes the average across years 1995-2009.

9 Interaction Between Treatment and District Fire Incidence

Table 3 in the main text shows results when interacting direct democracy with district-level median income. Table A7 below replicates this interaction using district-level fire incidence, measured as the log of the number of fires per 1,000 residents in 2009. In all specifications, the estimates suggest low-incidence districts see increases in response times while high-incidence districts see either smaller increases or even decreases. The estimates in the both the upper and lower panels suggest high-incidence (poorer) districts actually see more negative impacts on tax revenues compared to low-incidence (wealthier) districts. Additionally, the magnitudes of the coefficients, as well as the statistical precision, is greatly reduced compared to the specifications that use district income. This may be because fire incidence has more measurement error than median income, given that the former is voluntarily reported by districts and the latter is compiled by the Census. It may also be that income is a better proxy for potential exposure to fire than actual incidence.

Table A7: The effect of direct democracy on revenues and service quality: interaction with district fire incidence.

(a) Using logged fires per capita rescaled from zero to one.

	Property Tax Growth (Percent)			Response Times (Minutes)		
	(1)	(2)	(3)	(4)	(5)	(6)
Direct Democracy	-1.26 (1.01)	-1.28 (1.02)	-1.28 (1.27)	0.74 (0.31)	0.72 (0.31)	0.72 (0.33)
Treat X Incidence	-1.81 (3.11)	-1.83 (3.16)	-1.83 (3.26)	-1.04 (0.93)	-1.04 (0.93)	-1.04 (0.99)
Observations	9,128	9,128	9,128	7,759	7,759	7,759
Year FE	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Covariates		Y	Y		Y	Y
Clustering	District	District	County	District	District	County

(b) Using an indicator for being above the sample median on logged fires per capita.

	Property Tax Growth (Percent)			Response Times (Minutes)		
	(1)	(2)	(3)	(4)	(5)	(6)
Direct Democracy	-1.47 (0.71)	-1.52 (0.71)	-1.52 (0.91)	0.59 (0.22)	0.58 (0.22)	0.58 (0.25)
Treat X Incidence	-0.58 (0.93)	-0.51 (0.94)	-0.51 (0.95)	-0.26 (0.28)	-0.27 (0.28)	-0.27 (0.33)
Observations	9,128	9,128	9,128	7,759	7,759	7,759
Year FE	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Covariates		Y	Y		Y	Y
Clustering	District	District	County	District	District	County

Notes: Cell entries are treatment effect estimates, with clustered standard errors in parentheses. All specifications also include a linear time trend, and an interaction between fire incidence and a linear time trend.

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