ESSAYS IN LOCAL PUBLIC FINANCE

By

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Economics – Doctor of Philosophy

2018

ABSTRACT

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My dissertation studies how political factors, local labor demand shocks, and voting behavior affect state and local public goods provision. Following a brief introduction, I begin with "Legislative Redistricting, Party Politics, and the Spatial Distribution of Transportation Expenditure." In this essay, I estimate how a state representative's political party affects road construction expenditure in areas that she represents. An extensive literature asks how a legislator's party affiliation affects public expenditure in the area the legislator represents. Unfortunately, almost all studies estimate this effect using party changes through election outcomes, which could be correlated with unobservable determinants of transportation expenditure. To overcome this issue, I identify my estimates using changes in party affiliation engendered by the 2012 state legislative redistricting in Ohio. In many cases, redistricting moved a geographic area into a district whose incumbent representative belonged to the opposing political party. This created variation in partisan alignment unrelated to election outcomes. From 2010-2017 the Republican party controlled the Ohio House of Representatives, the Ohio Senate, and the governorship. Using variation due to redistricting for identification, I find that areas moving from Republican to Democratic districts due to redistricting received $3.5 million (0.19 standard deviations) less annual highway construction funding than areas that remained in Republican districts. This funding decrease derives from a decline in the number of large construction projects in these areas. The estimated effects differ substantially when identified using variation through voting in non-redistricting years, perhaps due to selection issues concerning the type of districts changing parties through election outcomes. In addition, the expenditure change associated with a party change through election outcomes depends on whether the incumbent lost an election or retired, further evincing selection issues associated with this variation.

In my next essay, "Municipal Government Reaction to Mass Layoffs in Ohio," I study how municipal government finances respond to negative local employment shocks. Using data from 595 municipalities in Ohio, I estimate the change in municipal revenue after reported mass layoffs and plant closings, as well as the municipality's response: possible adjustments to tax rates, expenditure, and borrowing. I find that income tax revenue plummets in the year after a mass layoff, driven by a large decline in income tax base. Municipalities do not raise income or property tax rates to compensate for the income tax drop - rather, tax rates decline slightly. Property tax revenue also declines, while revenue from service charges and fees and intergovernmental revenue do not change significantly. Thus, total revenue drops substantially for several years after a mass layoff. In response, municipalities cut expenditure across several categories, including general government, public safety, leisure and community environment, and capital outlay. Cities also draw down their unreserved fund balance substantially, avoiding deeper cuts to expenditure by depleting their accumulated funds.

In my last essay, "Ballot Order and Ballot Roll-off: Evidence from Ohio," coauthored with Mike Conlin and Paul Thompson, I study how an election item's position on the ballot affects the probability that voters abstain from voting on that item ("roll-off"), and on the probability that voters choose to vote yes conditional on casting a ballot. Local tax referenda in Ohio rotate ballot position every year based on the level of local jurisdiction that placed the referendum on the ballot, providing a source of exogenous variation to test these propositions. Previous research suggests that voters are less likely to cast a vote for election items lower on the ballot, and more likely to choose the status quo. These findings support the idea of choice fatigue, suggesting that facing more decisions impairs voters' decision making ability. Unlike previous papers, I am able to control for demographic characteristics (age and party affiliation) of voters who see each referendum. I find that voters tend to cast more yes votes for items lower on the ballot. I also find that older voters are much less likely, and partisan voters much more likely, to abstain from ballot items, showing the importance of controlling for these characteristics when estimating the effect of ballot position on roll-off.

ACKNOWLEDGEMENTS

I thank my committee - Leslie Papke, Ron Fisher, Cory Smidt, and especially my chair Mike Conlin - for their counsel and support.

I thank the Lincoln Institute for supporting my research through a C. Lowell Harriss Dissertation Fellowship.

I also thank my parents for their investment of time and effort in my education.

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CHAPTER 1

INTRODUCTION

State and local government activities comprise a substantial share of economic activity in the United States, and provide goods demanded by almost all citizens. According to the Census Bureau, state and local governments spent $3.4 trillion in 2015 [United States Census Bureau, 2017b], roughly 19% of United States Gross Domestic Product. State and local governments produce many public services often considered essential, including public safety, roads, education, sanitation, and utility services. State and local tax and expenditure decisions drive important choices by private citizens: where to live, where to start a business, and where to educate one's children.

Besides the impact of their fiscal decisions, state and local governments merit special attention for three important reasons. First, despite the scope and influence of state and local fiscal decisions, some issues, like the effect of partisanship on expenditure, have received more study at the federal level than at the state or local level. Second, state and local governments face special challenges that matter less to national governments. For example, I argue that state and local governments are more vulnerable to economic fluctuations than national governments, while facing legal limitations on their tax and borrowing decisions, especially at the local level. Finally, state and local governments provide a broad array of institutions and populations. Certain economic phenomena may manifest themselves differently within different institutional frameworks - in addition, certain institutions may provide a unique opportunity to test theories about economic behavior.

My dissertation studies how local labor demand shocks, the political process, and voting behavior affect state and local public good provision. Three papers comprise my dissertation. Although all relate to state and local public finance, each approaches the topic from a different perspective. "Legislative Redistricting, Party Politics, and the Spatial Distribution of Transportation Expenditure," combines political economy and public finance by asking how the political process affects the allocation of public goods. "Municipal Government Reaction to Mass Layoffs in Ohio" joins labor economics and public finance by asking how negative labor demand shocks affect tax,

expenditure, and borrowing decisions by local governments. Finally, "Ballot Order and Ballot Roll-Off: Evidence from Local Referenda in Ohio" combines behavioral economics and public finance, studying the effect of voting behavior on local tax decisions.

CHAPTER 2

LEGISLATIVE REDISTRICTING, PARTY POLITICS, AND THE SPATIAL DISTRIBUTION OF TRANSPORTATION EXPENDITURE

2.1 Introduction

The condition of public roads serves as a critical benchmark of state government performance. The average US state devotes five percent of its direct expenditure to highways. Although transportation lags behind education and public welfare in dollar amount, the importance of transportation spending stems from its visibility and broad use. While only a fraction of the population receives social assistance, almost everyone uses roads [Fisher, 2009, pp. 150-151]. Besides conferring direct benefits to citizens, a functional highway system fosters local development by providing a necessary input for most industries. In the 2017 edition of *Area Development* magazine's annual site selection survey, corporate executives and managers regarded highway accessibility as the most important of twenty-seven location draws. In fact, the survey has rated this the most or second most important factor for five years in a row [Fisher, 2009, Gambale, 2016, 2017].

State governments bear primary responsibility for road construction in most of the United States. In Ohio, the state spent $3.07 billion on highways and roads in 2014. This constituted the majority of the $5.41 billion of state and local spending on Ohio roads and highways, including the bulk of capital expenditure ($2.41 billion out of $3.19 billion).[1] Because road construction and maintenance disproportionately benefit citizens living near the work site, the state government may favor certain geographic areas through the provision of road construction projects. I test whether a geographic area in Ohio receives more road project funding when its state representative belongs to the Republican party, which has controlled the Ohio State Assembly and governorship for most of the past two decades.

[1] These totals closely reflect national spending patterns. On aggregate, states undertook 59% of expenditure on highways (57% in Ohio), including 73% of capital expenditure (76% in Ohio). [United States Census Bureau, 2017a]

I estimate how changes in political party, generated by the 2012 state legislative redistricting,[2] affected the distribution of transportation expenditure throughout Ohio. The redistricting process divided the state into 265 areas of intersection between the ninety-nine old legislative districts and the ninety-nine new legislative districts. I estimate the change in dollar value of state sponsored construction projects before and after redistricting in these areas of intersection, depending on whether an area shifted to a state representative of a different party after redistricting.

Previous papers studying partisan alignment's effect on resource allocation [Berry et al., 2010, Case, 2001, Solé-Ollé and Sorribas-Navarro, 2008] have focused on change through elections. Change in a district's party through voting depends on voters' preferences and beliefs about the party's ability to provide public goods. In addition, party change through voting may be correlated with unobserved demographic or economic shifts that determine road construction spending. For these reasons, voting outcomes in a district likely depend on public good provision to the district, biasing any estimates that depend on party variation through voting.

The redistricting process creates variation in political party that is independent of voting outcomes. After redistricting, 56 areas of intersection moved to a representative of the other political party - 34 moved from the Republican to the Democratic party, and 22 moved from the Democratic to the Republican party. Using variation from redistricting, I find that areas changing from a Republican to a Democratic state representative experienced a large decrease in highway construction expenditure, relative to areas represented by a Republican before and after redistricting. Areas switching from a district with a Republican representative to a district with a Democratic representative received $3.5M less per year after redistricting than areas that remained in the Republican party. In percentage terms, areas that remained in a Republican district before and after redistricting received 66% more annual construction expenditure than areas that moved from a Republican to a Democratic district. The governor belonged to the Republican Party and the Republicans held a

[2] Ohio, like every other state, redraws its state legislative districts every ten years. Redistricting ensures that each district contains the same share of the state's population as other districts. According to the United States Supreme Court in the 1964 Reynolds v. Sims ruling, the equal protection clause of the United States Constitution guarantees that all state legislative districts have "substantially equal" population. The Department of Justice and the federal court system have interpreted "substantially equal" as allowing each district to vary by 10% from an equal share of the state's population, and Ohio's State Code establishes the same standard. See Section 2.4 for more on the redistricting process.

majority in both chambers of the State Assembly during this time. Thus, this finding suggests a preference in public good allocation toward areas represented by the governing party.

Despite the drop in expenditure, the total number of projects in areas moving from Republican to Democratic districts did not change. Areas represented by a Republican before and a Democrat after redistricting, however, received fewer large projects (projects involving new construction, widening, intersection and interchange work, miscellaneous projects, and bridge repair) than areas remaining with a Republican representative. From 2013-2016, areas that moved from a Republican district to a Democratic district due to redistricting gained 76% fewer large construction projects than areas that belonged to a Republican district before and after redistricting. These results suggest that, while representatives' political affiliation does not influence routine repairs and maintenance, partisan politics impact allocation of large projects either through legislation, representatives lobbying the Department of Transportation, or action by the Governor's office. Meanwhile, areas that moved from a Democratic to a Republican district during redistricting years did not receive an expenditure increase. If it is easier to delay major projects than to undertake new ones, I would expect to see a drop in large projects within areas moving to Democratic districts sooner than an increase in large projects in areas moving to Republican districts. I also find that districts with an incumbent representative receive less funding than those with an incumbent. Areas that moved from a Democratic to a Republican district lost their incumbent representative, and the associated decline in funding may have offset the gain from moving to a Republican representative.

I compare my estimates, using variation in representative's party through the redistricting process, to estimates based on variation in representative's party through election outcomes. I find that the negative effect of moving from a Republican to a Democratic district identified through redistricting variation exceeds the effect identified using variation through election outcomes. Meanwhile, the estimates based on changes through elections suggest that areas moving from Democratic to Republican districts would experience higher expenditure - this doesn't happen after changes due to redistricting. In addition, the estimates based on voting suggest that the change in expenditure was much larger when an incumbent representative had been voted out of office than

when the incumbent had chosen not to run again. In years with a Democratic governor, areas where a Democratic incumbent had been voted out received $6.4M less annual construction funding in the next two years. If the incumbent Democratic representative had retired and a Republican replaced her, however, expenditure increased slightly. The different effect for incumbents who lost rather than retired suggest possible selection issues associated with variation through election outcomes. This difference in estimated effect may reflect reverse causality - in areas where expenditure had begun to fall, voters blamed their incumbent representative. More generally, unobservable changes in economic or demographic determinants of transportation expenditure are likely to be correlated with residents' political preferences that drive election outcomes.

2.2 Related Literature

Numerous empirical papers have estimated the impact of partisan alignment on expenditure distribution. Case [2001] distinguished two possible objectives: a ruling party seeking to maximize the size of its majority will target swing districts, while a risk averse ruling party seeking to maximize the probability of maintaining its majority will target its base. Studying poverty assistance expenditures in Albania, she found that the majority Democratic Party directed transfers toward its own base. Similarly, Castells and Solé-Ollé [2005] estimated a structural model that disentangled three motives for distributing transportation expenditure across Spanish electoral districts: the marginal effect of funds on output, redistributive concerns, and expenditure's effect on the probability that the majority party would win reelection. They found that funds were distributed more according to their effect on the ruling party's probability of winning reelection than efficiency and equity concerns. Solé-Ollé and Sorribas-Navarro [2008], presented a model where the party controlling the national legislature prefers to distribute funds to lower level governments with the same partisan affiliation. Testing the model's predictions on Spanish municipalities from 1993-2003, they found that aligned municipalities received 40% more grants than unaligned. Other papers have used variation in the ruling party [Johansson, 2003] or a regression discontinuity design in legislator vote share [Bracco et al., 2015] to evaluate the proposition that expenditure distribution across

districts depends on the party that represents those districts. Albouy [2013] finds that United States senators and representatives belonging to the majority party attract more funds to own states, also using a regression discontinuity design. Finally, some authors have asked whether federal house districts [Berry et al., 2010] or states [Larcinese et al., 2006] aligned with the president receive more federal expenditure.

The above literature relies on variation in partisan alignment through election outcomes. But expected growth in expenditure could influence who runs in an election and who wins. Redistricting provides changes in partisan alignment that do not depend on election outcomes. Voters from Republican districts are regrouped with voters in Democratic districts, and vice-versa. In many areas, the process changes the party of the legislator representing an area, due to shifting district boundaries rather than election outcomes. By exploiting redistricting variation to identify coefficient estimates, I avoid selection issues associated with election variation, issues that could lead to biased estimates.

A few papers within the political science literature have used redistricting as a source of exogenous variation. Ansolabehere, Snyder, and Stewart [2000] exploited this variation to estimate the component of "personal voting" in an incumbent politician's electoral advantage. After redistricting, an incumbent only possesses a personal advantage among the voters in the intersection of her new and old district. Thus, the authors measured personal voting advantage by comparing the incumbent's vote share between old and new counties in her district. Ansolabehere, Snyder, and Stewart [2002] find that, following a 1960s court ruling equalizing the population of state legislative districts, more spending went toward counties in formerly underrepresented districts. Chen [2010] uses a State Senate expansion in New York to test whether areas with more overlap in the upper and lower house receive more earmark expenditure. Chen's identification strategy is similar to my own - he considers the effect of a zip code area moving from one district to another. He also includes indicators for zip codes moving from Democratic to Republican districts or vice-versa, although a much smaller share of areas changed party in his sample relative to mine. My paper considers a different outcome - both count and expenditure on transportation expenditure, rather

than aggregate earmark expenditure. My paper considers not only the effect of representative's party alignment with the majority in the state government, but also the effect of the senator and representative belonging to the same party. My paper finds different effects from Chen [2010] - he finds that areas moving from the minority to the majority party in the senate experience a larger magnitude change than areas moving from the majority to the minority party, while I find the opposite. I also compare change in the number of total projects and the number of large projects when an area changes parties. Perhaps most importantly, my paper compares estimates identified from variation through voting to estimates identified from variation through redistricting, and finds that they differ.

I estimate that areas belonging to Republican districts before and after redistricting receive a 66% increase in construction expenditure, compared to areas that move from Republican to Democratic districts. This figure exceeds the estimates in previous papers. At the federal level in the United States, Berry, Burder, and Howell [2010] estimate that House districts belonging to the president's party receive 4.5% more federal spending than other districts. Albouy [2013] estimates that states with an entirely Republican congressional delegation would earn 31% more transportation funding when the Republican party controlled the Senate, House and presidency - states with an entirely Democratic delegation received only 17% more when Democrats controlled the Senate, House, and presidency. Solé-Ollé and Sorribas-Navarro [2008] and Bracco, Lockwood, Porcelli, and Redoano [2015] each estimated that lower level governments controlled by the same party as the national government receive a roughly 40% increase in grants.

Estimates in my paper differ from previous estimates for multiple reasons. First, I estimate the effect on expenditure when a district boundary change moves part of a district to a new representative belonging to a different party, while previous papers estimate the change in expenditure after voters elect a representative from a different party. Change in party through election outcomes likely depends on changes in voters' preferences, changes that may be correlated with shifts in unobservable determinants of transportation expenditure. This fact implies that there are selection issues associated with the type of districts that change party through elections. At the end of the

paper I estimate the change in transportation expenditure associated with a party change through election variation. Using this variation, I estimate that areas moving from the Republican to the Democratic party in years with a Republican governor only lose $1.2M - $2.2M in expenditure per year, depending on the specification.

Rather than studying expenditure distribution at the national level, I focus on state level allocation. The spending item I consider is particularly amenable to this research question. Road construction expenditure contrasts with spending on poverty assistance, earmarks, or education, items that benefit only a subset of the population. With these items it is difficult to account for demand heterogeneity, and demand for these items will likely correlate with partisan preferences. Also, because state legislative districts are small and most people use roads, a road construction project within a state legislative district serves a larger share of district population than other expenditures. Thus road construction expenditure more efficiently targets the constituency that a representative wishes to favor. In addition, it is difficult to account for heterogeneity in demand for items used by a fraction of the population. Need for education or poverty assistance will fluctuate widely depending on economic and demographic trends within a district. Because of the different environment, as well as the exogenous source of regressor variation, the estimated effect in my paper may differ from the results in previous studies.

2.3 Road Project Data

I estimate the effect of representative's party affiliation on highway construction funding, using all highway projects in Ohio that received direct state funding from 2007 to 2018.[3] The dataset, from the Ohio Department of Transportation's "Transportation Information Management System," includes 9780 projects with 30,045 work locations and total estimated expenditure of $23.1 billion.

[3] Ohio Department of Transportation, *Transportation Information Management System*, https://gis.dot.state.oh.us/tims. The dataset includes all projects that have secured funding from 2003 onward. There are some projects in the file budgeted for years after 2018 (as late as 2040), but I exclude these. I have chosen to include projects beginning in 2007 for two reasons. First, this centers the dataset symmetrically around January 2013, when representatives from the new districts took office. Second, Governor Ted Strickland, a Democrat, took office in 2007. The dataset begins with his tenure, followed by Republican John Kasich's two terms in office. This allows me to easily control for the political party of the governor.

The unit of observation is work location. Some work locations (such as bridge repair) occupy a single point. Other work locations involve repairs extending over a stretch of road and are coded as lines. Many projects include multiple work locations, often with some coded as points and others as lines. The dataset includes geographic coordinates for each work location to six decimal places - I can place each work location precisely within a house and senate district.[4,5]

The Ohio Department of Transportation (ODOT) maintains more than 50,000 lane miles of roads and 15,000 bridges. ODOT is responsible for the state's interstate highways, numbered federal highways, and state routes. Outside of the state highway system, local governments maintain more than 200,000 lane-miles of county, township, and municipal roads through a mix of state formula grants and local taxes. On locally managed roads, the state provides funding or directs the distribution of federal funds for some construction projects. Ohio's transportation budget passes every odd-numbered year, with the legislature allocating funding within line-item categories and dictating general parameters for how these funds will be spent. Ultimately, through legislation, the legislature determines the level of state funding by setting the state fuel tax rate and tolls. The state splits its fuel tax, by formula, between the ODOT and local governments - the legislature also decides what percentage will go to each. Outside of the biennial budget, the state legislature exercises some control over the distribution of expenditure through specific programs that distribute state and federal funds. The governor's office exercises more direct control over these decisions.

The ODOT, a branch of the governor's office whose director is a gubernatorial appointee, plans and approves specific projects. Large new construction projects in excess of \$12M[6] require

[4] This means the location is precise to within a few feet.

[5] A project may span multiple house districts if it includes multiple work locations. Cost is recorded at the project level, so I must allocate the cost among work locations for each project, and among districts for some work locations that span multiple districts. If a project has multiple work locations then I divide the cost evenly among work locations. A project may also span multiple districts if a work location coded as a line crosses district boundaries. If one work location spans multiple districts, I allocate its cost between those districts according to the length of segment in each district. Consider a work location allocated expenditure est_cost across N areas of intersection, with each area containing a roadwork segment of length $length_i$. Each area i is allocated $est\_cost_i = est\_cost \times \frac{length_i}{\sum_{n=1}^{N} length_n}$. Summary statistics of some key characteristics at the project level are listed in Table 2.9 of the Appendix.

[6] From 1997 to 2012 the cut-off was \$5M. In 2012 the legislature raised it in accordance with the ODOT's estimation of increased costs.

approval by the Transportation Review Advisory Council (TRAC), a committee whose members include the Director of Transportation, six gubernatorial appointees, and two legislative appointees. Beyond the ODOT's regular budget, some funds administered by the ODOT may be allocated by executive or legislative action on a biennial or a triennial basis. For example, the Bridge Partnership Program, initiated in 2014 by executive action, distributed $120M of federal money for fiscal years 2015-2017. In May 2017, the legislature extended the plan, and promised additional funds, in a separate bill from the biennial budget.

A representative's party could influence expenditure toward her district in several ways. If the representative belongs to the governor's party, then she may be able to lobby the ODOT for funds more effectively. A representative could also coordinate with members of her own party in the House or Senate. For example, she could threaten to introduce a bill altering the ODOT's funding. A representative's power within the state assembly may be limited, however, if she is not a member of the majority party. Similarly, a representative belonging to the majority party may possess more power to protect scheduled projects in her district from delay or cancellation. Partisanship could also influence decisions by the TRAC. As Republican governors or Republican legislators appointed almost all members of the TRAC during this period, the TRAC may have favored Republican controlled areas. A Republican representative lobbying or negotiating with the TRAC to direct projects toward her own district would likely have an advantage, compared to a Democrat.

Table 2.1 presents summary statistics for a few variables at the area of intersection-by-year level. Recall that "area of intersection" refers to one of the 265 geographic areas formed by the intersection of old and new House districts. These areas form the unit of observation in the empirical analysis that follows. The first and second column divide area of intersection by political party, while the third column totals all areas. For reference, I have summarized all variables at the house district level in Table 2.2.[7]

The first two rows describe the number of projects and estimated total expenditure[8] on all

[7] Many more characteristics of projects are available in the TIMS database.

[8] This is the sum of estimated total cost of all projects in the area of intersection. Estimated total cost is set during

projects. On average, each area of intersection receives $6.8M per year in state construction project expenditure on 32 construction projects.[9] The third and fourth rows show number and estimated total cost of large projects. Large projects belong to the six categories of road work with the largest average project cost (new construction, intersection or interchange work, widening, miscellaneous projects,[10] and bridge repair - see Table 2.9). Roughly one-tenth of the projects in each area of intersection are large projects, although these projects account for more than half of total expenditure. The fifth row displays estimated total cost for projects where the primary sponsor is either the ODOT or some other state agency. Roughly one-fifth of state construction project expenditure goes toward projects sponsored by local governments.

Table 2.2 provides a better picture of how these variables differ between Republican and Democratic districts - districts all contain similar population, unlike the areas of intersection described in Table 2.1. Total expenditure remains almost the same between Republican and Democratic districts, but Republican districts receive more projects. This likely reflects Republican districts' location in more rural areas (see Figure 2.2 in the next section). Because rural areas contain more road mileage but fewer bridges and intersections, Republican districts receive more small projects and fewer large projects.

Localities also contribute their own funds to road maintenance. Three variables in Tables 2.1 and 2.2 measure contribution to road provision by local governments: public works expenditure by townships and counties, transportation expenditure by municipalities,[11] and average property tax rate devoted to roads by all local governments.[12] Local expenditure data come from summaries

the planning stage, before firms bid on the contract - it may diverge somewhat from actual expenditure, but it probably more closely reflects policymakers' expectation of costs when allocating projects.

[9] I assign projects to years based on the fiscal year when the project will be funded. The Ohio fiscal year runs from July 1 of the preceding calender year through June 30 of the same calender year, so that fiscal year 2017 runs from July 1, 2016 through June 30, 2017. I assign projects to the calender year before the fiscal year when they are funded, so that all projects funded in fiscal year 2017 are 2016 projects.

[10] Includes all projects that could not easily be classified. Includes section improvement, intelligent vehicle systems, building demolition, and realignment or relocation.

[11] In the case where a local government's boundaries straddle multiple districts, I assign expenditure to each district proportional to the fraction of the local government's population on each side of the boundary.

[12] The Ohio Department of Taxation publishes annual property tax millage rates levied by every local government in the state. The population weighted average millage rate devoted to roads is constructed by summing all road millage rates in the area, each weighted by the local government's share of the area's population.

of Annual Financial Reports[13] published by the Ohio Auditor's office. Unfortunately, only the financial reports for municipalities feature a specific item for transportation.[14] For townships and counties, the Annual Financial Reports summarized total expenditure on public works without separating transportation expenditure.[15] I derive local expenditure for each area of intersection by summing expenditure by all local governments within the area.[16] When a local government's jurisdiction overlaps two areas, I divide spending between the two areas according to the proportion of the local jurisdiction's population within each area. Municipalities spend more on transportation in Democratic districts, while county and township governments spend more on public works in Republican districts - in more rural areas, county and township governments play a larger role in public service provision than in urban areas.

Ohio funds a large share of local road expenditure through gas tax revenue. The state splits revenue from its gas tax levies between the ODOT and distributions to counties, townships, and municipalities. The state distributes funds to municipalities according to the share of registered vehicles inside each municipality, and to townships according to the share of registered vehicles and road miles in the township.[17] Changes in these variables over time, then, reflect changes in

[13]The municipality data from 2006-2012 were taken from municipal audits conducted by the Ohio auditor. I also filled some data that were missing in the county Annual Financial Reports from audits conducted by the Ohio auditor. All other data came from summarized annual financial reports.

[14]Municipalities reported transportation expenditure differently in the Annual Financial Reports - some listed expenditures on "Public Works" or "Public Services" without listing transportation expenditures separately. As cities that reported zero transportation expenditure always reported zero utility expenditures and often reported zero expenditure on public health, I gather that these items are often grouped together under "Public Works" or "Public Services." For municipalities with no spending on transportation listed in the Annual Financial Report, I impute transportation spending as the sum of expenditure on public health, basic utilities, public works, public services, and transportation, multiplied by the average ratio of transportation to these five items for all other municipalities in that year.

[15]The local financial data also includes a separate item for capital outlay. For many localities, this item includes capital expenditure on roads. But according to these data, capital expenditure by municipalities, counties, and townships throughout the state exceeds $1.7 billion per year, roughly the same amount as state road construction expenditure. According to the census, however, local capital spending on roads equaled only one third of state capital spending, implying that the majority of municipal capital spending did not go towards roads and highways. For this reason, I do not include local capital expenditure as a covariate.

[16]The data on municipal transportation expenditure and public works expenditure, are not available for all local governments in all years. In cases where only one consecutive year of data is missing, I interpolate the missing year as the mean of the prior year and the year after. I do not include the municipalities and townships that are missing more than one consecutive year of data.

[17]More precisely there are two funds for the distribution of gas tax: the Gasoline Excise Tax Fund (Fund 7060) and State and Local Government Highway Fund (Fund 7068). For municipalities, distributions from both funds are

the number of registered vehicles in each area. Localities also fund expenditure through their own tax effort. Municipalities, counties, and townships may, with referendum approval from residents, levy a special property tax rate for road maintenance. Tables 2.1 and 2.2 summarize the population weighted average local property tax devoted to roads in each area of intersection and each district. On average, local governments raised 0.75 mills of property tax for road repair each year. More is raised in Republican than in Democratic districts - again, likely because Republican areas tend to be located in more rural areas with township governments that collect more revenue through property tax.

Employment data in the next two rows come from the LEHD branch of the Census Bureau. These data are available at the census block level, and have been summed at the area of intersection and district level. Republican districts have less employment and larger employed population - many people reside in Republican areas but commute to Democratic areas for work. Population is available only for 2010, from the Census Bureau. Note that Republican districts had slightly higher population in 2010 than Democratic districts. As mentioned in the introduction, more areas shifted from Republican to Democratic districts than vice versa, despite Republicans picking up one more seat - the redistricting process needed to add population to Democratic districts. The last two variables provide some measure of need for transportation expenditure. Sufficiency rating of bridges comes from the National Highway Administration's bridge inventory. Bridges tend to be in better repair in Republican districts. This may reflect a pattern of past political partisanship, but may stem from other differences between Republican and Democrat controlled regions. The last row shows daily vehicle miles traveled on roads in USDOT functional classes 1-6 - the ODOT provides this data, as well.[18]

proportional to the number of registered vehicles in the municipality. Distributions from Fund 7068 are equal for all townships. From Fund 7060, roughly half is distributed equally. For the other half, the township gets either a minimum distribution of funds, or 70% of the share it would receive if the funds were allocated half according to share of road miles and half according to share of registered vehicles. Funds for counties are split evenly. For townships, I include only distributions from Fund 7060, which accounts for about $\frac{2}{3}$ of the total distributed to townships.

[18] For a description of functional classes, please see Footnote 26 in Section 2.5.3.

2.4 Districts and Redistricting

The Ohio legislature ("General Assembly") has an upper house ("Senate") and a lower house ("House of Representatives"). There are ninety-nine representatives and thirty-three senators in Ohio. Each representative serves one of the ninety-nine state house districts. Each senator serves one of the thirty-three senate districts, each constructed from three contiguous house districts. Voters choose their representatives for two year terms every even-numbered year and the elected representatives take office in January of every odd-numbered year. Senators serve four year terms, with half of the senate elected every even-numbered year. In recent years the Republican party has dominated state politics in Ohio: from 2007-2018 Republicans controlled the state Senate every year, the state House of Representatives in all but two years, and the governorship in all but four years (see Figure 2.1).

State legislative districts are redrawn every ten years, based on the population information provided by the decennial census. In Ohio, a political commission determines state legislative districts. This commission is composed of the governor, state auditor, secretary of state, and one member each selected by the House Majority and Minority Leaders.[19] The commission draws districts such that each district contains roughly $1/99^{th}$ of the state's population. By law no district may vary more than 10% from this benchmark. Redistricting occurs the year after the census, most recently 2011, meaning state representatives were elected from the new districts starting in 2012. Similarly, half of state senators were elected from the new districts in 2012, half in 2014. This means that state representatives elected from the new districts took office in 2013, and state senators elected from the new districts took office either in 2013 or in 2015.

Figure 2.2 displays the geographic intersection between pre-redistricting ("old") and post-redistricting ("new") House districts, the unit of observation in my analysis.[20] Redistricting created

[19](Ohio Constitution XI § 1). The House and Senate Majority leaders each select three members for an advisory committee, including one from the opposing party [State of Ohio, Ohio Revised Code §103.51]. Note that Ohio voters amended the constitution to change these procedures in 2015, and yet another amendment began collecting signatures in 2017. The 2015 amendment expanded the redistricting committee from five to seven (with two from the opposing party). The circulating amendment would require new districts to be redrawn based on past political preferences and restrict the breakup of counties.

[20]I derive each intersection between new and old districts by spatially joining 2003-2012 districts and 2013-2022

301 intersections between old and new house districts, and ninety-two intersections between old and new senate districts. I restrict attention to areas with population over 100; there were 265 of these for the House and seventy for the Senate.[21] The boundaries of all but six House districts and two Senate districts changed. In some districts that had experienced population growth or decline, the commission simply added or removed a slice of land. As of the 2010 Census, for example, old house District 2 had grown to a population of 170,573, 53% larger than $\frac{1}{99}^{th}$ of state population. 116,760 people remained in new District 67, a geographic subset of old District 2, while 54,813 people were moved to new District 68. Other districts were carved up more thoroughly: in thirteen house districts no intersection of the old and new district contained more than half of the old district's population.

I estimate the effect of party change on spending using transitions between parties during the redistricting year: "R to R," "R to D," "D to R," and "D to D." Figure 2.2 plots this "transition matrix" for the House of Representatives onto the map of Ohio. Generally, urban areas like Toledo, Cleveland, and Cincinnati lean Democrat, while rural areas lean Republican. Appalachia and the "Rust Belt" region around Lake Erie are Democratic strongholds. Areas that changed parties after redistricting concentrated in these regions, around the borders between Democratic and Republican districts near Columbus, Cincinnati, Toledo, and in the North and East of the state.

Table 2.3 documents how areas of intersection transitioned between representatives in all five state House of Representatives elections from 2008 to 2016. The first column displays the proportion of representative transitions in each party transition for election years that did not immediately follow redistricting: 2008, 2010, 2014, and 2016. The second column shows representative transitions for the redistricting election year, 2012. The third column reports test statistics for the difference in means between redistricting and non-redistricting years.

districts using ArcMap10.1 GIS software.

[21] The spatial merge process, rather than true change in the boundaries, may have produced the very small areas of intersection. Most areas with population under 100 have zero population. There are eleven areas with population between 100 and 1000. These may result from the commission "fine tuning" the district's size or composition. Such fine tuning could conceivably include the exchange of an area with zero population, such as transferring the headquarters of a powerful corporate donor [Daley, 2016], although this seems unlikely at the state government level. More likely, the areas of intersection with population in the hundreds reflect a legal requirement to respect local government boundaries where possible.

Table 2.3's first panel shows how areas transitioned between parties.[22] During the redistricting year, many more areas changed from a Republican to a Democratic representative, or *vice-versa*, than in other years. In non-redistricting years, only 8% of areas changed party. But in the redistricting year, 13% (34 areas) changed from a Republican to a Democratic representative, and 8% (22 areas) switched from Democratic to Republican.

The second panel shows the probability that an area reelects its old representative after an election. This is much more common in non-redistricting years, occurring with a 0.39 + 0.31 = 0.70 probability, compared to only a 0.30 probability in the redistricting year. The second panel also shows the proportion of representatives who replaced an incumbent from their own party. Most new representatives belonged to the same party as their predecessors: 73% ($\frac{0.12 + 0.10}{1 - 0.70}$) in non-redistricting elections, and 70% ($\frac{0.28 + 0.21}{1 - 0.30}$) in the redistricting election year.

The third panel tabulates the possible reasons why an area did not keep its incumbent. In typical election years, the incumbent had either been voted out or did not run for reelection. Voters rarely removed an incumbent candidate from office - this occurred in only 4% of non-redistricting area-by-year observations, and in only 1% of redistricting area-by-year observations. In most areas that changed representative in non-redistricting years, the area's incumbent did not run for reelection[23]- this occurred in 26% of area-by-year observations during non-redistricting election years, out of the 30% of area-by-year observations where the representative changed. In contrast, the incumbent chose not to run in only 17% of areas during the redistricting year, while 70% of areas changed representative. Rows 13-14 show the share of areas whose last state representative won reelection, but where the area had moved into a different district than that representative - this category includes more than half of all areas and the vast majority of areas that had changed representative $\frac{52\%}{100\% - 30\%} = 74\%$.

Table 2.3 shows that far more areas changed representative and changed party during the 2012 election than in other election years. More importantly, almost all of these changes derived from

[22] Columns 1 and 2 each sum to one in the first panel. Column 1 sums to 0.92 in the second panel, the proportion of areas that changed party in non-redistricting elections. Column 2 sums to 0.79 for the same reason.

[23] This category includes the eight area-by-year observations where the incumbent lost in her own party's primary. In each of these cases, the successful primary challenger won the general election.

the redistricting process. Even among the 17% of areas that changed representative because the incumbent retired or lost, most had moved to a different district than the old incumbent and would have changed representative anyway. But even this fact does not reveal fully how redistricting drove the change in representatives. In total, there were twenty districts where at least one incumbent did not win reelection in 2012.[24] This number includes eight districts with two incumbents - 16 incumbents ended up in the same district as another sitting representative, and in seven of these double incumbent districts, one of the incumbents did not run. Thus, there were only 14 areas where the incumbent resided in the area, and was not reelected. Only four of these areas changed party: These were the two areas where a Republican lost the general election, and two areas where the sitting Democrat did not run and the Democrat who did was defeated.

Because a political commission composed primarily of Republicans drew the new House districts, some suspect that gerrymandering affected the new district boundaries [Daley, 2016]. A party that gerrymanders attempts to maximize either the number of seats that it wins or the probability that it will win a majority [Owen and Grofman, 1988]. According to the theoretical literature on gerrymandering [Friedman and Holden, 2008, Gilligan and Matsusaka, 1999, Owen and Grofman, 1988, Sherstyuk, 1998] the gerrymandering party does this by adjusting the proportion of support for its own party within districts. The optimal solution to this problem involves conceding a minority of districts with a vast majority of voters (ideally 100%) supporting the opposing party, while crafting another set of districts with a "safe " majority for the gerrymandering party. Thus, areas that shift to a new district or to a representative of the opposing party may have systematically different levels of partisan support than other areas. Because I use fixed effects estimation, correlation between changes in party through redistricting may be correlated with the *level* of partisan support, without biasing the estimates. My estimates remain consistent as long as *changes* in partisan preferences over time remain mean independent of changes in representative's party

[24] Two incumbents lost in a general election, one lost his primary, 17 incumbent representatives did not run for reelection. Another representative ran for reelection in a different district that did not overlap with her old district. Six of the representatives who did not run were term limited, one held the office in place of a different representative who had joined the governor's cabinet, and one resigned while facing corruption charges. Thus, only seven representatives chose not to run voluntarily.

through redistricting, conditional on the various control variables. Changes in representative's party through election outcomes, on the other hand, are almost certainly correlated with changes in partisan preferences over time.

2.5 Empirical Specifications

I estimate the difference in construction expenditure between areas represented by a majority party Republican and areas represented by a minority party Democrat. Because variation in representative's party affiliation through election outcomes may be correlated with unobservables determining road construction, I initially use only variation from redistricting for identification. The empirical specifications are based on the redistricting transitions shown in Figure 2.2. I test: (i) whether areas that left the Republican party during the redistricting year (the "R to D" transitions)[25] suffered a drop in funding, relative to areas that remained Republican (the "R to R" transitions) and (ii) whether "D to R" areas received more funding after redistricting than "D to D" areas. First, I consider aggregate construction funding before and after redistricting. At the area of intersection between old and new districts, I sum the total cost of all projects from 2013-2018 (the year after redistricting took effect and the first five years after) and compare this average to the total cost of projects from 2007-2012. Figure 2.3 plots average expenditure before and after redistricting for each category: R to R, R to D, D to R, and D to D.

The bar chart indicates that expenditure did not increase in areas that switched from the Republican to the Democratic party, while generally increasing in all other areas. The average annual increase is large: $21M over six years for Republican areas that remained Republican, and slightly less for areas that had a Democratic representative in 2012. Only Republican areas that moved to Democratic representatives during the redistricting year experienced no increase.

[25] From now on, when I refer to party transitions, or to R to D, D to R, etc., I refer only to transitions during the redistricting year.

2.5.1 Trends in Outcome Variables

The estimation in Figure 2.3 and the regressions that follow involve a difference in differences approach. According to this conception, I compare the R to D treated areas to a set of R to R control areas, and I compare the D to R treated areas to a set of D to D control areas. To ensure the validity of this approach, I must ensure that the expenditure change associated with a party change does not reflect an upward expenditure trend during the pre-treatment period.

Figure 2.4 plots changes in expenditure for each party transition category, with R to R areas compared with R to D areas and D to R with D to D. As seen in Figure 2.4, R to R areas received a relatively constant amount of expenditure from 2007-2012, while R to D areas experienced a slight uptrend. In the two years following redistricting, the R to D areas fell to a much lower level of expenditure than the R to R areas, although the time trends remain roughly parallel. From 2007-2012 D to R districts experienced a general decrease in expenditure and D to D a general increase, although there was much fluctuation around this trend - after redistricting, D to R districts did not change appreciably, while expenditure in D to D districts generally trended downward.

2.5.2 Regression Analysis

Although Figure 2.3 depicts how district expenditures vary with party transitions caused by redistricting, this simple differencing does not account for changes in time varying determinants of transportation expenditure. Additionally, these differences compare post-treatment years with a Republican governor and a Republican controlled legislature (2013-2018) to pre-treatment years with a Democratic governor (2007-2010) and a Democratically controlled House of Representatives (2009-2010). To address these issues, I first estimate the following specification:

$$expenditure_{it} = \beta_0 + (\beta_1 R\_to\_D_i + \beta_2 D\_to\_R_i + \beta_3 D\_to\_D_i) \times (year_t > 2012)$$
$$+ (\beta_4 R\_to\_D_i + \beta_5 D\_to\_R_i + \beta_6 D\_to\_D_i) \times (year_t < 2011) + \delta_t + \gamma_i + \epsilon_i \quad (1)$$

where $expenditure_{it}$ is area of intersection i's road expenditure in year t. The party change indicators - $R\_to\_D_i, D\_to\_R_i$, and $D\_to\_D_i$ - capture how each area's representative transitioned

between parties during the redistricting year (2012). $R\_to\_D_i$, for example, equals one for areas that moved from a Republican district in 2012 to a Democratic district in 2013. The β_1 coefficient represents the difference in expenditure for these areas after redistricting for areas that changed from Republican to Democratic, relative to areas that remained Republican ($R\_to\_R_i$ is the omitted category).

Post-redistricting elections in November 2012 closely followed the change from Democratic to Republican governor and from Democratic to Republican House in November 2010. I want to identify the effect of changing from a Republican to a Democratic representative, or vice-versa, conditional on the Republican party's control of the state government. Thus, I include an indicator for years 2007-2010 interacted with the redistricting party change indicators. The coefficient on each of the post redistricting party-change variables ($(R\ to\ D) \times (year > 2012), (D\ to\ R) \times (year > 2012), (D\ to\ D) \times (year > 2012)$) indicates the increase in funding between the two years immediately preceding redistricting (2011-12) and the six years after. γ_i denotes area of intersection fixed effects, while δ_t denotes year fixed effects.

The estimates from this specification are provided in the first column of Table 2.4. The coefficient for areas that changed from a Republican to a Democratic legislator - $(R\ to\ D) \times (year > 2012)$ - is quite large in magnitude. Areas leaving the Republican party received roughly \$3.5M less in annual construction funding than those that remained. From Table 2.1, the mean annual estimated cost of projects in each area is \$6.8M, with a standard deviation of \$17.8M. Thus, areas that switched from a Republican to a Democratic representative saw their funding drop by 20% of a standard deviation. The coefficient estimate is statistically different from zero at the 95% confidence level. This is consistent with partisanship having a large effect on construction funding. However, areas that moved from a Democratic to a Republican representative received \$0.73M less funding than those that retained a Democratic representative, though this estimate is not statistically significant. Thus, areas leaving the Republican party seem to suffer a decrease in funding, while areas moving to a Republican representative experience no increase.

This asymmetry may reflect an immediate decrease in funding to R to D areas from canceled

or postponed projects, with no immediate increase in new projects directed toward D to R areas - planned projects may be canceled or delayed quickly, while it takes some time to develop and begin work on new construction. Figure 2.4 supports this explanation. R to D areas experience an immediate drop in funding, relative to R to R areas. For D to R areas, however, there is no immediate change compared to D to D areas - instead, expenditure in D to R areas gradually increases over the six years following redistricting, while expenditure in D to D areas gradually increases. The asymmetry may also reflect an advantage for areas that retain their incumbent representative after redistricting. The loss of funding from a D to R area moving to a new representative could offset the gain from moving to a majority party representative.

2.5.3 Controls

Construction spending likely depends on population, economic activity, and road usage, which vary within areas across years. Local preferences for spending on roads may also change over time. If areas that changed party during redistricting experienced greater economic growth, greater population growth, or more growth in residents' preferences for roads than other areas, this could lead to biased estimates. The next specification includes covariates to more effectively model demand for road construction spending.

First, I control for local government spending on roads and highways. Local spending likely responds to changing demand for roads in an area. To the extent that spending on local routes complements or substitutes for state spending, local spending in an area may attract or crowd out state funded construction. I include the the lagged population weighted average property tax rate devoted to roads and highways, lagged municipal spending on transportation expenditure, and lagged county and township spending on public works within in area. Because residents directly approve the property tax rate devoted to roads in referendum elections, this variable in particular reflects local demand by residents. The expenditure variables control for local government expenditure on roads from funds other than property tax revenue and state gas tax levies, such as income tax revenue, sales tax revenue, or fees.

I also include lagged distribution of state gas tax revenue to municipalities and townships within each area. Distributions to municipalities and townships depend on the number of registered vehicles within each area, so that these variables provide a measure of residents' road usage. I also include lag of employment, as well as lag of the number of employed people in each area. Employment provides a measure of business activity within each area. Areas experiencing economic growth may demand more spending on roads. On the other hand, the state may attempt transportation capital projects to stimulate areas in economic decline. Employed population provides a measure of demand for roads in the area by residents, as well as a proxy for population.

To account for road condition, I include the lagged average sufficiency rating for bridges inspected within each area, from the Federal Highway Administration's National Bridge Inventory. Finally, I control for lagged usage of state roads, measured by vehicle miles traveled on non-local roads.[26] ODOT records daily vehicle miles traveled at the county level. Although this variable should track roadway usage and need better than any of the other control variables, its measurement at the county level makes it a less reliable predictor of demand for smaller areas in my sample.[27,28]

Column 2 of Table 2.4 reports estimates when these covariates are added to the party change indicators in Column 1. The coefficient on the $(R\ to\ D) \times (year > 2012)$ becomes slightly smaller in magnitude than the coefficient in Column 1 (2.6M instead of 3.5M), and becomes marginally statistically insignificant (p-value = 0.113). Still, the coefficient remains large and negative - the

[26] The US Department of Transportation divides roads into seven "functional classes": Interstates, Other Freeways or Expressways, Other Principal Arterial, Minor Arterial, Major Collector, Minor Collector, and Local. A road's functional class is based on its physical characteristics and connection to other roads. Vehicle miles traveled is reported by functional class. Although functional class does not depend on who owns or maintains the roads, only 0.003% of state roads were classified as Local, compared to 83.5% of local government roads. For counties that cross district boundaries, I calculate vehicle miles traveled in an area as that area's population weighted share of vehicles miles in the county that contains it, the same as I calculated the local expenditure variables.

[27] I add lagged controls, rather than contemporaneous values, to avoid problems of reverse causality. For example, state road construction funding may substitute or complement local effort, and better roads within an area may increase traffic or vehicle ownership among residents. Recall that the previous sample included projects where a local government had been the primary sponsor as long as the state or federal government distributed some aid. The specification with controls excludes these projects to focus only on projects sponsored by the ODOT or (in rare cases) some other state agency.

[28] Unfortunately, while the sample of transportation data run from 2007-2018, the data on local expenditure and employment only run through 2015, meaning that I lose the last two post-redistricting years when I include the lagged controls. I also drop fifteen observations where sufficiency rating was unavailable for several years.

estimate's 26% drop in magnitude mostly reflects the exclusion of locally sponsored projects, which accounted for 22% of estimated cost. While restricting the data to years 2007-2016 does not appreciably change the coefficient estimates, the decrease in sample size does slightly increase the standard errors.[29] Nonetheless, the similar coefficients for this truncated sample suggest that the effect of representative party change occurs quickly, and that projects on state highways rather than locally sponsored projects drive this effect.

While the set of covariates is extensive, these may not adequately control for all trends in unobservable factors determining road construction spending. It is possible that areas changing from the Republican to the Democratic party, or vice versa, had been growing at different rates than areas remaining in the same party. Areas may have been more likely to switch party in districts that were broken up more thoroughly during the redistricting process. The redistricting process changes districts that grew or shrank in population, and population change is likely tied to demand for roads. Additionally, there may be time trends in distribution of districts, perhaps due to dissipating effects of the Democratic control of the House and governorship at the beginning of the sample. To deal with these issues, Column 3 of Table 2.4 adds a time trend for each party change category, as well as the lagged controls described above.

The difference between areas that left the Republican party and areas that stayed in the Republican party increases in magnitude to $6.6M and remains statistically significant. Interestingly, the coefficient for areas that switched from a Democratic to a Republican representative becomes less negative than the coefficient for areas that retained a Democratic representative (by about $3.5M), although the difference remains statistically insignificant. These estimates suggest that when the Republican party controls both levels of the Assembly and the governorship, areas with Republican representatives reap the benefit.

[29] For the equations with controls - reported in Columns 2, 4, and 5 in Table 2.4, and Equations 3-6 in Table 2.5 - I estimated the regression without controls on a sample that excluded state sponsored projects from 2007-2016. I also excluded the fifteen areas with missing data on bridge sufficiency rating. The coefficient estimates were very similar to the estimates with controls. Estimating Equation 2 on the reduced sample without controls resulted in a lower coefficient for (R to D)×(year > 2012) coefficient than in the estimates with controls ($3.1M instead of $2.6M), and a slightly larger difference between the (D to D)×(year > 2012) and (D to R)×(year > 2012) coefficients. The standard errors were generally slightly smaller in the specifications with controls. I also ran each regression on the full set of years but only including state sponsored projects, again excluding controls.

2.5.4 Percentage changes

Given the substantial dispersion in the dependent variable (see the first column of Table 2.1), it is important to estimate the proportional change in construction projects caused by party change. Estimating proportional changes ensures that a few outlier areas do not drive the results. Ideally, the natural logarithm of construction projects would replace the level as dependent variable, but the log dependent variable is not defined for much of the sample. Although each area received 33 construction projects per year on average, 14% of area-by-year observations in the sample have received zero construction projects. Instead, Poisson quasi-maximum likelihood estimation (QMLE) with an exponential conditional mean function provides consistent estimates of the semi-elasticities, as long as the conditional mean is correctly specified. I estimate a model with both area of intersection and year fixed effects.[30,31]

Columns 4 and 5 of Table 2.4 present the results of this specification. Other than a different functional form for the conditional mean, these specifications are identical to Equation 1 and Equation 2 in the first two columns. The coefficients suggest that areas belonging to a Republican district before and after redistricting receive 56% to 66% more highway funding than areas moving from a Republican to a Democratic district. The coefficients on the party change variables, especially the $(R\ to\ D) \times (year\ >\ 2012)$ variable, change very little with the addition of controls, although standard errors increase rather substantially.

2.5.5 Accounting for the Senate

In Ohio, each House of Representatives district lies entirely inside of a state Senate district. We have seen that, although the Senate was redistricted along with the House, no area changed to a senator

[30] Poisson QMLE remains robust to distributional misspecification - in particular, it does not require $Var[y|\boldsymbol{X}]$ to equal $E[y|\boldsymbol{X}]$ for consistency. If the conditional variance depends linearly on the mean ($Var[y|\boldsymbol{X}] = \sigma E[y|\boldsymbol{X}]$), moreover, the estimator is efficient. Uniquely among parametric non-linear models, the distribution of parameter estimates does not depend upon the distribution of the fixed-effects, so that the fixed effects coefficients need not be estimated directly. This frees the estimator from the "incidental parameters problem" - the parameter estimates converge to their true values as the number of areas, not the number of years, increases [Wooldridge, 2010, Chapter 19].

[31] The number of observations is slightly lower for the Poisson regressions, as areas where expenditure was zero in all years are excluded.

of the opposite party after redistricting took effect. This means that areas whose representative changed parties either moved from having a senator and a representative of the same party to different parties, or *vice versa*. In bicameral legislatures, constituents may assign credit for funds received partially to their representative and partially to their senator [Chen, 2010]. The governor or other members of the legislature may be less willing to direct funds to an area if they know that a member of the opposing party will receive credit for that funding. At the same time, it is likely easier for a representative to direct funds toward her district in coordination with a senator[32] with the same party affiliation.

In the next set of regressions I include an indicator for areas with both a Republican state representative and Republican senator, and an indicator for areas with a Democratic state representative and a Democratic senator, each interacted with a post-2012 indicator. This specification tests whether it is advantageous for an area to have a representative and senator belonging to the same party. In addition, it tests whether the effects of party change estimated in the previous specifications really represent a majority party advantage. Perhaps most areas had the same party senator and representative prior to redistricting, or perhaps areas that changed party had belonged generally to senate districts controlled by the opposing party. In either case, the effect in the previous regression would be partly an effect of senator and representative party alignment, rather than an affect of the representative's party directly.

The last two columns of Table 2.4 contain the estimates from this specification. Column 6 shows estimates from the specification in Column 1 with the addition of the alignment controls, while Column 7 includes controls. The point estimates suggest that, if an area switches to a representative from the same party as the senator representing that area, the area receives increased highway funding. But an F-test of the joint significance of the coefficients for representative and senator belonging to the same party fails to reject the null that both coefficients are zero (p-value = 0.33 without controls, 0.56 with controls). Moving from the Republican district to a Democratic district still causes an estimated decline in construction spending. The decline does

[32] Recall that in Ohio, each Senate district is composed of three contiguous House districts.

vary substantially, however, depending on whether the senator and representative for an area belong to the same party. The estimates in Column 6 suggest that areas switching from a Republican to a Democratic representative receive $5.7M ($3.4M + $2.3M) less in construction spending when the senator is a Republican, and $1.1M ($3.4M - $2.3M) less when the senator is a Democrat. Adding controls for demand while controlling for alignment between House party and Senate party causes the standard errors to increase. Still, the estimates in Column 7 show that areas moving from a Republican Senate and House district to a Democratic House district are estimated to lose $4.6M ($2.3M + $2.3M), with this estimate marginally different from zero in a statistical sense (p = 0.08).

2.5.6 Number of Construction Projects

The prior specifications consider construction expenditure as a continuous variable distributed across areas of the state. Total construction expenditure, however, is allocated to a certain number of projects. An area may receive less funding because the state undertakes fewer projects in the area. On the other hand, the state may undertake the same number of projects while reducing the average funding devoted to each project. I now consider whether change in representative party affiliation affects number of projects and number of large projects. Large projects include new construction, intersection/interchange, widening, other projects, and bridges and tunnels - the six categories with largest average project cost (see Table 2.8 of the appendix).[33] A state representative may be more able to influence allocation of large projects than allocation of projects in general. Lobbying or negotiating for a new construction project yields a higher payoff than lobbying or negotiating for maintenance work or landscaping. In addition, large projects take longer to develop between planning and the beginning of construction.

I estimate the effect of redistricting party change on number of projects and number of large

[33] Given the closeness in mean cost between the bridges and tunnels category and the maintenance category, it may seem arbitrary to count one as a large project and not the other. Work on bridges and tunnels, however, involves work at a specific point and only crosses district boundaries when there are multiple work areas within a single project. On the other hand, maintenance often extends over a stretch of roadway and thus more often crosses district boundaries. There are far more bridge and tunnel projects than maintenance projects (2186 vs. 1255 - see Table 2.8). But there are fewer bridge and tunnel projects per year in each area of intersection, compared to maintenance (1.8 vs. 2.3).

projects using fixed-effects Poisson QMLE. The base specification includes indicators for the (R to D), (D to R), and (D to D) party change categories, each interacted with a pre-2011 and a post-2012 indicator for each category, as well as area of intersection and year fixed effects. The second specification includes controls. The third specification includes controls and a linear year trend for each party change category (R to R, R to D, etc.). Each specification is estimated twice, with two dependent variables: total number of projects, and total number of large projects.

Table 2.5 indicates that when the dependent variable is number of projects, the estimates show no difference between areas that remained within Republican districts and areas that moved to Democratic districts. However, areas moving from Republican to Democratic districts do experience a sharp decline in the number of large projects. Depending on the set of covariates, areas in Republican districts before and after redistricting received from 43% to 107% more large projects than areas that move to a Democratic district. Clearly, a decrease in the number of large projects drives the decline in total construction expenditure for areas that moved from Republican to Democratic districts. The results suggest that while partisan politics do not affect mundane maintenance decisions, majority party legislators and the governor's office influence the location of large projects.

Areas moving from the Democratic to the Republican party receive more projects in general, but fewer large projects, than areas that belonged to Democratic districts before and after redistricting. However, these differences diminish as controls are added. As in the previous section's specifications, any difference between areas that left Democratic districts and areas that remained Republican is much smaller than the difference between areas that left Republican districts and areas that remained.

2.6 Variation from Voting and Redistricting

Party changes through election outcomes may affect distribution of transportation funding differently than party changes driven by redistricting, for two reasons. First, there may be selection issues associated with variation based on voting - election outcomes may reflect changes in unob-

servable determinants of transportation funding. Second, party changes through election outcomes occur in more closely contested districts. Identifying party changes through redistricting avoids these problems. In the next set of estimates, I provide descriptive evidence that selection issues bias the estimated effects when party changes result from election outcomes.

In Section 2.5, I estimated the effect of having a Republican representative when Republicans held majorities in the House and Senate under a Republican governor. Now, I compare the effect of having a Republican representative in years with a Democratic governor and years with a Republican governor. Each area of intersection by year observation falls within one of four categories: Republican representative and Republican governor, Republican representative and Democratic governor, Democratic representative and Republican governor, or Democratic representative and Republican governor. I estimate differences in expenditure levels within each of these categories using the following specification with area and year fixed effects.

$$expenditure_{it} = \beta_0 + \beta_1 R\_rep\_R\_gov_{it} + \beta_2 D\_rep\_R\_gov_{it} + \beta_3 R\_rep\_D\_gov_{it}$$

$$+ \gamma_i + \delta_t + error_{it}$$

Coefficients are identified using variation in representative's party through redistricting and through election outcomes. If expenditures are higher in areas represented by the party that controls the House and Senate, with no advantage to areas represented by members of the governor's party, then I would expect $\beta_1 = \beta_3 > 0$ and $\beta_2 = 0$. If expenditures are higher in areas represented members of the governor's party but not for areas represented by the party controlling the House and Senate, then I would expect $\beta_2 = \beta_3 < 0$ and $\beta_1 = 0$.

The estimated coefficients, in Table 2.6, demonstrate an advantage for areas with a Republican representative - these areas gain \$1.2M more in funding during years with a Republican governor, and \$1.0M more in years with a Democratic governor, relative to areas with a Democratic representative. After adding controls in the second column, the estimated difference between districts with a Republican representative and a Democratic representative increases to \$1.4M, while the

advantage for Republican districts during Democratic governor years rises to $1.3M. In neither case, however, can I reject the null hypothesis that areas with Republican representatives attract more transportation funding than areas with Democratic representatives - the p-value is 0.20 in the regression without controls, and 0.22 in the regression with controls. There is no evidence that areas with a representative belonging to the governor's party receive more road construction expenditure when using variation through both election outcomes and redistricting.[34]

The next two regressions separate the effect of party changes due to election variation from the effect of redistricting party changes. Recall that the first set of regressions in Table 2.4 compared spending during the six years after redistricting to spending in the two years before. Here, I combine the redistricting party change indicators from those regressions with the party and governor alignment indicators. [35]

Column 3 displays the estimates when controls are not included. Areas that changed from a Republican to a Democratic representative (or from a Democratic to a Republican representative) during a regular election year lost (gained) $1.2M ($2.98M - $1.83M) annual construction expenditure during years with a Republican governor, and $1.0M in years with a Democratic governor. Column 4 includes controls (and drops years 2016-2018). Including controls, I estimate that areas moving from the Republican to the Democratic party (or the Democratic to the Republican party) lose (gain) $1.7M ($5.35M - $3.64M) in years when there is a Republican governor, and $1.4M in years when the governor is a Democrat. Column 3 shows that areas changing from a Republican to a Democratic representative through redistricting lost $1.84M + $2.98M - $1.83M = $2.99M in annual construction expenditure (p-value = 0.03). During the redistricting year, of course, a Republican governor held office. Similarly, Column 4 shows that areas moving from the Republican

[34] These estimates suggest little advantage in belonging to the governor's party. The variation in governor's party, however, derives from Democratic governor Ted Strickland's term from 2007-2010, which followed sixteen years of Republican governors. It is possible that during his single term Governor Strickland did not possess the same political clout as his predecessors or successors. From Section 2.3, for example, recall that the Transportation Review Advisory Council approves the largest projects (those with value exceeding $12 million dollars). Although the TRAC is largely appointed by the governor (six seats out of nine), members are appointed in overlapping terms of seven years - Democratic Governor Taft appointed only two members to this committee during his term.

[35] The pre-2011 party change indicators, e.g. (R to D)×(year < 2011), are not included because I am controlling for party and alignment with the governor in each year.

to the Democratic party due to redistricting lost $3.1M ($1.41M + $5.35M - $3.64M) in annual funding (p-value = 0.06).

Thus, the change in expenditure associated with a party change through redistricting differs from the change in expenditure associated with a party change through elections by millions of dollars. The estimates are somewhat imprecise - a joint test of the coefficient on (R to D)×(year > 2012) and the difference between the coefficients on (D to R)×(year > 2012) and (D to D)×(year > 2012) gives a p-value of 0.12 in the equation without controls and 0.16 when controls are included. Still, the large coefficients on the redistricting change indicators strongly suggest that estimates identified through election results are biased.[36]

Outside of the redistricting year, areas changed parties in two ways. Either the incumbent representative lost the election, or the incumbent representative chose not to run and her party's candidate failed to win the general election.[37,38] The last set of regressions, in Columns 5 and 6, include an indicator for areas where the representative was in her first term and the previous

[36] I considered the possibility that the difference in coefficients reflects asymmetry between the effect of changes from R to D and D to R in non-redistricting years. If areas moving from R to D in non-redistricting years experience a large decrease in funding while areas moving from D to R change very little, then the overall positive effect of Republican representation would be small. I estimated the following equation:

$$\begin{aligned} expenditure_{it} &= \beta_0 + \\ &(\beta_1 R\_to\_D\_redist_i + \beta_2 D\_to\_R\_redist_i + \beta_3 D\_to\_D\_redist_i) \times (year_t > 2012) \\ &+ \beta_4 R\_to\_D_{it} + \beta_5 D\_to\_R_{it} + \beta_6 D\_to\_D_{it} + \delta_t + \gamma_i + \epsilon_{it} \end{aligned}$$

Here, $R\_to\_D_{it}$ indicates that area i changed from a Republican representative in the previous election cycle to a Democratic representative in any year t from 2007-2018 - similarly for $D\_to\_R_{it}$ and $D\_to\_D_{it}$. $R\_to\_D\_redist_i$ indicates party change during the redistricting year, the same as $R\_to\_D_i$ in the previous specifications. For the sake of brevity I do not show the results here. The coefficients on the $R\_to\_D\_redist_i \times (year > 2012)$, $D\_to\_R\_redist_i \times (year > 2012)$, and $D\_to\_D\_redist_i \times (year > 2012)$ are almost identical to the coefficient estimates in Columns 3 and 4. Again, I test whether the coefficients on $R\_to\_D\_redist_i \times (year > 2012)$ and the difference between the coefficients on $D\_to\_R\_redist_i \times (year > 2012)$ and $D\_to\_D\_redist_i \times (year > 2012)$ are jointly significant. In a regression without covariates, the joint test gives a p-value of 0.08, and the $R\_to\_D\_redist_i \times (year > 2012)$ coefficient is marginally significant on its own, with a p-value of 0.06. With the addition of covariates (and the loss of three years) the p-value for the joint test increases to 0.13. Again, the estimates yield suggestive evidence that the coefficients identified from party changes through voting differ from the coefficients identified from party changes through redistricting.

[37] In 41 year-by-district observations (or 110 year-by-area of intersection observations) the representative left office during the term (usually after an appointment to a preferable office, due to a scandal, or due to unexpected death). There were only three year-by-district observations where the appointed replacement ran in the general election and lost. In these regressions, I have considered the replacement representative as the incumbent.

[38] The third possibility - the incumbent losing the primary and her replacement losing the general election - never occurred. Ten incumbents lost the primary election between 2007 and 2018, but each candidate who beat the incumbent in the primary won the general election.

incumbent lost. I interact this variable with an indicator for the representative belonging to the same party as the governor. This means that the first three variables are identified from years when a representative retired after her first term and a member of the opposing party replaced her. In years after an incumbent loses, her district suffers a large decrease in funding, particularly if the incumbent had belonged to the governor's party. Under a Republican governor, areas where an incumbent Republican representative lost suffered \$8.54M (\$7.09M + \$1.65M + \$5.59M - \$5.79M) less road construction expenditure (p-value = 0.05). If, on the other hand, an incumbent from the Republican governor's party retired and a non-incumbent of the opposite party replaced her, her district would lose only \$1.45M (\$1.65M + \$5.59M - \$5.79M) in expenditure.[39] The difference could reflect the effect of expenditure trends on partisan preferences, instead of the other way around. If an incumbent of the governor's party suffers defeat, this likely means her constituents are less satisfied with the governor's party in that year than in previous years. Dissatisfaction with the governing party may stem from poorer public service provision. The lower level of public services provided likely causes the incumbent legislator's defeat, not the other way around. As an alternative explanation, districts that reject an incumbent representative have experienced particularly stark changes in preferences, and these changes reflect stark changes in economic and demographic determinants of road expenditure.

2.7 Incumbent Representatives and Redistricting Party Change

According to the results in Section 2.5 (using variation through redistricting), shifting from a Republican district to a Democratic district creates a large drop in predicted construction funding. But shifting from a Democratic to a Republican district generates no corresponding increase in funding. As discussed at the end of Section 2.5.2, the asymmetry may reflect an incumbent advantage - areas that change from a Democratic to a Republican district gain a party affiliation boost, but lose their incumbent representative. The last two columns of Table 2.6 suggested a strong

[39] In years with a Democratic governor, areas where an incumbent Democrat lost would only receive \$6.46M (\$7.09M + \$1.65M - \$2.28M) less funding, according to the regression without controls. But areas where the incumbent Democrat retired and a Republican replaced her would actually gain \$0.63M.

incumbent advantage, based on variation through both elections and redistricting. In this section, I use redistricting variation to test whether the party change disadvantage estimated in Section 2.5 partly reflects the advantage of retaining the same representative and belonging to the same district post-redistricting. Each area that changed party from 2012-2013 necessarily switched to a representative who had not represented that area in the past. Many areas switched representative but did not switch party, however. Recall from Section 2.3 that 185 areas switched to a non-incumbent representative from 2012-2013 - of these, only 56 changed party.

For several reasons, an incumbent representative whose district boundaries have changed may reward the old area of her district relative to the new area. First, the incumbent representative possesses greater knowledge of the old area's needs. Second, it is likely quicker to postpone old projects than to begin new projects. If an area that moves from a Democratic district for a Republican district is less likely to suffer postponement of old projects and more likely to obtain new projects, then in the short term it will gain no funding increase, because new projects take time to develop.

Table 2.7 shows the results of reestimating the first five columns of Table 2.4, adding two variables: an indicator for areas where the representative was Republican before and after redistricting, but the representative changed, and areas where the representative was a Democrat before and after redistricting, but the representative changed. In Column 3, I also add trends for R to R and D to D districts that retained the same representative, while Columns 4 and 5 use Poisson QMLE to estimate the percentage changes in dependent variable associated with a change in party or representative.

The results give strong indication that incumbent representatives attracted more funding that new representatives. According to the specification in Column 1, areas that had belonged to the Republican party and retained the same representative attracted more funding than areas that moved from one Republican representative to another (the omitted category). R to D areas experienced a much smaller increase in funding when compared to R to R areas that changed representative than when compared to all R to R areas. On the other hand, D to R areas experienced a post-redistricting

increase in funding relative to D to D areas that changed representative ranging from $1.6M in the first column to $8.1M in the third column with controls and time trends. Thus, after controlling for whether areas moved to a new incumbent representative, the effect of moving from a Democratic to a Republican district is estimated to be large and positive, relative to the specification that compared D to R to all D to D.

According to the regressions based on redistricting variation in Section 2.5, an increase in spending for areas that moved to Republican districts did not accompany the estimated drop in spending for areas that left the Republican party. The results in Table 2.7 suggests that areas moving to a new district experience a decrease in funding, regardless of party. After controlling for this factor, R to D areas experience an increase in funding that equals or even exceeds the decrease in funding for areas that move from the Republican to the Democratic party.

2.8 Conclusion

Policymakers allocate road construction expenditure across regions based not only on concerns for efficiency or redistribution, but perhaps also according to partisan preferences. I show that areas with a state representative belonging to the majority Republican party draw substantially more road construction funding than areas with a Democratic representative. I estimate an effect of representative's party on spending comparable to or larger than estimates of party alignment on nationwide spending distribution in other studies, such as in Spain [Solé-Ollé and Sorribas-Navarro, 2008] and Italy [Bracco et al., 2015]. My estimates, moreover, exceed estimates of Berry, Burder, and Howell [2010] and Albouy [2013] regarding the effect of congressional representation on federal spending in the United States. I find that areas moving from a Republican to a Democratic district receive 66% less expenditure in years where the assembly and governorship were Republican, while these studies found from 5% increase for districts aligned with the president to 31% increase for states whose entire congressional delegation belonged to the majority party.

While previous studies used variation in partisan alignment through election outcomes, changes in voter preferences are likely correlated with unobservable shifts in need or preferences for roads.

In addition, voters may choose a representative based on their expectation that she can direct public expenditure toward their district. For these reasons, endogeneity of party changes through elections likely leads to biased estimates. Unlike most previous papers, I avoid this endogeneity issue by focusing on party changes generated by the redistricting process. Besides concerns about bias, estimates identified using party changes through elections heavily weight districts where it is most likely for a party change to occur. Thus estimates identified using voting variation tend to estimate effects for swing districts. It is unlikely that the majority party would target expenditure equally between safe and swing districts [Case, 2001, Dixit and Londregan, 1998]. Because the variation that I use derives from boundary changes rather than voting, the effect that I identify more closely represents the average over the entire distribution of voter preferences, instead of the average over swing districts only.

The large effect estimated in this paper probably also reflects the institutional setting considered. At the federal level, each state has two senators who may belong to different parties. Although each federal representative is accountable to her own sub-state district, the prevalence of state-level block grants provides an incentive for state representatives to work across party lines in bringing funds back to the state. At the state level, however, one party represents each district in the House of Representatives. Because state house districts are geographically small and the entire population benefits from transportation expenditure, each representative faces strong incentives to direct funds toward her own district. I also provide evidence that areas with a representative and senator in the same party receive substantially more transportation expenditure - this may indicate coordination of efforts, or a willingness of other Republican policymakers to aid districts where their own party will receive all of the credit. Areas represented by the majority party reap substantial benefits, particularly if the same party controls the House and overlapping Senate district. Areas belonging to the minority party suffer.

The empirical analysis shows that areas moving from a district represented by the governing Republican party to a district represented by the minority Democratic party suffer a large decline in construction project funding. The effect reflects a diminished number of major construction projects

directed toward these areas. Although partisan concerns do not enter into mundane construction decisions like maintenance and landscaping, the results imply that legislators in the majority party are able to reward their constituents by directing large projects toward their own districts.

I also estimate the change in expenditure associated with a change in representative's party through election results in non-redistricting years. The estimates show that the manner in which districts change through election results determines the change in expenditure. Areas where an incumbent representative from the governor's party is voted out of office suffer a much larger expenditure decline than areas where party changes when the incumbent does not run. This is consistent with a non-random selection of districts changing parties through election results. More importantly, estimates of the change in expenditure associated with a party change through voting differ from estimates based on redistricting. This difference may derive from endogeneity of representative party changes due to election results. It may also reflect that districts changing party through voting form a selected subsample of swing districts. The comparison confirms the importance of isolating an exogenous source of variation in political party to estimate these effects. This paper advances the literature by applying such a credible identification strategy to this question.

CHAPTER 3

MUNICIPAL GOVERNMENT REACTION TO MASS LAYOFFS IN OHIO

3.1 Introduction

3.1.1 Municipal Reaction to Mass Layoffs

On October 17, 2008, General Motors closed its assembly plant in Moraine, Ohio, costing the city 1150 jobs. Between this plant closing, GM's layoff of 960 second-shift employees in September, and layoffs at two smaller auto manufacturing plants, Moraine lost 2553 jobs in 2008. This number equaled 41% of the city's population. Beyond the hardship suffered by residents employed at the plant and at businesses serving it, the closing depleted the city's ability to provide public services. Moraine's 2% income tax raised $19.9 million of revenue in 2007 - in 2009, it raised only $12.4 million. Property tax revenue fell from $772,000 in 2007 to $474,000 in 2009. Despite the drop in revenue, the city did not raise tax rates until 2013, when it tripled its property tax rate before hiking its income tax rate in 2014. Both increases required approval in referendum elections, asking that residents relinquish a larger share of their diminished incomes in tax. Moraine also cut expenses. Total annual expenditure averaged $27.4 million from 2005-2008, but fell to $19.9 million annually from 2009-2013. Capital expenditure and expenditure on leisure and community environment (such as parks and recreation) dropped by more than one-half. The city also increased its debt over this time period, from $5.3 million in 2009 to $11.8 million in 2013. At the same time, the city ran down its available assets - government fund cash and investments halved from $24 million to $12 million.

Sudden declines in economic activity threaten local government finances more than national or state government budgets. Due to greater volatility of taxable activity at the local level, local governments must particularly concern themselves with revenue variability. In Ohio, a state hit

hard by the Great Recession, state income tax base fell 8.3% between the 2008 and 2009 tax years.[1] But many municipalities imposing an income tax suffered a more severe decline. Income tax base dropped by 43% in Leipsic, a village raising most of its revenue through a local income tax. Leipsic was one of 20 municipalities where taxable income fell more than 25%. Meanwhile, income tax base rose at least 10% in 23 municipalities. Ohio municipalities also raised funds through the property tax - assessed property value fell more gradually than income tax base, but the decline persisted for longer. Between 2008 and 2009, assessed real property value fell 1.9% across Ohio. By 2013, assessed real property value had fallen 9.8% from its high in 2008, although the annual decline never exceeded 4%. Relative to the income tax, the property tax fluctuates less year by year.

Local governments' responses to tax base declines, either by increasing taxes or by shifting to other revenue sources, are limited by state laws restricting the type of tax imposed and the tax rate. In Ohio, state law prohibits municipalities from imposing general sales taxes, although municipalities may impose property and income taxes. Residents must approve any increase in the property or income tax rate beyond 1% through a referendum election. These limitations protect residents from unexpected tax increases, but also impair municipalities' ability to adjust revenue collection to changes in economic conditions. If a municipality cannot raise revenue to its previous level, it must either cut expenditures, borrow, or deplete any saved funds it may have accumulated.

I consider the fiscal policy response of municipal governments in Ohio to an important shock: shutdown, or contraction in employment, by local businesses. I identify these shocks using notices of closings and mass layoffs given under the Worker Advisory and Retraining Notification (WARN) Act. From 1997-2013, 1664 closings and layoffs caused the loss of 321,077 jobs in the 595 Ohio municipalities I consider. Mass layoffs decreased municipal revenue starting in the year of the layoff and continuing for several years afterward. The revenue drop was often unexpected - in most cases the municipal government was not notified until a few months before a layoff occurred. In addition to estimating the size and duration of the revenue decline associated with a mass layoff, I investigate municipalities' fiscal policy response. In doing so, I provide a positive analysis of

[1] Average municipal income tax base fell 9.2%.

municipal decision making when the trade-offs associated with these decisions may be particularly severe.

To discover the effect of mass layoffs on fiscal outcomes, I model each outcome as a function of reported job loss in mass layoffs, scaled to municipal population ("proportional job loss"). Using an event study framework, I include lags of reported job loss in past layoffs to estimate a layoff's dynamic effect over several years. I estimate that an announced mass layoff with proportional job loss equal to 1% of municipal population results in a 0.75% decline in income tax base from the year before the layoff to the year after. This means that a mass layoff of average size, with proportional job loss equal to 3.2% of the population, will decrease income tax base by 2.4%. In subsequent years, the income tax base does not recover to the pre-layoff level. I find that assessed property value does not decrease significantly after a mass layoff occurs. This is likely because assessed property value reflects sale prices only after a triennial appraisal process. Because an appraised increase in value is phased in proportionally over three years, it takes as long as six years for assessed property value to reflect changes in sale price.

I find that municipalities do not change their income tax rate significantly in response to a mass layoff. In fact, income and property tax rates decline slightly. As the income tax base falls with no responding increase in tax rates, I find that revenue declines. Income tax revenue falls, remaining below the pre-layoff level four years after the layoff. Due largely to the drop in income tax base, total revenue decreases after a reported mass layoff, and remains below the pre-layoff level four years following.

Total municipal expenditure declines following a mass layoff, and also recovers slowly. Consistent with previous literature, expenditure on general government, leisure and community environment, and capital outlay all decrease. Somewhat unexpectedly, public safety expenditure also declines sharply, perhaps due to a decrease in business demand for those services, or because expenditures in this category are more easily adjusted. In addition to cutting expenditures, municipalities shift their structure of liabilities and decrease outstanding fund balances. For cities, where data on assets and liabilities are available, long term debt increases while short term debt decreases.

Unreserved fund balance, moreover, decreases substantially, and remains below the pre-layoff level at least four years after a mass layoff occurs. Thus, cities avoid deeper cuts to present expenditure, at the cost of a more precarious financial position in the future.

3.1.2 Related Literature

A number of papers address local governments' reaction to fiscal distress. Poterba [1994] studies state governments' response to unprojected decreases in revenue and increases in expenditure, but focuses primarily on how budget institutions and the characteristics of elected officials affect adjustment to equilibrium. In an analysis of Danish municipalities similar to Poterba, Rattsø and Tovmo [2002] find that property tax rates respond inversely to unexpected increases or decreases in revenue, while the income tax rate only responds to negative shocks. Skidmore and Scorsone [2011] analyze the expenditure decisions of Michigan cities undergoing fiscal stress.[2] Certain categories of expenditure, specifically capital outlay and parks and recreation, proved vulnerable to cuts.

Other papers address how local governments respond to specific causes of revenue decline. Cromwell and Ihlanfeldt [2015] find that local governments in Florida increased millage rates after decreases in property values and state aid during the great recession. Dye and Andrew Reschovsky [2008] discuss the response of property tax revenue per capita to a change in state aid to all levels of local government. Among local governments in general, there was no statistically significant relationship between change in state aid and change in property tax revenue per capita.[3] Chernick, Langley, and Reschovsky [2011] ask how revenue and expenditure changed in large cities during the Great Recession, using "constructed governments" that aggregated the tax and expenditure of all local governments in each area. They find that property tax revenue fluctuated less than local income or sales tax revenue during this period. Lutz, Molloy, and Shan [2011] investigate several

[2] They measure fiscal stress by an index of the difficulty of raising revenue minus an index of the cost of providing a bundle of services.

[3] There was a large, statistically significant negative relationship for school districts, likely driven by school finance reforms in some states.

ways a decrease in housing prices could affect local revenues, including a decrease in property tax, sales tax, income tax, or conveyance taxes on property transfers. Testing these channels during the great recession, they find that only property tax revenue decreased. Lutz [2008] estimates the elasticity of property tax revenue with respect to property values, using Census data for a panel of MSAs. He finds the elasticity is highest after 3 years, at 0.4.

A few papers consider the fiscal impact of a boom or bust within a particular industry. Feler and Senses [2017] estimate the response of local government expenditures to import competition, although they aggregate all local governments at the commuting district level. Wu and Korman [1987] regress changes in property value, property tax revenue, and non-property tax revenue on changes in manufacturing employment in New York State counties. They find that each manufacturing job lost was associated with a decline in property values and property tax revenue, but do not consider government response to the revenue decline. Finally, Newell and Raimi [2015] investigate how discovery of new shale oil and gas resources affected local government finances in eight states. Although discovery of fossil fuel resources boosted property and sales tax base, it also expanded the cost of government service provision (e.g. infrastructure expenditure).

My paper advances the literature in four ways. First, while others have studied the effect of an ailing local economy on municipal revenue, none have considered mass layoff events directly. Second, papers about a declining economy's effect on local governments have either ignored local government response, or have considered the aggregate response by various levels of government across states.[4] I consider the response of one level of government, where each municipality is a decision making unit responding to a layoff event under the same institutional constraints. Third, I consider a wider range of policy responses by the local government, including tax rate changes, shifts to other revenue sources, expenditure cuts in the aggregate or within specific categories, and debt finance. Finally, I consider the case of a government with two tax instruments, an income and property tax. I estimate the effect of a mass layoff on each tax base, as well as the government's potential decision to shift between revenue bases.

[4] Skidmore and Scorsone [2011] is an exception, but the authors consider only expenditure response while I consider changes in tax rates, shifts to non-tax revenue sources, borrowing, and change in fund balance.

3.2 Institutions and Data

3.2.1 Ohio Municipalities

Ohio's 932 municipal governments provide basic government services, including fire, EMS, and police protection; roads, sewers, and other infrastructure; and amenities like parks, swimming pools, and cemeteries.[5] Municipalities raise revenue from various sources, including income and property taxes. The income tax is imposed, at the same rate, on income earned within the municipality and on residents' income earned outside the municipality. Wages, rental income, and net business profits attributable to activity in the jurisdiction are taxed.[6,7]

A municipality that levies a property tax imposes the tax on both commercial and residential property at the same statutory rate.[8] Property is appraised every three years, with one-third of the change in value applied in each of the three years following an appraisal - the assessed value equals 35% of appraised value.[9] Assessed value changes more rapidly if the property is demolished or sold for lower than its appraised value. Voted property taxes are a levy on value at the time the tax is approved. An increase beyond that value lowers the effective tax rate, rather than raising revenue. This cap is applied separately to Class 1 (residential and agricultural) and Class 2 (commercial and industrial) property. Each year, the county assessor adjusts property tax rates so the revenue

[5] Municipalities with population less than 5000 are referred to as "villages," while those with population greater than 5000 are referred to as "cities." Of the 932 incorporated municipalities in Ohio, 251 are currently cities, while the rest are villages.

[6] In many cases a resident may be granted a credit against income earned in other jurisdictions. Suppose that there are two jurisdictions. In jurisdiction A the tax rate is 2%, in jurisdiction B, 4%. If each jurisdiction allows a 100% credit on income tax paid in the jurisdiction where workers are employed, then residents of jurisdiction A commuting to jurisdiction B will pay no income tax in jurisdiction A, while residents of jurisdiction B that commute to jurisdiction A would pay 2% income tax in jurisdiction A and 2% in jurisdiction B. If only 50% credit were granted, then residents of jurisdiction A commuting to jurisdiction B still only pay taxes to jurisdiction B, while residents of jurisdiction B commuting to jurisdiction A will be "double taxed" paying 2% in jurisdiction A and 3% in jurisdiction B. Credits allowed vary across municipalities.

[7] Other sources of revenue include fees and fines, payment for services by residents or other governments, and intergovernmental revenue. Municipalities are allowed to impose a lodging tax and an admissions tax on events. Each comprises a negligible fraction of revenue: in 2013 202 municipalities collected $59.8 million total through lodging taxes, while 46 municipalities collected $26.3 million in admissions tax, $14.4 million by Cleveland.

[8] Although the municipality cannot choose different rates, state property tax relief measures mean that the effective tax rate on residential property is typically lower.

[9] An exception applies to agricultural land, which may be evaluated according to its current use rather than its appraised market value.

collected from each class of real property will not exceed the amount levied when the rate was approved. If Class 2 value decreases while Class 1 value increases, or vice versa, revenue could fall in a municipality while overall assessed property values increased. The revenue cap does not apply to taxes within the 10 mill limit, or any higher limit approved by a charter.[10]

Three other local governments impose property taxes in Ohio: local and vocational school districts, counties, and townships.[11] The total property tax burden in a municipality depends upon the taxes imposed by these other three governments. For each municipality in the sample, I calculate the sum of tax rates imposed by all overlapping jurisdictions. In cases where a municipality spans several school districts or counties, the school district or county rate is calculated as the average property tax rate of those jurisdictions weighted by the share of the municipality's real property lying in each overlapping jurisdiction.[12]

The data comprise a balanced panel of 595 municipalities in Ohio from 1997-2013, including gross income tax revenue, real and tangible personal property value, property and income tax rates, and all WARN notices issued in Ohio during this time. Revenue and expenditure by category are available from 1999-2013, while employment is available from 2002-2013. Finally, for 181 cities, data on outstanding debt, cash and investments, and unreserved fund balance were available from 2002-2013.[13] I provide summary statistics for income tax base, property tax, population, and other

[10] Until 2009, property tax was levied on the tangible personal property of manufacturers. Tangible personal property included equipment and machinery, inventories, and fixtures and furnishings. The tax was imposed at the same statutory rate as the tax on real property, although none of the discount factors applied to real property applied to tangible personal property. Tangible personal property composed a small share of property value, in my sample 10% of real property across all municipalities, higher in industrialized areas. From 2005-2009, Ohio phased out the tax on tangible personal property, reducing the rate of appraised value to assessed value 6.25 percentage points per year from the initial rate of 25%.

[11] Each municipal jurisdiction overlaps one or more county governments, and one or more school districts; in suburban or rural areas villages may overlap with township governments. Because local school districts, counties, townships, and municipalities all impose a property tax, the ten unvoted mills are typically allocated between these three levels of government. The municipality may be allowed to impose three or four "inside" mills of property tax without referendum approval, while the remainder of the inside millage is allocated to the school district, county, and township governments. As seen in the second panel of Table 3.1, the property tax rate imposed by municipalities generally accounts for a small proportion of the total property tax imposed by all local governments within the boundaries of the municipality ($\frac{7.11}{54.5} = 13.0\%$).

[12] Although school districts may impose an income tax, I consider only the municipal income tax rate in determining tax burden. The municipal income tax rate is usually larger than the school rate, and data on the school income tax rate is not available in all years.

[13] Data on tax rates and tax base were collected by the Ohio Department of Taxation [Ohio Department of Taxation,

municipal variables in Table 3.1. The majority of municipalities raised revenue through an income tax. All municipalities raised some revenue through the property tax (only one municipality-by-year observations shows zero property tax revenue), but the income tax composed the largest source of revenue during this period. The municipal income tax raised on average $58.9 million per year, more than twice as much as the property tax at $24.3 million.[14]

3.2.2 WARN Act Summary

The 1988 Worker Adjustment and Retraining Notification (WARN) Act requires employers of 100 workers or more to disclose site closures and mass layoffs 60 days in advance. The employer must notify employees, labor unions, local elected officials, and the state rapid response department.[15] There are four thresholds that trigger mandatory WARN notification: shutdown of a employment site with employment loss for more than 50 employees within 30 days; a mass layoff causing employment loss for more than 500 workers, again within 30 days; an employer with more than 150 workers laying off more than 33% of its workforce; or multiple sites satisfying any of these thresholds jointly during a 90 day period.[16]

The Ohio Department of Job and Family Services provides data on plant closings from 1996-

"Tax Data Series"]. Employment data comes from the Census Bureau's Longitudinal Employer-Housing Dynamics project [United States Census Bureau, "LEHD Origin Destination Employment Statistics"]. Revenue, expenditures, and debt were collected from both audit reports of Ohio municipalities by the Ohio Auditor's Office, and from annual financial reports submitted to the Ohio Auditor's Office by municipalities. Unfortunately, data on revenues and expenditure were missing for some municipalities. I have restricted the sample to the 595 municipalities for whom these data was available in every year from 1999-2013.

[14] Tax revenue variables and income tax base are tabulated in the year collected. Income tax collections reflect economic activity in the previous year.

[15] Information in this section is from United States Department of Labor, "The Worker Adjustment and Retraining Act: Revising the Act and Educational Materials Could Clarify Employer Responsibilities and Employee Rights."

[16] To qualify as an employee under these thresholds, a person must work at least 20 hours per week for six months out of the year. Employment loss includes those who lose at least half of their hours or those who are laid off for more than six months. Employment loss does not include those who were transfered or refused a transfer within "reasonable commuting distance." An employer who fails to file a WARN notice must give workers back pay and benefits as well as up to $500 to the local government for each day of violation. This requirement can only be enforced in court by the aggrieved party (who may have their legal fees reimbursed). This penalty and enforcement structure may not be severe enough to ensure compliance. A 2003 Government Accounting Office Report found that only 33% of 2001 mass layoff events triggering the WARN threshold could be matched to a WARN notice; however, this study could only match 13% of WARN notices to mass layoffs in BLS data [United States Government Accounting Office, 2003].

2015. These data indicate the date of the notice, the date of the plant closing or mass layoff,[17] the number of workers affected, and the name of the county, municipality, and firm. From 1997-2013, 978 municipality by year observations had at least one reported closing. Table 3.1 shows summary statistics for plant closings.[18] At least one WARN notice occurred in 9.7% of all municipality-year observations. In municipalities where at least one mass layoff occurred during the year, 325 jobs were lost on average.

Because the unit of observation is the municipality, the key regressor will be job loss scaled to municipal population, or "proportional job loss." Rescaling job loss to be a fraction of municipal population gives a better picture of the layoff's importance in the municipality where it occurs. In municipalities where a mass layoff occurred, job loss in mass layoffs averaged 3.2% of municipal population. Figure 3.1 illustrates the distribution of this variable across incorporated municipalities in 2009, the sample year when the largest number of layoffs occurred. Job loss scaled to population was largest either in smaller municipalities located far from any major metropolis, or in smaller municipalities on the outskirts of large urban areas.

3.3 Effect of a Mass Layoff on Tax Base

3.3.1 Income Tax Base

A mass layoff may occur multiple times for each municipality, with each layoff affecting fiscal outcomes for several years. Thus, I model each fiscal outcome (income and property tax base, income and property tax rates, revenue and expenditure, outstanding debt and asset balances) as a function of a series of proportional job loss lags. Proportional job loss is defined as number of jobs lost in a reported mass layoff divided by municipal population. Failing to control for past layoffs would decrease the precision of the estimates, because the effect of each layoff would be conflated with the effects of past layoffs. More importantly, because the probability of a layoff occurring in

[17] I do not observe in the data whether these notifications apply to plant closings or mass layoffs where the site does not shut down, so I will refer to them all as "mass layoffs."

[18] In municipalities where more than one closing occurred during the same year, the multiple closings were counted as a single closing with job loss equal to the sum of job loss in all closings.

a given year is positively related to the probability of a layoff occurring in previous years, failing to control for job loss in past layoffs would bias the estimates. Including four lags of the job loss variable as well as the contemporaneous term also illustrates the effect of a single mass layoff over time. The coefficient on the fourth lag of job loss, for example, illustrates the lingering effect of the mass layoff on income tax base four years after the layoff occurs.

For municipality i in year t, I model the relationship between job loss and income tax base using the following event study specification:[19]

$$log(income\_tax\_base)_{it} = (job\_loss_{i,t+1},\ job\_loss_{it},\ job\_loss_{i,t-1},\ ...,\ job\_loss_{i,t-4})\boldsymbol{\gamma}$$

$$+ \boldsymbol{X_{i,t-5}\beta} + \xi_i + \delta_t + error_{it} \quad (1)$$

Since the time-constant component ξ_i is likely correlated with the probability of a mass layoff occurring, I estimate the model using fixed effects. I also include a set of year dummies, and a vector of control variables, lagged by five years.[20] In municipalities where a layoff occurred, mean income tax base may be lower throughout the sample time period than in years before the layoff. In other words, if a layoff has a lasting effect, this will drag down mean income tax base. This means the dependent variable would be higher than its sample mean in the year before the layoff, and lower in years after the layoff. Thus, I include the lead of the job loss variable. The coefficient on the lead of announced job loss shows how much higher the dependent variable is predicted to be the year before a mass layoff event of a certain size, relative to other sample years for that municipality. Note that the dependent variable is logged while proportional job loss is expressed as a fraction. Thus, the difference between the coefficient on the lead term and the coefficients on the lags show the percentage change in the dependent variable associated with a mass layoff with job loss equal to 1% of population, from the year before the layoff to however many years after.

[19] For more on event studies in economics, see MacKinlay [1997] and Sandler and Sandler [2013].

[20] $\boldsymbol{X}$ includes five year lagged controls for log of population, log of real property value, log of residential property value, income tax rate, and aggregate property tax rate for all levels of government overlapping the municipality.

The first column of Table 3.2 reports estimates with income tax base as the dependent variable.[21] In municipalities where a mass layoff occurred, income tax base was higher the year before the layoff than in other sample years. In the year that the layoff began, a job loss equal to 1% of municipal population causes income tax base to drop about $0.293 - 0.0805 = 0.21\%$ from the pre-layoff level, although the difference is not statistically significant (p-value = 0.16). Because the income tax base variable reflects the year that income was collected, this means income dropped the year before the layoff took place. This could mean that plants began cutting some staff prior to the mass layoff, reducing hours but not firing employees, or that profits began to fall in plants that would shut down. During the year following the mass layoff income tax base drops by 0.54% (-0.459 - 0.0805) compared to the year of the layoff, or 0.75% compared to the year before the layoff. This means a layoff at the mean of the proportional job loss variable, 3.2% of the population, results in a 2.4% drop in tax base from the year before the layoff to the year after. Income tax base remains below the pre-layoff level - a mass layoff with proportional job loss equal to 1% results in 0.46% lower income tax base four years after, with the difference statistically significant at the 99% confidence level.

The loss of income tax revenue persists for a number of possible reasons. First, employees of the firm who lived in the municipality may emigrate to another location for work. Second, employees who commuted into the municipality may find work in a different location. Finally, employees who find another job in the municipality, or former resident employees who now commute outside the municipality, may receive lower wages. Finally, in the case of a plant closing, the municipality loses tax that the business paid on its net profits, and enterprises serving the business or its workers will suffer losses and reduce employment as well.[22] These tend to amplify the effects described

[21] The marginal tax rate does not change with income. For this reason, I can divide gross revenue by the income tax rate to measure income tax base. The panel of income tax base, property values, and tax rates runs from 1997 to 2013. Because WARN notice data is available from 1997 to 2014, five periods are lost due to the inclusion of lags and leads. Only municipalities that had an income tax in all years (1997-2013) are included in the income tax and employment regressions.

[22] Greenstone, Hornbeck, and Moretti [2010] structurally estimate the effect of a large plant opening on total factor productivity of plants in the same county, discovering that opening a new "million dollar plant" increases the total factor productivity of incumbent plants by 12%, increasing labor demand and wages. In the converse scenario, when a firm closes, labor demand and wages at nearby firms decline. Firms that marketed their goods to the firm conducting

above.

Figure 3.2 plots the coefficients on the job loss variables, illustrating the layoff's effect over time. Figure 3.2 also plots the coefficients from the second column of Table 3.2, when log of employment is the dependent variable in Equation 1. Employment follows the same path as income tax base, but the drop in employment is somewhat less severe initially. The drop in income tax base may be somewhat more severe because it includes lost tax on profits, as well as on lost wages from laid off workers. The decline in income tax base likely also reflects skill mismatch for laid off workers who quickly find new jobs. If some laid off workers quickly accept a position that does not require as much human capital, then they will receive low wages despite remaining employed.

3.3.2 Property Tax Base

The third and fourth columns of Table 3.2 display results of regressions with assessed real property value as the dependent variable. The right hand side is identical to Equation (1), with one exception: because I include fixed effects, I exclude controls for real property value and Class 1 property value from the real property value equation.[23] After a mass layoff, real property value declines slightly. For a layoff with job loss equal to 1% of population, real property value falls 0.05% from the year before the layoff to the fourth year after, although the difference is not statistically significant.

Several factors may prevent a decline in real property value from showing in the data. Perhaps property owners anticipate the layoff, so that a downtrend in property value precedes the layoff. If not, there will still be some lag between the layoff and any decline in sale prices, as unemployed workers may delay choosing to relocate, for example. Finally, there will be a lag between the layoff and the next reappraisal of property; depending upon the time between the layoff and the triennial reappraisal, it could take as long as six years for a decline in sale prices to fully reflect in appraised value.

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the layoff or its employees experience lower profits, and labor demand shifts to the left.

[23] The property value regressions, unlike the income tax regression, include all municipalities in the sample. Like the income tax base regression, they include a control for the income tax rate, with a rate of zero for municipalities that do not have an income tax.

3.4 Municipal Response

A municipal government may respond to a mass layoff by altering its fiscal policy. It can attempt to recover lost revenue by raising tax rates or by switching to other revenue sources. Failing this, it must cut expenditure, undertake more debt finance, or deplete its saved resources. Expenditure cuts may not affect all items proportionally, depending upon the perceived necessity of the item and changes in demand for the item. A municipality may issue debt or draw upon rainy days funds, rather than cutting expenditure, if administrators perceive the effects of a mass layoff to be short lived. If the layoff's effects are expected to last, then the municipality is more likely to reduce its issue of new debt, but may draw on accumulated funds or refinance outstanding debt to adjust to a new level of expenditures.

3.4.1 Tax Rates

Table 3.3 shows the result of the fixed effects event study specification from Equation 1 with income tax rate and property tax rate as dependent variables. Both income tax and property tax rates decline. For income tax rate, the difference for the coefficient in the period before the layoff and the coefficient four years after is $(0.127 - 0.0390) = 0.09$. A mass layoff of mean size with proportional job loss of 3.2% lowers the income tax rate by $0.032 \times 0.08 = 0.0029$ percentage points, 0.34% of a standard deviation. By a similar calculation, property tax rate (measured in mills) falls by 0.4% of a standard deviation from the year before the layoff to four years later.[24] Neither difference proves statistically significant. But clearly municipalities do not compensate for a decline in revenue base by raising tax rates.

Tax rates fall after a mass layoff either because the municipal government does not wish to increase its tax rate, because voters refuse tax increases or renewals, or because the municipal government anticipates that a tax referendum will be unpopular and does not attempt it. In some cases, a voted increase in property or income tax rate is approved for a fixed duration; the

[24] $\frac{0.032 \times (0.570 - (-0.0333))}{4.79} = 0.004$

municipality must pass a renewal of an expiring rate, or the total rate decreases. It is unlikely that residents would be more willing to approve a rate increase following a mass layoff. Marginal utility of income increases for voters whose income has fallen, and if a mass layoff causes job loss for commuters, this shifts more tax burden onto residents. The government's decision to propose a tax referendum depends on the marginal benefit of revenue and its expectation that the referendum will pass. For a tax base decrease to increase the probability that a referendum passes, the median resident must have highly inelastic demand for public services.

3.4.2 Revenue

If the tax base falls with no compensating increase in tax rates, revenue will fall. Regressions in Table 3.4 confirm this, using different categories of revenue as the dependent variable in Equation 1.[25] Income tax revenue declines, with the magnitude of the decline and its persistence over time very similar to the pattern for income tax base displayed in Table 3.2. Interestingly, property tax revenue decreases as much as income tax revenue in the first and second years after a reported mass layoff. As seen in Tables 3.2 and 3.3, property tax rate and real property values fell as well, contributing to the decline. But the small declines in real property value and tax rate cannot account for the large property tax revenue decline. Property tax revenue may fall without a decline in property value or tax rates for at least two reasons. First, property tax delinquency may increase.[26] An increase in volatility of either Class 1 or Class 2 property values following a mass layoff could cause overall property tax revenue to decline (c.f. Section 3.2.1). If Class 2 value falls while Class 1 value rises, or *vice-versa*, then revenue from Class 2 value falls while revenue from Class 1 value is capped at the amount authorized by the existing levies and likely remains the same.[27]

[25] Although only the coefficients on the proportional job loss variables are shown, these regressions include the same controls as the regressions in Section 3.3.

[26] Statewide, net property tax delinquency equaled 0.7% of property tax revenue between 1997 and 2010. Property tax delinquency was countercyclical, reaching 1.5% in the 2001 recession year and 1.6% in the 2008 recession year. Unfortunately municipal data on property tax delinquency are not available.

[27] Besides the data on income tax revenue, all revenue and expenditure data are from audit reports and annual financial reports for Ohio municipalities from 1999-2013. These data reflect the year when the revenue was available; thus, total revenue reflects income tax revenue from activity in the previous year.

The last three columns of Table 3.4 shows how a mass layoff affects revenue from fees, fines, and service charges, intergovernmental revenue, and total revenue. Because there are many zeros in the data, I alter Equation 1 and use fixed effects Poisson estimation instead of OLS with a logged dependent variable. As with a logged dependent variable, each coefficient shows the percentage change in the dependent variable associated with a change in the right hand side variable.[28] For a mass layoff with 1% proportional job loss, services, fees and fines revenue declines 0.27% from the year before the layoff to two years after. Still, the coefficient on the forward job loss variable is not statistically different from the coefficients on any lag. Intergovernmental revenue does not change systematically following a mass layoff.[29] Column 5 shows that the declines in income tax revenue, property tax revenue, and fines, fees and services revenue drive a substantial decline in total revenue. Revenue declines 0.41% from the year before a mass layoff with 1% proportional job loss to the year after. Standard errors are relatively large, but a test that average revenue in the years after a mass layoff equals average revenue in the year of the layoff and the year before marginally rejects the null (p-value = 0.10).

3.4.3 Expenditure

The decline in revenue associated with a mass layoff pressures municipalities to cut expenditure. In addition, a mass layoff may reduce the demand for some municipal services. Amenities such as fire protection, emergency medical services, police protection, well maintained roads and bridges,

[28] The Poisson fixed effects estimator is robust to distributional assumptions, conditional on a correctly specified mean. Like fixed-effects OLS, it does not suffer from the incidental parameters problem [Wooldridge, 2010, Chapter 19]. Any municipality with all zero values of the dependent variable drops out of the estimation - thus three municipalities with all-zero values for services, fines and fees revenue are dropped from Column 3 of Table 3.4, leading to slightly fewer observations in this regression.

[29] Ohio municipalities participate in a revenue sharing program, where the state distributes unconditional aid to municipalities based on population, property tax base, and whether the municipality had any income tax. In 2007, distributions to municipalities totaled $416 million. In the same year, gas tax distributions to municipalities from the Ohio Department of Transportation totaled $245 million, based on number of registered vehicles in each municipality. $661 million of the $1.59 billion in intergovernmental revenue derived from factors that would either not change, or that would shrink during a local economic downturn. Other sources of aid included partial or total payment for capital projects distributed by the Department of Transportation or the Ohio Public Works Commission. As will be seen next, a drop in expenditures accompanies the drop in revenue detailed here. Any aid comprised of a state match of local funds likely decreases with this decrease in expenditure.

and access to water and power are highly demanded by most enterprises. Most mass layoffs in the sample stem from an establishment closing, and the rest likely accompany an establishment scaling back its operations, leading to a decline in the demand for services that it uses.

A municipal government will seek to cut services where the marginal benefit from providing the service is relatively elastic, or where the marginal benefit from the service decreases with a plant shutdown. Previous literature suggests that municipalities facing a decline in revenue or a fiscal crisis will cut expenditure on general government operations, on parks and recreation, and on capital outlay [Cromwell and Ihlanfeldt, 2015, Skidmore and Scorsone, 2011], which seem to have a flat marginal benefit curve. The marginal benefit curve for fire, ambulance, and EMS services may be steeper, but a plant closing may shift the demand for these services to the left.

Table 3.5 shows that total expenditure declines after a mass layoff.[30] For a layoff with proportional job loss of 1%, I estimate that total expenditure declines 0.26% from the year before the layoff to two years after, or 0.52% from the year of the layoff to two years after. Most categories of expenditure also fall after a mass layoff. General government expenditure falls 0.38% from the year before to two years after a mass layoff with proportional job loss of 1%. For a layoff this size over this time frame, public safety expenditure falls by 0.24%, leisure and community environment expenditure falls by 1.75%, and capital outlay falls by 1.02%. The drop in public safety expenditure contrasts with previous literature estimating municipal response to decreases in revenue, and may reflect a decrease in demand. Alternatively, municipalities facing a large, unexpected shock to revenue simply need to cut expenditure quickly, and public safety expenditures are a large category that may be easily reduced. The drop in infrastructure spending more likely reflects a decrease in demand, since it begins the year of the layoff, before the larger decline in revenue. In contrast, expenditure on public health increases, reinforcing the findings of Kuhn, Lalive, and Zweimüller [2009] and Browning and Heinesen [2012] that plant closings raise demand for public health services.

[30] Controls are included, but their estimated coefficients are suppressed in the output table.

3.4.4 Cities' Assets and Debt

The large, persistent revenue decline associated with a mass layoff brings about a decrease in expenditure, but this decrease need not perfectly track the drop in revenue. Municipalities may also borrow to fund certain expenditures, like infrastructure improvements and capital outlays. A municipal government with declining tax base and no desire to raise taxes may choose to fund necessary capital expenditures by borrowing. A municipality may not borrow to directly fund operating expenditures. Still, municipalities may free up current revenue for operating expenditures by funding capital outlays through debt rather than current revenues.

Because municipalities may only borrow for certain purposes, however, accumulated asset balances may provide a more important source of emergency funds than debt issue. Unlike states, municipalities may do not set aside a restricted "rainy day fund," but often accumulate an unreserved fund balance for the same purpose [Marlowe, 2005, 2013]. Unreserved fund balance refers to the difference between spendable assets and short term liabilities that is not reserved by law for a specific expenditure - essentially the municipality's accumulated resources that it may designate for any use. Thus, municipalities may use unreserved fund balance to avoid expenditure cuts during periods of revenue decline.[31]

Summarized Annual Financial Reports from the Ohio Auditor's Office provide data on assets and liabilities for cities, but not villages, from 2002-2013.[32] Beyond data availability issues, it makes sense to analyze cities separately. Cities likely possess more sophisticated resources for managing investments, and thus may find it easier to manage accrued assets. Similarly, issuing debt

[31] If Ricardian equivalence holds, then a municipality will increase its debt (or reduce its fund balance) in two circumstances. A municipality may borrow or draw down savings to intertemporally smooth expenditure if it expects a decrease in revenue to be temporary, or to gradually adjust to a lower level of expenditure if it expects the decrease to be permanent. If Ricardian equivalence does not hold, then present administrators and voters may approve temporarily higher spending at the expense of future taxpayers.

[32] Unreserved fund balance includes designated fund balance and undesignated fund balance, although the distinction is not particularly meaningful in practice [GASB, Governmental Accounting Standards Board, 2006]. Starting in 2013, Summarized Annual Financial Statements reported restricted, committed, assigned, and unassigned fund balances [Government Accounting Standards Board, 2009]. For 2013, I replace unreserved fund balance with assigned and unassigned fund balances. Some cities did not report assets or debt every year. If a city had not more than one consecutive year of missing data, then I interpolated the variable's value in that year as the linear combination of the value in the year before and the year after.

involves substantial fixed costs of legal fees, ratings fees, and underwriter compensation. Thus, villages typically issue debt only in special circumstances, while the largest cities issue debt on an annual basis. Summary statistics on cities' outstanding debt, unreserved fund balance, and cash and investments are presented in Table 3.1. Most cities had some form of long-term, general obligation[33] bonds issued, while a smaller number had outstanding notes or loans. Most cities also had a positive unreserved fund balance. Cities often held substantial cash and investment reserves, as well - indeed, cash and investments nearly equaled debt owed by cities, on average.

I estimate the effect of mass layoffs on debt, unreserved fund balance, and cash and investments using a fixed effects event study regression. The specification is similar to Equation 1, but the dependent variable is measured in per capita terms (divided by municipal population) and not logged. While debt and cash and investments are either positive or zero, unreserved fund balance is negative for many observations. Besides accounting for negative observations in unreserved fund balance, the linear specification allows for a direct comparison between changes in sources of funds, while expressing the dependent variable in per capita terms keeps large observations from dominating the estimation.

Table 3.6 shows the results of this estimation. For a mass layoff with job loss equal to 1% of population, general obligation bonds decrease in the second, third and fourth years following a mass layoff by about $11 per capita, relative to the year before. Notes and loans payable, however, increase in the second, third, and fourth years following a mass layoff, by roughly the same amount. The short term debt undertaken by municipalities includes bond anticipation notes and tax anticipation notes, preparing municipalities for an increase in expenditure. As municipalities decrease expenditure (especially capital expenditure), this type of short term debt decreases. Despite increasing capital expenditures, however, municipalities increase long-term outstanding debt. The increase may reflect a choice of how to finance expenditures undertaken in the past. For example, Moraine Ohio (discussed in the introduction) issued $5.8 million of new long term debt in 2010, two years after

[33] General obligation bonds are backed by the full credit of the municipality issuing them. Other types of long term debt, such as revenue bonds and special assessment bonds are backed only by a specific source of revenue and are not considered in what follows.

experiencing a series of devastating layoffs. This issue retired outstanding notes financing past expenditure [Moraine, 2010]. Moraine's administration likely decided to finance a larger share of these expenditures through debt, rather than tax, after the layoff occurred.

Per capita unreserved fund balance decreases $47 in the year after a mass layoff with 1% proportional job loss, before recovering to a level roughly $32 per capita below its level at the year before the layoff. A mass layoff of average size, with proportional job loss equal to 3.2% of population, lowers unreserved fund balance by 12% of a standard deviation from the year before the layoff to the year after. The results suggest that cities, unwilling or unable to raise tax rates and unwilling to cut operating expenditures, choose to instead deplete their accrued assets. Column 4 shows that most of the long term decline stems from municipalities drawing down their balance of cash and investments - cash and investments per capita decline $24 per year from the year before the layoff to four years after. While municipalities may hold a fund balance to avoid expenditure cuts in response to temporary shocks, the results in Table 3.2 suggest that the decline in income tax base associated with a mass layoff persists over time. At the same time, unreserved fund balance does not recover to the pre-layoff level after four years, leaving cities vulnerable to further financial stress.

3.5 Conclusion

The shock to municipal finances following a reported mass layoff proves to be large and economically significant. Revenue declines substantially for several years, and municipal governments are unwilling or unable to increase tax rates in response to this drop. Instead, municipalities respond by cutting expenditures and increasing outstanding debt. Municipalities do not seem to fully recover within four years of a layoff's occurrence. Income tax revenue, total revenue, and total expenditure remain below their pre-layoff level four years after the layoff's occurrence. Municipalities cut expenditure not only on general government, leisure and community environment, and capital outlays, but even on public safety. Municipalities run up outstanding long-term debt, and to an even greater degree dig into discretionary funds accumulated from past revenue.

These results bear at least two important implications for policy. First, by estimating the size and duration of the shock to revenue, the impact on different types of revenue and expenditure, and how effectively municipal fiscal policy ameliorates the shock, I provide information to state and federal policymakers evaluating different types of aid to economically distressed communities. Second, as most Ohio municipalities impose an income tax, unexpected job losses will impede revenue raising capabilities more in this state than in others. Economists and policy researchers have weighed the advisability of relying on traditional property taxes against the advantages of increasing revenue through sales or income taxes.[34] Because the income tax base fluctuates more than the property tax base, high reliance on an income tax exposes local governments to greater revenue variability. Municipalities' ability to respond to an income tax decline casts light on the wisdom of tapping this revenue source.

Although longer term public safety cuts and reduced assets seem potentially harmful, further research is needed to better ascertain the exact welfare implications of these effects. Do the expenditure cuts associated with a mass layoff correspond to lower quality of government service provision, such as higher crime, or lower 911 and EMS response times? Are municipalities able to maintain a sound fiscal position after the reduction in fund balance, or do they enter fiscal crisis?[35] Knowing the effect of a mass layoff, and municipalities' response, is a good start, but open questions remain.

[34] Fisher [2009] summarizes the policy debate over property taxes. McGuire, Papke, and Reschovsky [2014] compare the property tax to its alternatives in school finance, while Mikesell [2010] provides a descriptive overview of local sales and income taxes. Both Sobel and Holcombe [1996] and Dye [2004] measure the procyclicality of the state income tax, while Jesse Edgerton and Andrew F. Haughwout and Rae Rosen [2004] show a case where increased income taxes lead to higher revenue variation at the local level. Chernick, Langley, and Reschovsky [2011] find that property tax displayed less cyclicality in large cities during the Great Recession than local sales or income taxes.

[35] Beckett-Camarata [2004] surveyed officials in Ohio local governments suffering from a state-defined fiscal emergency. 47% of respondents attributed the fiscal emergency to a plant closing, suggesting that many localities suffer long-term fiscal hardship after these events.

CHAPTER 4

BALLOT ORDER AND BALLOT ROLL-OFF: EVIDENCE FROM LOCAL REFERENDA IN OHIO (COAUTHORED WITH MIKE CONLIN AND PAUL THOMPSON)

4.1 Introduction

Research in economics, marketing and political science has demonstrated that the size of the choice set and the sequence of choices affect an individual's decisions, in environments ranging from on-line grocery orders to car sales to elections. Numerous empirical papers provide evidence of "choice fatigue," testing whether individuals' choices depend on how many decisions they have made previously. A significant number of these papers use election ballot order to test: (i) whether individuals are less likely to vote on contests located further down the ballot, a phenomenon that political scientists call "roll-off"; and (ii) whether a contest's ballot location influences the choice of those who do vote. Augenblick and Nicholson [2016], hereinafter referred to as A&N, provide the most convincing strategy for identifying a causal relationship between ballot position and election outcomes, using a set of 392 contests in San Diego County between 1992 and 2002.[1] Because the ballot location of a given contest varies across precincts in San Diego, A&N are able to convincingly address contest heterogeneity. Due to a different set of local contests on different precinct ballots, a contest's position varies across ballots, which allows A&N to use within-contest variation for identification. In addition, because they observe precincts across multiple elections, they are able

[1] A number of other papers consider similar questions in terms of the relationship between ballot order or ballot length on the one hand, and roll-off or election outcomes on the other, but we feel that no other identification strategy to determine the causal effect is as convincing as A&N. Bowler, Donovan, and Happ [1992] regress both roll-off and probability of voting no on ballot rank for a set of California ballot proposals. Although they find significant effects in both cases, they fail to account for many of the proposition characteristics that may be correlated with ballot length. Selb [2008] considers the effect of ballot length on voting patterns, using a set of Swiss referendum elections. Although the author fails to find a statistically significant relationship between ballot length and no votes, he does estimate a statistically significant effect of ballot length on the variance of no votes. Ho and Imai [2008] estimate the causal relationship between the position in which a candidate's name is listed on the ballot within a contest and the vote share that the candidate receives, using a dataset of state office elections in California. They identify a statistically and economically significant effect for minor party candidates and for primary elections. Ho and Imai [2006] also find a positive relationship between ballot position and votes received in the 2004 California recall election.

to control for time invariant precinct-level factors that influence voter behavior.

A&N find evidence of roll-off and, perhaps more interesting, they find that voters are more likely to choose the status quo – including voting no on propositions and voting for the first candidate listed – for contests that appear lower on the ballot. While the results of this thorough analysis are consistent with voter fatigue, A&N also mention two other possible explanations: time-varying precinct characteristics such as voter composition being correlated with ballot location and the probability of a voter "rolling off" being correlated with a voter's preferences (especially in terms of the status quo results). While A&N are unable to directly test for these alternative explanations, they do find that choice fatigue does not occur on contests toward the top of the ballot that have no ballot position variation and that the results hold when ballot length is included as a covariate.

Using information on 2004-2012 Ohio tax referenda proposed by local administrative divisions (townships, municipalities, school districts, and counties) and different variation for identification, our paper complements the work of A&N. In terms of variation used for identification, Ohio law regulates order within the "questions and issues[2] portion of the ballot as follows (Revised Code § 3505.06 (B) (1)). State questions and issues are at the top of this portion of the ballot, followed by questions and issues involving local jurisdictions. The order of local questions and issues rotates annually based on jurisdiction type. In 1997, county referenda were placed at the top of the ballot, followed by municipal referenda, township referenda, and finally school and other district referenda. The next year, and every year following, the top jurisdiction category moved to the bottom of the ballot, while every other jurisdiction category moved up one rank. Thus, in 2010, municipalities were placed first, followed by townships, school and other districts, and counties. In 2011, however, townships were placed first, and municipalities fell to the bottom. This rank rotation provides a source of exogenous variation in ballot order, allowing us to test for voter fatigue. The main disadvantage of this paper relative to A&N is that rank, our proxy for ballot location, does

[2]The ballot in Ohio is divided into three sequentially ordered sub-ballots (Revised Code §§ 3505.03 – 3505.06). First, the "Office type ballot" presents choices of candidates chosen through the nominating process, including state and federal candidates, as well as many candidates for local offices. Second, the "Nonpartisan ballot" includes candidates for state or local school board, candidates for judicial office, and candidates for municipalities and townships not nominated through a primary. Finally, the questions and issues ballot contains proposals to be accepted or rejected through the referendum process.

not vary for a given referendum. For this reason we are unable to use within-contest variation to estimate voter fatigue. To adequately address referendum heterogeneity, we restrict our analysis to tax referenda because Ohio law standardizes the proposal process for these referenda and specifies a particular "taxing authority" which may propose referenda for each administrative division. More importantly, we are able to control for many characteristics of the referenda, including whether the referendum renews an existing tax, the purpose of the tax revenue, the type of tax and the tax rate. These characteristics are likely to affect the salience, palatability, and welfare impacts of the referenda.

The main advantage of this paper over A&N is that we have voter level information from which we can construct measures of voter composition for each referendum: specifically, the fraction of voters over 65 years of age, the fraction registered democrats and the fraction registered republicans. These composition measures may be important. Numerous studies document how an individual's attention span, cognitive abilities and decision making vary with age and how voter preferences vary with political party. Another difference is that while voting no on a proposition is a vote for the status quo in A&N, the status quo for our referenda depends on whether a referendum renews an existing tax. A yes vote is a vote for the status quo when the referendum involves a tax renewal and a no vote is a vote for the status quo when the referendum does not involve a tax renewal.

The empirical results in this paper suggest that controlling for variation in voter composition may be important when testing for choice fatigue. We find that the fraction of individuals at the ballot box choosing not to vote on a township referendum increases with the fraction of voters under the age of 65 and with the fraction registered as either a democrat or republican. However, we do not find the effect of ballot location on this decision to vary significantly based on the age or political affiliations of the voters. Thus, our results suggest that the evidence of roll off is not due to variation in the age and party affiliation of voters. That said, we do find that those referenda with large fractions of voters under the age of 65 or registered as democrat or republican have a much larger fraction of voters choose to not cast a referendum vote - irrespective of where the referendum appears on the ballot. This is important when considering status quo bias because we also find

that while the fraction voting yes on the referendum does not appreciably vary with political party affiliation, it does vary significantly based on age. Not only does the share voting yes vary with the fraction of voters over 65 years of age, this relationship depends on whether the referendum involves a tax renewal or a new tax. For tax renewal referenda, where a yes vote supports the status quo, a larger fraction of voters over the age of 65 results in a larger fraction of yes votes compared to a referendum involving a new tax. While we do not find this differential relationship to vary based on where the referendum appears on the ballot, it does suggest that if voter composition measures are not controlled for, results that are consistent with status quo bias could actually be due to unobserved voter heterogeneity.

4.2 Data and Summary Statistics

The Ohio Board of Elections provided referendum and voter characteristic information from 2004 through 2012.[3] The referendum data consists of the outcomes of local tax referenda located on general and primary election ballots and the ballot language from the Ohio Board of Elections website.[4] In terms of the different types of jurisdictions, there are 3,504 township referenda, 688 county referenda, 2,136 municipality referenda and 2,362 school district referenda. In terms of referendum outcomes, we have the number of yes votes and no votes. The first column in Table 4.1 contains summary statistics for only township referenda and indicates that the average numbers of yes and no votes are 734 and 490, respectively.[5] This results in the share of yes votes averaging

[3]For every administrative division that may levy taxes, the Ohio Revised Code specifies a "taxing authority" authorized to propose tax referenda. For a county, the taxing authority is the county commissioners; for a municipality, the legislative authority (e.g. city council); for a township, the township trustees; and for a school district, the district board of education. Generally, in order to place a tax or bond referendum on the ballot, the taxing authority must first adopt a resolution describing the purpose of the tax issue, and describing various characteristics of the tax or bond issue (such as the rate of taxation in the case of a tax levy, or the total debt issued in the case of a bond).

[4]Elections in Ohio are held on four uniform election dates during years without a presidential election, and on three uniform election dates during presidential election years. Taxing authorities may propose ballot questions for any of these election dates. The general election occurs in November. In years where no presidential election occurs, primary elections take place in May, while special elections may be held in February or August. During presidential election years, primary elections take place in March, superseding both the May primary and, in every year since 2000, the February special election.[Ohio Secretary of State, 2013]

[5]We gathered information on over 13,000 referenda which were on an Ohio ballot between 2004 and 2012. We dropped all referenda that did not involve a tax or had missing information (such as number of yes and no votes). We also dropped referenda that took place during either February or August (i.e., special elections). We also dropped

0.62 and 85.8 percent of these referenda passing.

Along with vote counts on the referenda, the individual Ohio voter file[6] identifies the jurisdiction of each registered voter and which elections the individual went to the ballot box to vote. By identifying the jurisdiction of each registered voter and which elections the individual went to the ballot box to vote, the Ohio Board of Elections individual voter file allowed us to credibly identify the number of voters who did not vote on the township referendum. The percent of voters who did not cast a vote on the referendum averaged 15.1 percent across all township referenda. Unfortunately, due to missing voter specific jurisdiction designations, it was difficult to credibly identify the fraction of voters who voted on the other types of referenda.[7] This is the reason we distinguish between townships and the other jurisdiction types and provide summary statistics for county, municipality and school district referenda in column 2 of Table 3.1.[8] Compared to township referenda, these jurisdictions' referenda average seven times more votes (8,343 total votes compared to 1,224), with a smaller share of voters supporting the referendum and a lower probability of passing.

The individual voter file also specified birth year and political affiliation for each registered voter. From this information, we constructed the fraction of voters over 65 years of age, the fraction registered democrats and the fraction registered republicans. Because these measures are fractions of the total voters identified from the jurisdiction and we have no reason to believe the misclassifications of jurisdiction location in the files are correlated with an individual's age or

all "special district" referenda because we were not able to identify the number of voters in the district and unable to identify whether an election would have been ranked among the "school and other districts" or with a different jurisdiction. We dropped all referenda involving seven of the 83 Ohio districts because of concerns with the individual voter files which are maintained by each county. For the remaining 76 counties, we individually went through each referendum to ensure the referenda and voter information was reliable. For those referenda that caused concern, such as those having more total referenda votes than voters at the ballot box, we dropped them. These were relatively few referenda and the results of our empirical analysis do not change appreciably if we kept them. In the end, dropping these referenda left us with a dataset containing 8,690 referenda.

[6] This file contains voting records for all registered voters in the state of Ohio. These files can be accessed at: https://www6.sos.state.oh.us/ords/f?p=111:1

[7] For most counties, we are reasonably comfortable with the number of voters identified for county referenda. We chose not to include these referenda because the number of county referenda is limited and, of the jurisdiction types, controlling for heterogeneous referenda characteristics is most problematic for county referenda.

[8] We do not present separate estimates for county, municipalities and school district referenda because the estimates are similar across these jurisdiction types but more precisely estimated when all three jurisdiction referenda are used.

party affiliation, we construct these demographic variables for all four types of jurisdictions. Table 3.1 indicates that approximately a quarter of all voters are over 65 years of age irrespective of the jurisdiction type and that about twice as many individuals are registered republicans as registered democrats. Interestingly, about half of all voters do not indicate a party affiliation.

Figure 4.1 depicts how these demographic characteristics of voters vary across elections for the townships that have a referendum and for the other three jurisdictions that have a referendum. It is clear that voter characteristics vary significantly across elections with younger voters being much more likely to vote in presidential and gubernatorial elections relative to other general elections and with a higher proportion of party affiliated voters turning out for primary elections. Not only are voter preferences likely to vary with these demographic characteristics but the decision to abstain from voting on the referendum may also vary. In addition, how abstaining varies with ballot location may also vary across age and party affiliation. The specifications in the next section address these issues.

The ability to identify when the referendum appeared on the ballot (i.e., which election) allows us to determine the rank ordering for the particular jurisdiction's referenda in that election year. This rank order proxies for the referendum's exact ballot position and varies between one and four (e.g., a one indicates that referenda for the particular jurisdiction type precedes referenda for the other three jurisdiction types and a four indicates it succeeds these other jurisdiction types).[9] The average rank is close to 2.5 for all four types of jurisdictions because the number of referenda proposed remains roughly constant across years. The exact wording on the ballot allows us to identify not only the jurisdiction but also whether the referendum renews an existing tax the purpose of the tax, the type of tax and the tax rate. The referenda propose to fund many different types of expenditures which vary across jurisdiction type. The most prevalent types for

[9] We could construct another measure of ballot location by estimating the average number of contests that would appear on the ballot for each township referendum. The problem with this measure is that, unlike A&N, we can only estimate an average number due to overlapping jurisdiction issues. In addition, we are concerned that the number of different types of referenda in a geographic area is correlated with unobserved voter preferences. We prefer using rank for this reason, as well our concern that when an administrative unit places a tax referendum on the ballot may depend on their expectation of whether the other overlapping administrative divisions have a tax referendum on the ballot. We are less concerned that an administrative division's decision to place a tax referendum on the ballot depends on the division's rank in that particular year.

township referenda are police/fire/emergency medical services (ems), roads and cemeteries; for county referenda, police/fire/ems, community/senior center, health services and child services; for municipality referenda, police/fire/ems, roads, current expenditures and parks/recreation facilities; and for school district referenda, capital projects, current expenditures, emergency expenditures and permanent improvements. Table 3.1 indicates that slightly less than half of the referenda involve a tax renewal (48.3% for townships and 41.3% for counties, municipalities and school districts)[10] and identifies the proportion of the referenda pertaining to the different purposes. Table 3.1 also provides descriptive statistics on the type of tax and tax rate. All of the township referenda involve property taxes and their average millage rate is 1.52. Counties can raise revenue through a sales or property tax while school districts and municipalities can raise revenue through an income or property tax. Column 2 of Table 3.1 indicates that 83% of the referenda for these three jurisdiction types involve a property tax while only 7% propose a sales tax and only 11% propose an income tax. The average millage rate, sales tax rate and income tax rate are 3.351, 0.456 and 0.693, respectively.

Along with the rank ordering, the ability to identify which election the referendum appeared on the ballot allows us to identify other aspects of the election that might be correlated with whether an individual at the ballot box voted on the referendum and also how they voted. Table 3.1 indicates that about a quarter of the referenda were placed on the November ballot in presidential election years while 18.7% of township referenda and 15.4% of county/municipality/school district referenda occurred in the November ballot in gubernatorial election years. The percentage difference between presidential and gubernatorial elections is primarily attributable to the fact that there were three presidential and only two gubernatorial elections during the time period analyzed and not due to a significant difference in the number of referenda appearing on a given election.[11] However, these percentages are significantly greater than the percent of referenda that appear on the primary elections for president and governor. Over 40% of the referenda appear on the ballot in odd number

[10] If an existing millage is set to expire, the taxing authority may request a "renewal levy" to extend a tax of the same millage rate for a longer period of time. The taxing authority may submit the renewal levy at any election during the last year in which the tax is collected, or at the general election of the previous year.

[11] Presidential elections took place in 2004, 2008 and 2012 while gubernatorial elections took place in 2006 and 2010.

years when there is neither a presidential nor gubernatorial election (general or primary). These numbers indicate that while slightly more referenda appear during general elections in the even years, when a president or governor is chosen, referenda are much more likely to appear in a November general election than in a March or May primary election.[12] Table 3.1 indicates that 84.3% of township referenda appear on a November election while 71.2% of county/municipality/school district referenda appear on a November election. Since voter composition differs in presidential and gubernatorial elections as well as across general and primary elections, these percentages seem particularly worthy of note.

4.3 Empirical Methodology and Results

To credibly estimate how ballot location affects whether and how people vote, contest heterogeneity must be accounted for. As discussed by A&N, much of the existing literature involving the effect of ballot location just correlates ballot length and aggregate votes which is problematic if the types of contests vary, in terms of aspects like saliency and importance, with ballot location and length. While some of this literature attempts to control for specific characteristics of the contest, this is often difficult due to the limited set of observables and the significant differences across contests. A major advantage of the A&N paper is that they are able to convincingly address contest heterogeneity because the ballot location of a given contest varies across local jurisdictions in San Diego due to other local contests on a jurisdiction's ballot. Therefore, they are able to use within contest variation to identify the effect of ballot location. Since rank, our measure of ballot location, does not vary across a referendum, we are unable to use within referendum variation to identify the effect of ballot location. Instead of including referendum fixed effects, we address contest heterogeneity by focusing on tax referenda and controlling for a rich set of referendum observables.

Along with contest heterogeneity, it is important to control for jurisdiction and election heterogeneity. Tastes/preferences for and importance of a particular contest are likely to vary across voters in different jurisdictions and this could influence not only the choice whether to vote but also

[12] Primary elections occur in May except when there is a November presidential election in which case they occur in March.

how to vote on a contest. Similar to A&N, we address the time invariant jurisdiction characteristics by including jurisdiction specific fixed effects. We also account for election specific heterogeneity by controlling for election characteristics that do not vary across jurisdictions. These election characteristics, such as whether a referendum is held during a presidential election, likely influence the type of individuals who decide to go to the ballot box.[13] Unlike A&N, we allow the effect of these election characteristics on voter composition to vary across heterogeneous jurisdictions.

In an effort to address the contest, jurisdiction and election heterogeneity in Ohio tax referenda, we estimate the following specification for the 3,504 township referenda:

$$Share_{re} = \alpha_t + \beta_1(Rank_e) + \beta_2(Ren_r) + \boldsymbol{\beta_r X_r} + \boldsymbol{\beta_j X_j} + \boldsymbol{\beta_e X_e} + \epsilon_{re} \quad (1)$$

where $Share_{re}$ is the share of voters who did not vote on referendum r in election e; $Rank_e$ equals one through four; Ren_r equals one if referendum r involved a tax renewal; X_r is the set of referendum characteristics (purpose of the tax, type of tax being proposed, and the tax rate); X_j is the set of township/jurisdiction specific indicator variables; and X_e is the set of election specific characteristics (number of state issues, presidential election, gubernatorial election, presidential primary, gubernatorial primary, and election month).

Column 2 of Table 3.2 provides estimates from the above specification while Column 1 provides estimates when jurisdiction fixed effects are not included. In both, the positive coefficient estimate associated with rank, while not statistically significant, is consistent with much of the literature on roll-off and suggests that voters are less likely to vote on referenda that are further down the ballot.[14] The estimate of β_2 is close to zero, indicating that the fraction of individuals at the ballot

[13] A&N do not need to include election characteristics that do not vary across jurisdictions because they use within contest variation and a contest appears on the same election date for all jurisdictions. Therefore, including contest fixed effects allow A&N to control for contest as well as election heterogeneity.

[14] While the robust standard errors result in the rank coefficient not to be statistically significant, the t-statistics are greater than one and the coefficients are statistically significant at conventional levels if different assumptions are made in terms of the error terms (such as being uncorrelated across referenda). One potential reason these estimates are not precisely estimated is that rank is a noisy measure of where the referendum occurs on the ballot.

box who choose not to vote does not depend on whether or not the referendum renews an existing tax.

To the specification denoted in Equation (1), we also add three election specific covariates that characterize voter composition: fraction of voters over 65 years of age, fraction of voters who are registered democrats, and fraction of voters who are registered republicans. Voters' preferences for a tax referendum are likely to vary with both age, whether they are registered with a party and, for those registered, which party they are affiliated with. While the township fixed effects account for election invariant differences in age and party affiliation across townships, they do not account for the variation across elections in voter composition within a township. Figure 4.1 depicts significant variation in these voter characteristics across elections. The coefficient estimates associated with these voter composition measure are in Column 3 of Table 3.2. They indicate that the fraction not casting a referendum vote decreases with the fraction of voters over 65 years of age and increases with registered voters (both democrat and republican). The effect of the fraction of voters over 65 is especially large with a one standard deviation increase (6 percentage points) resulting in a decrease in the fraction voting on the township referendum of 4.2 (6 times 0.6953) percentage points. This implies that the percent of voters over 65 years old who choose not to vote on the township tax referendum averages 14.57 and this percentage is 15.27 for voters under 65 years of age.[15] Interestingly, adding these voter composition covariates do not appreciably change the rank coefficient estimate.

We next consider whether the effect of ballot position on the decision to vote on the referendum varies across voter types by interacting our voter composition measures with our rank variable. The estimates associated with these interaction terms in Column (4) suggest that how ballot location affects the probability of voting does not vary significantly based on fraction over age 65 or party affiliation. More interestingly, when interactions between renewal and percent over 65 years of age

[15] The percent of voters choosing not to vote on the referendum is a weighted average of the percentage among voters over age 65 and the percentage among voters under age 65. Table 3.2 indicates that the fraction of voters choosing not to vote on the township referendum averages 0.151 and the fraction of voters over 65 years of age averages 0.239. Therefore, the coefficient of -0.6953 in Table 2.3 implies that the percent of voters over 65 years of age who don't vote on the township referendum is 15.1-(1-0.239)(0.6953) = 14.57 and this percentage for voters under 65 years of age is 14.57+0.6953 = 15.27.

and between renewal and percent registered democrat/republican are added as covariates, the effect of a tax renewal on the probability of voting appears to vary dramatically with voter age and party registration. The statistically significant coefficient estimates in Column (5) indicate that voters over age 65 are much more likely than younger individuals to vote on a referendum involving a tax renewal relative to one involving a new tax and voters registered to a particular political party (democrat or republican) are much less likely to vote on a referendum involving a tax renewal relative to one involving a new tax. The effect of the referendum involving a tax renewal on the decision of a specific voter type to vote on the referendum appears not to depend on where the referendum appears on the ballot, based on the estimates in Column (6) of Table 3.2.

The estimates in Table 3.2 suggest that the prior findings documenting roll-off are not the result of unobservable heterogeneity in voter characteristics. However, the estimates do raise concern that unobserved heterogeneity in voter composition may be a contributing factor in A&Ns empirical analysis testing for a status quo bias. If voters over the age of 65 are less likely and those who register a party affiliation are more likely to vote on a referendum involving a renewal (where passing would be maintaining the status quo), and if these voter composition measures are correlated with the contests location on a ballot, then the evidence consistent with status quo bias could actually be attributable to unobserved voter heterogeneity. The large within-jurisdiction, across-election variation in these voter characteristics (See Figure 1) causes further concern.

To provide further evidence that unobservable voter heterogeneity may be responsible for the results attributable to status quo bias, we estimated the same specification in Table 3.2 with share yes votes (i.e., yes votes divided by total votes) as the dependent variable while still using only township referenda. Table 3.3 contains these estimates which reinforce our concern regarding voter heterogeneity. The estimates in the first three columns suggest that the fraction voting yes: (i) increases as the referendum is located further down ballot; (ii) is greater for referenda involving a tax renewal; and (iii) increases with the fraction of voters over the age of 65. The estimates in Column (4) suggest that, like the decision to vote on the referendum, how ballot location affects the probability of voting does not vary significantly based on fraction over age 65 or party affiliation.

While the estimates in Column (5) indicate that the effect of a referendum involving a tax renewal on the fraction voting yes does not vary appreciably with voter party affiliation, the statistically significant estimate of 0.2899 associated with the interaction of percent over 65 and tax renewal referendum indicates that senior citizens, relative to younger voters, are almost 30 percent more likely to vote yes for a tax renewal than a new tax. The estimates in Column (6) of Table 3.3 indicate that the effect of a referendum involving a tax renewal on the share voting yes does not depend on where the referendum appears on the ballot for different age and party affiliation voters.

Table 3.4 contains estimates from the same specifications as in Table 3.3 using the 5,286 county, school district and municipality referenda. These estimates indicate that when we consider what affects the share who vote yes in these other jurisdictions, similar results are obtained as for the township referenda. Specifically, Table 3.4 indicates that the share voting yes is greater for items that are further down the ballot and for referenda that involve a tax renewal. The estimates in Columns (5) and (6) suggest that, like for township referenda, senior citizens are much more likely to vote yes for a tax renewal than a new tax compared to younger voters but that this difference does not depend on where the referendum is located on the ballot. The portions of voters affiliated with the democratic and republican parties appears not to affect share of yes votes. Columns (3) and (4) indicate that, unlike township referenda, the share voting yes decreases with the fraction of voters over the age of 65 and this affect is greater the further down the ballot the referendum is located.

4.4 Conclusion

A broad range of empirical research suggests that the sequence of choices influences an individual's decisions and use the concept of "choice fatigue" to explain this phenomenon. Some of the most interesting papers use ballot location to ascertain how choice fatigue affects not only the decision to vote but also how an individual votes. The best paper in this area is arguably Augenblick and Nicholson [2016] who look at contests in San Diego County between 1992 and 2002. They find that the lower the contest is on a ballot, the larger fraction of individuals will choose not to vote and, for those who do vote, more will vote no on a proposition and more will vote for the

first candidate list. They argue that this result is due to a "status quo bias" that is more prevalent when an individual experiences choice fatigue. Their identification strategy is quite ingenious but relies on the assumption that unobserved heterogeneity in voter composition within a jurisdiction across elections is not correlated with either ballot location and voter preferences. Augenblick and Nicholson's empirical analysis considers this selection issue but, unfortunately, they do not have voter level demographic characteristics to directly account for voter heterogeneity.

This study's contribution to the literature is based on our ability to directly account for the heterogeneity in voters' age and political affiliation. Using election results and voter information for local Ohio tax referenda from 2004 to 2012, our results suggest that controlling for voter age and political affiliation is important when explaining how ballot location effects whether and how individuals' vote. While Augenblick and Nicholson results suggesting status quo bias may not be attributable to unobserved voter heterogeneity in their San Diego County contest data, voter heterogeneity clearly has important implications for how people vote on Ohio tax referenda.

APPENDICES

APPENDIX A

NOTE ON PROJECT LEVEL STATISTICS

Table 2.8 shows summary statistics at the project level. The first row summarizes number of work locations involved in the project (projects along a stretch of road may be listed as separate work locations in the file). The third and fourth rows summarize number of house districts and number of senate districts that each project overlaps, while the fifth and sixth rows show number of areas of intersection between pre-redistricting and post-redistricting districts that each project overlaps.[1] Estimated total cost, summarized in the seventh row, is the closest available approximation to the value or size of the project. Average estimated total cost per project is about $2.36M.

The remainder of the table summarizes average estimated total cost and number of projects within different categories of sponsoring agency and type of work. I have created ten categories grouping different sponsors of the projects. Most projects list the ODOT itself as a sponsor, while a number list one of the ODOT's twelve districts along with one of five funding areas: bridges, traffic, maintenance, production, and planning. Some list a municipality or township[2] (I have grouped these together as "municipality sponsor") while others list a county as the sponsor (I have grouped all other special purpose local governments in the state, such as port authorities, with counties). Finally, some list a non-DOT state agency as a sponsor, or an agency in another state ("other state sponsor"). The fifth panel shows average cost and number of projects by primary work area. I created the work area categories by grouping expressions from a verbal description of the primary work area for each project: for example, the intersection variable groups the string "INTER" and thus includes projects involving an intersection or interchange.

[1] I describe how I construct geographic area of overlap between old and new districts in the text.

[2] According to ODOT employees working with these shapefiles, the shapefiles I am using include all projects in the state with some state or federal funding. Thus, a project sponsored by a county or municipality will be included if it is partly funded by the state or federal government.

APPENDIX B

TABLES

Table 2.1: Summary Statistics, by Party-Area of Intersection

	Mean (Standard Deviation)			
	Democratic	Republican	Total	Years Available
Estimated total cost	6460.2	7024.3	6772.5	2007-2018
	(17780.8)	(17855.4)	(17821.6)	
Number of projects	22.52	38.44	31.34	2007-2018
	(42.99)	(69.64)	(59.76)	
Number of large projects	2.980	4.348	3.737	2007-2018
	(6.052)	(8.755)	(7.697)	
Expenditure, large projects (Thousands)	3840.1	3011.8	3381.4	2007-2018
	(16137.2)	(12361.5)	(14174.8)	
Expenditure, Ohio is main sponsor (Thousands)	4908.3	5611.3	5297.6	2007-2018
	(16553.0)	(17380.7)	(17017.3)	
Republican	0	1	0.554	2007-2018
	(0)	(0)	(0.497)	
County & township public works exp. (Thousands)	2200.6	4295.6	3339.8	2007-2015
	(3017.6)	(4306.8)	(3914.7)	
Local government capital outlay (Thousands)	6542.6	5923.9	6206.2	2007-2015
	(7136.0)	(7580.0)	(7385.8)	
Municipal transportation spending (Thousands)	3765.3	2713.7	3193.5	2007-2015
	(5649.3)	(3420.0)	(4602.9)	
Gas tax rev. dist., municipalities (Thousands)	945.5	867.5	903.1	2007-2015
	(855.3)	(883.2)	(871.3)	
Gas tax rev. dist., townships (Thousands)	154.1	435.9	307.3	2007-2015
	(343.9)	(526.3)	(473.5)	
Average millage rate devoted to roads	0.423	1.016	0.746	2007-2015
	(0.808)	(1.117)	(1.031)	
Employment (Thousands)	19.61	18.30	18.90	2007-2015
	(21.81)	(17.45)	(19.57)	
Employed population (Thousands)	16.63	20.82	18.91	2007-2015
	(14.17)	(16.24)	(15.47)	
Population (Thousands)	37.17	45.45	41.75	2010
	(31.52)	(35.28)	(33.90)	
Sufficiency Rating, bridges	69.64	72.87	71.42	2007-2015
	(11.88)	(8.734)	(10.39)	
Daily vehicle miles traveled, non-local roads	56.22	71.26	64.40	2007-2015
	(49.13)	(59.25)	(55.37)	
Observations	1419	1761	3180	

There are 265 areas of intersection between old and new districts over twelve years (2007-2018), for a total of 3180 observations. Control variables are lagged one year in the regressions and not available for all years - table shows the years when control variables are used in the regressions.

†This includes only distributions from Fund 7060, which weakly increased with number of registered vehicles in the township. Townships also received distributions from Fund 7068, but these were allocated evenly among townships and were not available for all years.

Table 2.2: Summary Statistics, by Party-District

	Mean (Standard Deviation)			
	Democratic	Republican	Total	Years Available
Estimated total cost, (Thousands)	18670.1	17747.1	18128.5	2007-2018
	(30382.2)	(27370.2)	(28644.6)	
Number of projects	65.08	97.12	83.88	2007-2018
	(76.66)	(136.4)	(116.5)	
Number of large projects	8.611	10.98	10.00	2007-2018
	(9.968)	(15.65)	(13.64)	
Expenditure, large projects (Thousands)	11097.9	7609.4	9051.2	2007-2018
	(28526.7)	(19684.2)	(23792.4)	
Expenditure, Ohio is main sponsor (Thousands)	14185.0	14177.2	14180.4	2007-2018
	(28828.5)	(27108.8)	(27820.4)	
Republican	0	1	0.587	2007-2018
	(0)	(0)	(0.493)	
County & township public works exp. (Thousands)	5418.5	8880.8	7449.9	2007-2018
	(4921.2)	(6904.5)	(6392.1)	
Local government capital outlay (Thousands)	16110.1	12247.3	13843.8	2007-2015
	(13435.7)	(11488.9)	(12471.4)	
Municipal transportation spending (Thousands)	9271.5	5610.4	7123.5	2007-2015
	(9165.3)	(5128.7)	(7304.3)	
Gas tax rev. dist., municipalities (Thousands)	2328.2	1793.5	2014.5	2007-2015
	(1159.1)	(1230.3)	(1229.4)	
Gas tax rev. dist., townships (Thousands)	379.3	901.3	685.6	2007-2015
	(693.8)	(925.4)	(875.7)	
Average millage rate devoted to roads	0.507	0.962	0.767	2007-2015
	(0.732)	(0.760)	(0.781)	
Employment (Thousands)	48.29	37.84	42.16	2007-2015
	(33.30)	(23.87)	(28.61)	
Employed population (Thousands)	40.94	43.05	42.18	2007-2015
	(17.49)	(21.58)	(20.01)	
Population (Thousands)	107.4	114.8	111.8	2010
	(9.803)	(9.230)	(10.15)	
Sufficiency Rating, bridges	70.25	73.43	72.06	2007-2015
	(6.854)	(6.341)	(6.749)	
Daily vehicle miles traveled, non-local roads	138.4	147.3	143.7	2007-2015
	(61.20)	(78.17)	(71.75)	
Observations	491	697	1188	

There are 99 districts over twelve years (2007-2018), for a total of 1188 observations. Control variables are lagged one year in the regressions and not available for all years - table shows the years when control variables are used in the regressions.

Table 2.3: Representative Transitions and Relationship with Other Gov. Branches

Transition	2008-2010; 2014-2016	2012 (Redistricting year)	T-stat
R to R	0.51	0.46	1.55
R to D	0.04	0.13	-6.26
D to R	0.04	0.08	-2.74
D to D	0.41	0.33	2.43
Same Rep., GOP	0.39	0.18	6.45
Same Rep., Dem.	0.31	0.12	6.42
New Rep., Same Party, GOP	0.12	0.28	-6.50
New Rep., Same Party, Dem.	0.10	0.21	-5.13
Incumbent Lost General Election: GOP	0.02	0.01	0.47
Incumbent Lost General Election: Dem.	0.02	0.00	2.52
Incumbent Did not Run:† GOP	0.14	0.10	1.74
Incumbent Did not Run: Dem.	0.12	0.07	2.25
Incumbent in Different Dist.: GOP	0.00	0.26	-21.80
Incumbent in Different Dist.: Dem.	0.00	0.26	-21.37
Representative and other branches			
Same Party, House and Senate	0.80	0.85	-1.62
GOP, House and Senate	0.51	0.52	-0.29
Dem, House and Senate	0.30	0.33	-1.07
Representative Same Party as Gov.	0.51	0.54	-1.16
	N = 1060	N = 265	

†Includes incumbents who lost a primary election.

Table 2.4: Effect of Redistricting Party Change on Road Construction Spending, 2007-2018

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Construction spending ($1000s)							
(R to D) × 1(year > 2012)	-3462.6**	-2566.5	-6616.2**	-0.659**	-0.561	-3440.7**	-2308.9
	(1470.9)	(1612.0)	(3038.0)	(0.256)	(0.361)	(1529.2)	(1753.0)
(D to R) × 1(year > 2012)	-973.9	-923.0	-2087.2	-0.0170	-0.0848	-934.1	-857.6
	(1729.6)	(1811.6)	(3345.2)	(0.337)	(0.426)	(1725.6)	(1807.8)
(D to D) × 1(year > 2012)	-238.0	30.37	-5616.7*	-0.00809	0.0430	-324.2	171.2
	(1600.2)	(2069.7)	(3088.8)	(0.213)	(0.336)	(1591.3)	(2084.5)
(R to D) × 1(year = 2007-2010)	-1171.1	32.28	4028.9**	-0.342	-0.103	-1171.1	26.44
	(1112.3)	(1078.3)	(2019.8)	(0.216)	(0.241)	(1112.7)	(1076.3)
(D to R) × 1(year = 2007-2010)	301.9	-5.551	1111.3	0.0660	-0.156	301.9	-11.48
	(1918.9)	(2081.5)	(2386.2)	(0.435)	(0.604)	(1919.5)	(2081.2)
(D to D) × 1(year = 2007-2010)	-112.5	598.9	6087.8**	-0.0193	0.161	-112.5	593.8
	(1593.4)	(1677.0)	(2825.3)	(0.249)	(0.330)	(1593.9)	(1678.5)
(R to R) × year			48.34				
			(153.5)				
(R to D) × year			1385.7**				
			(556.1)				
(D to R) × year			424.3				
			(920.5)				
(D to D) × year			1914.7***				
			(706.9)				
GOP Rep., GOP Sen. year after redist. × (year > 2012)						2305.7	2296.8
						(2363.4)	(2538.8)
Dem. Rep., Dem. Sen. year after redist. × (year > 2012)						3567.8	2105.3
						(3264.4)	(3389.3)
L.Municipal transportation spending		0.0842	0.110		0.0000101		0.0886
		(0.574)	(0.580)		(0.0000474)		(0.569)
L.County & township public works exp.		0.576	0.620		0.0000374		0.575
		(0.374)	(0.376)		(0.0000306)		(0.375)
L.Gas tax rev. dist., municipalities (Thousands)		-11.64	-10.85		-0.000315		-11.58
		(13.45)	(13.38)		(0.00153)		(13.43)
L.Gas tax rev. dist., townships (Thousands)		-19.59	-0.979		-0.000198		-19.24
		(37.19)	(35.25)		(0.00372)		(36.95)
L.Average millage rate devoted to roads		-1300.1*	-1007.4		-0.534***		-1294.2*
		(762.1)	(897.5)		(0.204)		(759.9)
L.Employment		-202.1	-189.1		-0.0200		-202.1
		(298.1)	(297.3)		(0.0264)		(298.9)
L.Employed population		-226.0	-213.4		-0.0315		-228.4
		(335.3)	(337.1)		(0.0404)		(328.4)
L.Sufficiency Rating (bridges)		-86.27***	-92.19***		-0.0463***		-86.96***
		(29.70)	(30.19)		(0.0137)		(29.68)
L.Daily vehicle miles traveled, non-local roads		65.49	69.32		0.00995		68.69
		(97.08)	(97.13)		(0.0111)		(92.37)
Area of intersection fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demand	No	Yes	Yes	No	Yes	No	Yes
Party-change trends	No	No	Yes	No	No	No	No
Estimation	OLS	OLS	OLS	Poisson QMLE	Poisson QMLE	OLS	OLS
Observations	3180	2500	2500	3144	2440	3180	2500
R^2	0.006	0.011	0.013			0.007	0.011
Log Pseudolikelihood				-12008506	-9578191		

Robust standard errors in parentheses - OLS standard errors are clustered at the area of intersection level. * ($p < 0.1$), ** ($p < 0.05$), *** ($p < 0.01$). The dependent variable is estimated total cost (in thousands of dollars) of all construction projects in the area that received state funding for columns without controls, and total cost of projects sponsored by the state for columns with controls.

Table 2.5: Effect of Redistricting Party Change on Number of Projects, 2007-2018

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Num. Proj.	Num. Large Proj.	Num. Proj.	Num. Large Proj.	Num. Proj.	Num. Large Proj.
(R to D) × 1(year > 2012)	0.0658	-0.478**	-0.0378	-0.430**	-0.351**	-1.074***
	(0.136)	(0.216)	(0.112)	(0.192)	(0.177)	(0.374)
(D to R) × 1(year > 2012)	0.243*	-0.258	0.0298	-0.0839	-0.200	-0.282
	(0.145)	(0.260)	(0.169)	(0.295)	(0.319)	(0.416)
(D to D) × 1(year > 2012)	-0.0169	-0.0104	-0.167*	0.0586	-0.298*	-0.314
	(0.0802)	(0.177)	(0.0951)	(0.168)	(0.156)	(0.229)
(R to D) × 1(year = 2007-2010)	-0.141	-0.0510	-0.169	-0.0214	0.140	0.606*
	(0.177)	(0.262)	(0.173)	(0.263)	(0.227)	(0.368)
(D to R) × 1(year = 2007-2010)	0.0602	-0.0783	-0.0676	-0.127	0.164	0.0608
	(0.125)	(0.198)	(0.136)	(0.196)	(0.260)	(0.322)
(D to D) × 1(year = 2007-2010)	-0.247***	0.291*	-0.389***	0.306*	-0.260**	0.654**
	(0.0665)	(0.176)	(0.0785)	(0.177)	(0.120)	(0.281)
Area of intersection fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demand	No	No	Yes	Yes	Yes	Yes
Party-change trends	No	No	No	No	Yes	Yes
Estimation	Pois. QMLE	Pois. QMLE	Pois. QMLE	Pois. QMLE	Pois. QMLE	Pois. QMLE
Observations	3144	2964	2440	2430	2440	2430
Log Pseudolikelihood	-18656	-8082	-14426	-6313	-14387	-6291

Robust standard errors in parentheses. * ($p < 0.1$), ** ($p < 0.05$), *** ($p < 0.01$). The dependent variable is number of construction projects (or number of all large construction projects) in the area that received state funding for columns without controls, and number of projects (large projects) sponsored by the state for columns with controls. Controls include employment and employed population; public works expenditure by counties and townships, transportation expenditure by municipalities, capital outlay by townships, cities, and counties, and population weighted average local government property tax millage rate dedicated to roads; gas tax distributions to municipalities and to townships; daily vehicle miles traveled; and average FHWA sufficiency rating for bridges.

Table 2.6: Effect of Party and Alignment with Gov. on Construction Project Funding, Compare Voting Changes to Redistricting Changes 2007-2018

	(1)	(2)	(3)	(4)	(5)	(6)
Construction expenditure ($1000s)						
GOP Representative, GOP Gov.	2574.3*	4990.7**	2982.2	5353.1**	5585.2	6087.3**
	(1433.6)	(2200.2)	(1921.8)	(2682.6)	(3497.7)	(2869.0)
GOP Representative, Dem. Gov.	985.6	1309.4	1043.6	1421.3	2280.2	2932.5
	(1079.6)	(1244.8)	(1520.1)	(1788.9)	(1886.9)	(2310.6)
Dem. Representative, GOP Gov.	1346.7	3640.3*	1828.2	3641.7	5794.1*	5976.9**
	(1198.2)	(1918.0)	(1645.7)	(2297.0)	(3048.0)	(2483.1)
(R to D) × 1(year > 2012)			-1835.1	-1414.1	-1967.8	-1496.4
			(1356.9)	(1860.4)	(1371.7)	(1812.0)
(D to R) × 1(year > 2012)			-2069.6	-2550.1	-1985.6	-2324.9
			(2193.5)	(2574.9)	(2157.0)	(2547.0)
(D to D) × 1(year > 2012)			0.536	749.7	-411.9	332.7
			(1473.0)	(1972.7)	(1507.5)	(2025.8)
Incumbent Representative, Gov. same party					1648.2	2199.1
					(1118.6)	(1374.7)
Incumbent representative, Gov. different party					124.4	286.8
					(962.9)	(1233.9)
Representative beat incumbent, Gov. same party					3292.6**	3254.8**
					(1357.9)	(1407.6)
Representative beat incumbent, Gov. different party					-7094.4**	-8158.6*
					(3500.9)	(4559.2)
Area of intersection fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demand	No	Yes	No	Yes	No	Yes
Estimation	OLS	OLS	OLS	OLS	OLS	OLS
Observations	3180	2500	3180	2500	3180	2500
R^2	0.006	0.014	0.006	0.015	0.008	0.017

Standard errors, clustered at the area of intersection level, in parentheses. * ($p < 0.1$), ** ($p < 0.05$), *** ($p < 0.01$). The dependent variable is estimated total cost of all construction projects (in thousands of dollars) in the area that received state funding for columns without controls, and total cost of projects sponsored by the state for columns with controls. Controls include employment and employed population; public works expenditure by counties and townships, transportation expenditure by municipalities, capital outlay by townships, cities, and counties, and population weighted average local government property tax millage rate dedicated to roads; gas tax distributions to municipalities and to townships; daily vehicle miles traveled; and average FHWA sufficiency rating for bridges.

Table 2.7: Effect of Redistricting Party Changes on Construction Project Funding, Controlling for Areas that Changed Representative 2007-2018

	(1)	(2)	(3)	(4)	(5)
Construction expenditure ($1000s)					
(R to D) × 1(year > 2012)	-1436.3	-88.74	-3728.5	-0.405	-0.100
	(1643.8)	(1831.9)	(3445.2)	(0.311)	(0.460)
(D to R) × 1(year > 2012)	1052.5	1532.5	780.2	0.237	0.358
	(1879.1)	(2019.1)	(3821.3)	(0.381)	(0.501)
(D to D) × 1(year > 2012)	-531.1	-692.8	-7337.6*	-0.107	-0.154
	(1873.2)	(2258.4)	(3838.0)	(0.347)	(0.527)
(R to R)×(Same Representative)×(year > 2012)	5045.2**	6479.4**	8004.6	0.460*	0.791**
	(2195.6)	(2859.9)	(5078.9)	(0.266)	(0.398)
(D to D)×(Same Representative)×(year > 2012)	6509.3***	8547.4**	12154.0**	0.630**	1.142**
	(2459.7)	(3722.8)	(4889.4)	(0.305)	(0.518)
(R to D) × 1(year = 2007-2010)	60.75	1233.7	4837.8*	-0.0976	0.239
	(1346.1)	(1317.8)	(2577.7)	(0.272)	(0.304)
(D to R) × 1(year = 2007-2010)	1533.7	1148.5	1868.9	0.311	0.182
	(2064.0)	(2238.9)	(2962.0)	(0.466)	(0.632)
(D to D) × 1(year = 2007-2010)	-42.47	259.7	6724.1*	-0.0539	0.123
	(1967.2)	(2019.2)	(4062.7)	(0.407)	(0.430)
(R to R)×(Same Representative)×(year < 2011)	3066.9*	3039.3*	1622.1	0.445*	0.636**
	(1744.9)	(1702.2)	(3344.5)	(0.250)	(0.283)
(D to D)×(Same Representative)×(year < 2011)	3260.3	4199.5	636.3	0.512	0.745
	(2826.2)	(3392.8)	(4946.6)	(0.419)	(0.563)
Area of intersection fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Controls for demand	No	Yes	Yes	No	Yes
Estimation	OLS	OLS	OLS	Poisson QMLE	Poisson QMLE
Observations	3180	2500	2500	3144	2440
R^2	0.010	0.016	0.020		
Log Pseudolikelihood				-11929099	-9405760

Robust standard errors, clustered at the area of intersection level for OLS regressions, in parentheses. * ($p < 0.1$), ** ($p < 0.05$), *** ($p < 0.01$). Controls include employment and employed population; public work expenditure by counties and townships, transportation expenditure by municipalities, capital outlay by townships, cities, and counties, and population weighted average local government millage rate dedicated to roads; gas tax distributions to municipalities and to townships; daily vehicle miles traveled; and average FHWA sufficiency rating for bridges.

Table 2.8: Summary Statistics, Projects

	Mean (Count)	Std. Dev. (Count)	Number
No. work areas per project	3.248	6.887	9780
No. house districts per project	1.486	1.389	9780
No. house district overlap areas per project	1.747	2.380	9780
	Mean (Cost, $1000s)	Std. Dev. (Cost $1000s)	Number
Estimated total cost	2357.8	10022.4	9780
Spons. by County	1437.5	2744.0	1305
Spons. by other state	4420.7	7888.9	16
Spons. by ODOT	2641.8	11227.5	4493
Spons. by ODOT Dist. Planning	2590.8	9147.0	1333
Spons. by ODOT Dist. Maintenance	867.1	1254.6	235
Spons. by ODOT Dist. Bridges	464.4	575.1	20
Spons. by ODOT Dist. Production	3359.3	18329.7	753
Spons. by ODOT Dist. Traffic	419.1	237.0	11
Spons. by Municipality	1848.1	4779.6	1646
Landscaping or Noise Wall	964.3	1362.3	155
Safety Features	1140.8	2518.1	306
Signs or signals	823.9	1413.9	388
Sidewalk	904.9	3023.2	291
Construction	29798.8	43473.1	105
Maintenance	2055.6	8363.3	1255
Intersection/Interchange	3612.5	9807.4	387
Culvert, Drainage or Erosion	463.8	568.5	518
Widening	7871.4	16834.7	328
Road Surface	1794.1	2213.5	3556
Bridge or Tunnel	2132.1	10981.1	2186
Miscellaneous	3924.7	27298.6	250
Observations	9780		

Table 3.1: Descriptive Statistics

Variable	Mean	Std. Dev.	N
Income Tax			
Has income tax	0.75	0.43	10115
Income tax base (millions)	445	1620	7275
Municipal income tax rate	1.07	0.74	10115
Property Tax			
Real property value (millions)	195	665	10115
Res. and ag. value (millions)	139	416	10115
Comm. and ind. value (millions)	56.3	257	10115
Tangible personal property value (millions)	17.7	72.2	8330
Municipal property tax rate (mills)	7.11	4.79	10115
Prop. tax rate (mills), overlapping jurisdictions	54.5	25.9	10115
Municipality Characteristics			
Population	11326	41605	10115
Employment	6041	25181	7140
Land area	5.62	12.32	10115
Has a charter?	0.37	0.48	10115
Has council-manager gov.	0.16	0.37	10115
Layoffs			
Mass layoff reported (%)	9.7	29.6	10085
Number of mass layoffs occurring	1.69	1.94	983
Number of jobs lost in mass layoffs	327	1270	983
Proportional job loss (= $\frac{jobs\ lost}{population}$)	0.03	0.16	983
Revenue			
Property tax revenue (100,000s)	24.3	147.9	8925
Income tax revenue (100,000s)†	58.9	300.9	8925
Revenue from services (100,000s)	7.71	38.50	8925
Revenue from fines and fees (100,000s)	5.55	27.67	8925
Intergovernmental rev. (100,000s)	25.6	125.1	8925
Own source revenue (100,000s)	96.9	464.6	8925
Total revenue (100,000s)	123	588	8925
Expenditure			
General Government (100,000s)	18.8	63.5	8925
Public Safety (100,000s)	46.4	235.5	8925
Health (100,000s)	3.25	24.9	8925
Roads and Utilities (Infrastructure)	17.0	91.8	8925
Leisure and Community Environment (100,000s)	14.9	94.6	8925
Cap. Outlays (100,000s)	19.3	97.4	8925
Debt Expenditure (100,000s)	21.8	234.6	8925
Other Expenditure (100,000s)	0.24	7.15	8925
Total Expenditure (100,000)††	134	650	8925

Table 3.1 (cont'd)

Debt, Assets, and Fund Balance (Cities Only)			
General Obligation Bonds (100,000s)	145	748	2172
Notes and loans payable (100,000s)	19	59	2172
Unreserved Fund Balance (100,000s)	91	208	2172
Cash and Investments (100,000s)	158	462	2172
General Obligation Bonds $> $ 0	0.83	0.38	2172
Notes and Loans Payable $> $ 0	0.62	0.49	2172
Unreserved Fund Balance $> $ 0	0.93	0.25	2172
General Obligation Bonds per capita	353	472	2172
Notes and loans payable per capita	87	190	2172
Unreserved Fund Balance per capita	520	1225	2172
Cash and Investments per capita	762	1911	2172

† This row includes all municipalities, not only municipalities with an income tax.

†† Total revenue exceeds total expenditure by roughly $1.08M. Debt principal repayment, averaging $960,000 per year, is included in the total expenditure figure, while debt issue is not included on the revenue side. The $120,000 difference remaining implies that net borrowing increased $120,000 per municipality between 1999 and 2012.

Table 3.2: The Effect of Job Loss in a Mass Layoff on Tax Base

	Inc. tax base, log	Employment, log	Real prop. value, log
Proportional job loss, lead	0.293***	0.283**	0.00552
	(0.112)	(0.127)	(0.0227)
Proportional job loss	0.0805	0.127	0.00477
	(0.111)	(0.125)	(0.0222)
Proportional job loss, lag	-0.459***	-0.264**	-0.00827
	(0.101)	(0.114)	(0.0227)
Proportional job loss, two lags	-0.163***	-0.0989**	-0.0173
	(0.0408)	(0.0459)	(0.0229)
Proportional job loss, three lags	-0.129***	-0.0949**	-0.0325
	(0.0409)	(0.0461)	(0.0248)
Proportional job loss, four lags	-0.163***	-0.0883*	-0.0486
	(0.0402)	(0.0453)	(0.0377)
L5.Population, log	0.188***	0.217***	0.208***
	(0.0399)	(0.0450)	(0.0404)
L5.Res. and ag. value, log	-0.0984**	-0.0258	
	(0.0406)	(0.0457)	
L5.Real prop. value, log	0.392***	0.218***	
	(0.0554)	(0.0625)	
L5.Aggr. prop. tax rate (mills)	-0.000663	0.0000106	-0.000838**
	(0.000443)	(0.000500)	(0.000354)
L5.Muni. inc. tax rate	-0.0869***	0.0592**	-0.0113
	(0.0209)	(0.0235)	(0.0131)
Observations	5172	5160	7140
R^2	0.174	0.040	0.612

Estimated by fixed-effects OLS, with a full set of year dummies. Robust standard errors, clustered at the municipality level, in parentheses. * ($p < 0.1$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 3.3: The Effect of Job Loss in a Mass Layoff on Tax Rates

	Muni. inc. tax rate	Municipal property tax rate (mills)
Proportional job loss, lead	0.127	0.570
	(0.0903)	(0.561)
Proportional job loss	0.175*	0.290
	(0.0969)	(0.506)
Proportional job loss, lag	0.197*	0.0983
	(0.111)	(0.363)
Proportional job loss, two lags	0.0421**	-0.0158
	(0.0207)	(0.0673)
Proportional job loss, three lags	0.0390*	0.0530
	(0.0201)	(0.0478)
Proportional job loss, four lags	0.0492	-0.0333
	(0.0329)	(0.0856)
L5.Aggr. prop. tax rate (mills)	0.000210	0.00667
	(0.000625)	(0.00509)
L5.Real prop. value, log	-0.0272	-0.401
	(0.0825)	(0.735)
L5.Res. and ag. value, log	0.00641	-0.172
	(0.0530)	(0.510)
L5.Population, log	-0.00992	-0.260
	(0.0471)	(0.344)
L5.Muni. inc. tax rate		-0.341
		(0.224)
Observations	7140	7140
R^2	0.113	0.034

Estimated by fixed-effects OLS, with a full set of year dummies. Robust standard errors, clustered at the municipality level, in parentheses. * ($p < 0.1$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 3.4: The Effect of Job Loss in a Mass Layoff on Revenue

	Inc. tax rev., log	Prop. tax rev., log	Services, fees, and fines rev.	Intergovernmental rev.	Total rev., log
Prop. job loss, lead	0.402***	0.160	0.238	0.232	0.120
	(0.127)	(0.300)	(0.268)	(0.554)	(0.179)
Prop. job loss	0.236	-0.353	0.115	-0.237	0.0509
	(0.149)	(0.318)	(0.340)	(0.396)	(0.233)
Prop. job loss, lag	-0.211	-0.520*	0.166	-0.935**	-0.291
	(0.199)	(0.294)	(0.287)	(0.412)	(0.186)
Prop. job loss, two lags	-0.115***	-0.198	-0.0322	-0.0492	-0.131
	(0.0434)	(0.131)	(0.0360)	(0.0738)	(0.0819)
Prop. job loss, three lags	-0.105*	-0.160	-0.0542***	-0.00366	-0.0903
	(0.0623)	(0.113)	(0.0192)	(0.0525)	(0.0724)
Prop. job loss, four lags	-0.126**	-0.104	-0.0458	0.00100	-0.115
	(0.0563)	(0.124)	(0.0320)	(0.0379)	(0.0829)
Municipality fixed-effects	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	Pois. QMLE	Pois. QMLE	OLS
Observations	5410	7140	7104	7140	7140
R^2	0.197	0.063			0.097

Includes controls for log of real property value, log of residential and agricultural property value, log of population, municipal income tax rate, property tax rate of overlapping jurisdictions, and municipal property tax rate, each lagged by five years. Robust standard errors, clustered at the municipality level for OLS equations, in parentheses. * ($p < 0.1$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 3.5: The Effect of Job Loss in a Mass Layoff on Expenditure

	Gen. Gov.	Pub. Safety	Infrastructure	Leis. and comm.	Cap. outlays	Health	Debt Exp.	Total
Prop. job loss, lead	0.319	0.226**	0.348	1.701***	0.868	-0.424	0.337	0.120
	(0.240)	(0.0967)	(0.323)	(0.558)	(0.938)	(0.571)	(1.338)	(0.229)
Prop. job loss	0.267	0.251**	-0.339	0.891	1.124	-1.202*	3.416***	0.379
	(0.232)	(0.101)	(0.415)	(0.558)	(0.867)	(0.725)	(0.707)	(0.339)
Prop. job loss, lag	-0.0993	0.140*	-0.466**	0.811**	-0.719	-1.318**	2.092	-0.107
	(0.202)	(0.0787)	(0.204)	(0.394)	(0.713)	(0.646)	(1.309)	(0.166)
Prop. job loss, two lags	-0.0545	-0.0167	-0.00259	-0.0517	-0.149	-0.136	0.107	-0.136
	(0.0364)	(0.0119)	(0.0263)	(0.158)	(0.108)	(0.106)	(0.342)	(0.108)
Prop. job loss, three lags	-0.0167	-0.0129	-0.0265	0.0687	-0.121	-0.0105	0.00957	-0.0896
	(0.0322)	(0.0103)	(0.0183)	(0.0707)	(0.0984)	(0.0251)	(0.330)	(0.0777)
Prop. job loss, four lags	-0.0526	-0.0399	-0.0272	0.0563	-0.00225	0.0662***	0.423	-0.0623
	(0.0469)	(0.0270)	(0.0284)	(0.106)	(0.0701)	(0.0241)	(0.349)	(0.0790)
Observations	7140	7116	7140	6960	7020	6324	6696	7140
Municipality fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Estimation	Pois. QMLE	Pois. QMLE	Pois. QMLE	Pois. QMLE	Pois. QMLE	Pois. QMLE	OLS	
R^2								0.038

Includes controls for log of real property value, log of residential and agricultural property value, log of population, municipal income tax rate, property tax rate of overlapping jurisdictions, and municipal property tax rate, each lagged by five years. Robust standard errors, clustered at the municipality level for OLS regression, in parentheses. * ($p < 0.1$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 3.6: The Effect of Job Loss in a Mass Layoff on Debt and Asset Balance

	G.O. Bonds per cap.	Notes and loans payable per cap.	Unres. Fund Bal. per cap.	Cash and Invest. per cap.
Prop. job loss, lead	-1062.8*	1203.3**	3166.8***	2299.3***
	(551.1)	(464.9)	(1128.4)	(810.6)
Prop. job loss	-1051.3**	1631.3***	2160.1***	1668.5**
	(492.3)	(321.5)	(629.9)	(753.9)
Prop. job loss, lag	-1283.0***	73.31	-2338.0***	297.2
	(351.0)	(220.7)	(465.7)	(653.2)
Prop. job loss, two lags	26.81	-5.808	-32.28	-70.73***
	(17.58)	(4.119)	(23.08)	(22.95)
Prop. job loss, three lags	16.52	9.830***	-41.00	-53.49***
	(19.11)	(3.500)	(31.52)	(17.81)
Prop. job loss, four lags	-29.92	19.77*	-48.29*	-75.14
	(55.21)	(11.22)	(27.65)	(49.32)
Observations	2172	2172	2172	2172
R^2	0.053	0.042	0.060	0.021

Estimated by fixed-effects OLS, with a full set of year dummies. Includes controls for log of real property value, log of residential and agricultural property value, log of population, municipal income tax rate, property tax rate of overlapping jurisdictions, and municipal property tax rate, each lagged by five years. Robust standard errors, clustered at the municipality level, in parentheses. * ($p < 0.1$), ** ($p < 0.05$), ***

Table 4.1: Summary Statistics

Mean (Standard Dev.)

	Township	County, School District, Municipality
Yes Votes	734 (1394)	4720 (17741)
No Votes	490 (1004)	3623 (11035)
Share Yes [Yes Votes/Total Votes]	0.620 (0.107)	0.552 (0.119)
Referendum Passes	0.858 (0.350)	0.670 (0.47)
Fraction of Voters not Casting Referendum Vote	0.151 (0.184)	
Rank	2.495 (1.077)	2.468 (1.124)
Tax Renewal	0.483 (0.5)	0.413 (0.492)
Police, Fire and EMS Indicator	0.550 (0.498)	0.148 (0.355)
Community or Senior Center Indicator		0.027 (0.162)
Health Services Indicator		0.046 (0.21)
Child Services Indicator		0.013 (0.115)
School Capital Expenditure Indicator		0.103 (0.304)
School Current Expenditure Indicator		0.152 (0.359)
School Emergency Expenditure Indicator		0.13 (0.337)
School Permanent Improvement Indicator		0.095 (0.293)

Table 4.1 (cont'd)

Mean (Standard Dev.)

	Township	County, School District, Municipality
Roads Indicator	0.231 (0.422)	0.047 (0.212)
Current Expenditure Indicator		0.168 (0.374)
Parks and Recreation Indicator		0.032 (0.176)
Cemetery Indicator	0.108 (0.311)	0.013 (0.112)
Proposed Property Tax	1 (0)	0.83 (0.376)
Millage Rate	1.52 (1.034)	3.351 (2.662)
Proposed Sales Tax		0.074 (0.262)
Sales Tax Rate		0.456 (0.222)
Proposed Income Tax		0.110 (0.312)
Income Tax Rate		0.693 (0.379)
Number of State Issues	2.25 (2.082)	1.923 (2.089)
Presidential Election	0.287 (0.453)	0.243 (0.429)
Presidential Primary	0.039 (0.193)	0.067 (0.25)
Gubernatorial Election	0.187 (0.390)	0.154 (0.361)
Gubernatorial Primary	0.057 (0.231)	0.092 (0.289)

Table 4.1 (cont'd)

Mean (Standard Dev.)

	Township	County, School District, Municipality
Non-Presidential and Gubernatorial Election	0.430 (0.495)	0.444 (0.497)
November Election	0.843 (0.364)	0.712 (0.453)
March Election	0.039 (0.193)	0.067 (0.250)
May Election	0.118 (0.323)	0.222 (0.415)
Fraction of Voters over 65 years of age	0.239 (0.060)	0.255 (0.058)
Fraction of Voters registered as a Democrat	0.155 (0.098)	0.18 (0.113)
Fraction of Voters registered as a Republican	0.346 (0.120)	0.331 (0.130)
Observations	3,504	5,186

Table 4.2: Share of Voters who did not Vote on Referendum

	(1)	(2)	(3)	(4)	(5)	(6)
Rank	0.0197	0.0114	0.0117	-0.0397	-0.042	-0.0215
	(0.0163)	(0.0111)	(0.0114)	(0.038)	(0.0374)	(0.0512)
Renewal Indicator	-0.0082	0.0117	0.0144	0.0144	0.0541	0.168
	(0.0228)	(0.0178)	(0.0182)	(0.0177)	(0.0661)	(0.1562)
% of Voters over 65 years of age			-0.6953**	-0.9681**	-0.4317	-0.3546
			(0.2852)	(0.4006)	(0.2992)	(0.3562)
% of Voters Registered as Democrat			0.3842**	0.3723*	0.1448	0.1699
			(0.1611)	(0.2133)	(0.195)	(0.2755)
% of Voters Registered as Republican			0.1941	0.0619	-0.1773	-0.1072
			(0.2058)	(0.3185)	(0.2772)	(0.3506)
% over 65 years of age * Rank				0.0854	0.0681	0.0357
				(0.1051)	(0.0976)	(0.1485)
% of Voters Registered as Democrat* Rank				0.0192	0.0147	0.0008
				(0.0698)	(0.0674)	(0.1116)
% of Voters Registered as Republican* Rank				0.0642	0.0832	0.0521
				(0.0987)	(0.0962)	(0.1413)
% over 65 years of age * Renewal					-1.0214**	-1.2815**
					(0.3165)	(0.6164)
% of Voters Registered as Democrat* Renewal					0.3688**	0.321
					(0.1374)	(0.3015)
% of Voters Registered as Republican* Renewal					0.4566**	0.3359
					(0.1992)	(0.3934)
Renewal*Rank						-0.0489
						(0.0528)
% over 65 years of age * Renewal*Rank						0.1034
						(0.1972)
% of Voters Registered as Democrat* Renewal*Rank						0.0235
						(0.1156)
% of Voters Registered as Republican* Renewal*Rank						0.0565
						(0.149)
Township Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
R-squared	0.034	0.84	0.842	0.843	0.85	0.85
Observations	3,504	3,504	3,504	3,504	3,504	3,504

Covariates include millage rate, number of state issues on ballot and indicators for purpose of the tax revenue, for whether referendum stipulated bonds, for election characteristics (presidential/gubernatorial and whether a primary), and for election month. ** indicates statistically significant at five percent level and * indicates statistically significant at ten percent level.

Table 4.3: Share Yes for Township Referenda

	(1)	(2)	(3)	(4)	(5)	(6)
Rank	0.0054	0.0087*	0.0099**	0.0183	0.0211	0.0169
	(0.0041)	(0.0047)	(0.0046)	(0.0157)	(0.0151)	(0.02)
Renewal Indicator	0.1010**	0.1081**	0.1069**	0.1067**	0.0480**	0.0182
	(0.0046	(0.0056)	(0.0055)	(0.0055)	(0.02)	(0.0528)
% of Voters over 65 years of age			0.2580*	0.2438	0.1213	0.1166
			(0.1398)	(0.1691)	(0.186)	(0.2197)
% of Voters Registered as Democrat			0.1317	0.1523	0.2093	0.174
			(0.1063)	(0.1263)	(0.1366)	(0.1656)
% of Voters Registered as Republican			-0.0697	-0.0173	-0.005	-0.0022
			(0.08)	(0.1018)	(0.1046)	(0.1294)
% over 65 years of age * Rank				0.0098	0.0096	0.0116
				(0.0434)	(0.0414)	(0.0598)
% of Voters Registered as Democrat* Rank				-0.0112	-0.0137	-0.0006
				(0.0348)	(0.033)	(0.0512)
% of Voters Registered as Republican* Rank				-0.0244	-0.0292	-0.0296
				(0.0259)	(0.0254)	(0.0386)
% over 65 years of age * Renewal					0.2899**	0.3399
					(0.1188)	(0.235)
% of Voters Registered as Democrat* Renewal					-0.0689	-0.002
					(0.0777)	(0.1555)
% of Voters Registered as Republican* Renewal					0.0006	-0.0052
					(0.0569)	(0.119)
Renewal * Rank						0.0127
						(0.0209)
% over 65 years of age * Renewal*Rank						-0.0204
						(0.078)
% of Voters Registered as Democrat* Renewal*Rank						-0.0274
						(0.0612)
% of Voters Registered as Republican* Renewal*Rank						0.0008
						(0.0455)
Township Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
R-squared	0.381	0.705	0.709	0.709	0.713	0.713
Observations	3,504	3,504	3,504	3,504	3,504	3,504

Covariates include millage rate, number of state issues on ballot and indicators for purpose of the tax revenue, for whether referendum stipulated bonds, for election characteristics (presidential/gubernatorial and whether a primary), and for election month. ** indicates statistically significant at five percent level and * indicates statistically significant at ten percent level.

Table 4.4: Share Yes for County, School District, and Municipality Referenda

	(1)	(2)	(3)	(4)	(5)	(6)
Rank	0.0028	0.0039*	0.0038*	0.0280**	0.0276**	0.0352**
	(0.0029)	(0.0022)	(0.0022)	(0.0107)	(0.0105)	(0.0141)
Renewal Indicator	0.0994**	0.1062**	0.1077**	0.1083**	0.0455	0.1257*
	(0.0066)	(0.007)	(0.0067)	(0.0066)	(0.033)	(0.0726)
% of Voters over 65 years of age			-0.3871**	-0.1063	-0.2474	-0.1836
			(0.1702)	(0.2118)	(0.2097)	(0.2366)
% of Voters Registered as Democrat			0.0571	0.0642	0.1184	0.1092
			(0.1083)	(0.1408)	(0.1408)	(0.1429)
% of Voters Registered as Republican			0.1322**	0.1229	0.1138	0.1469
			(0.0635)	(0.0992)	(0.1035)	(0.1137)
% over 65 years of age * Rank				-0.1090**	-0.1058**	-0.1322**
				(0.0512)	(0.0492)	(0.0626)
% of Voters Registered as Democrat* Rank				0.0002	0.0018	0.0133
				(0.0289)	(0.0289)	(0.0389)
% of Voters Registered as Republican* Rank				0.0105	0.0074	-0.0023
				(0.0247)	(0.0242)	(0.0337)
% over 65 years of age * Renewal					0.3080**	0.0147
					(0.1461)	(0.2573)
% of Voters Registered as Democrat* Renewal					-0.1032	-0.0184
					(0.0709)	(0.1491)
% of Voters Registered as Republican* Renewal					0.0177	-0.0357
					(0.0589)	(0.1193)
Renewal * Rank						-0.0273
						(0.0301)
% over 65 years of age * Renewal*Rank						0.1114
						(0.1114)
% of Voters Registered as Democrat* Renewal*Rank						-0.0383
						(0.0588)
% of Voters Registered as Republican* Renewal*Rank						0.0154
						(0.0458)
Township Fixed Effects	No	Yes	Yes	Yes	Yes	Yes
R-squared	0.427	0.664	0.667	0.669	0.672	0.673
Observations	5,285	5,285	5,285	5,285	5,285	5,285

Covariates include millage rate, number of state issues on ballot and indicators for purpose of the tax revenue, for whether referendum stipulated bonds, for election characteristics (presidential/gubernatorial and whether a primary), and for election month. ** indicates statistically significant at five percent level and * indicates statistically significant at the ten percent level.

APPENDIX C

FIGURES

Figure 2.1: Partisan Control of Ohio Government

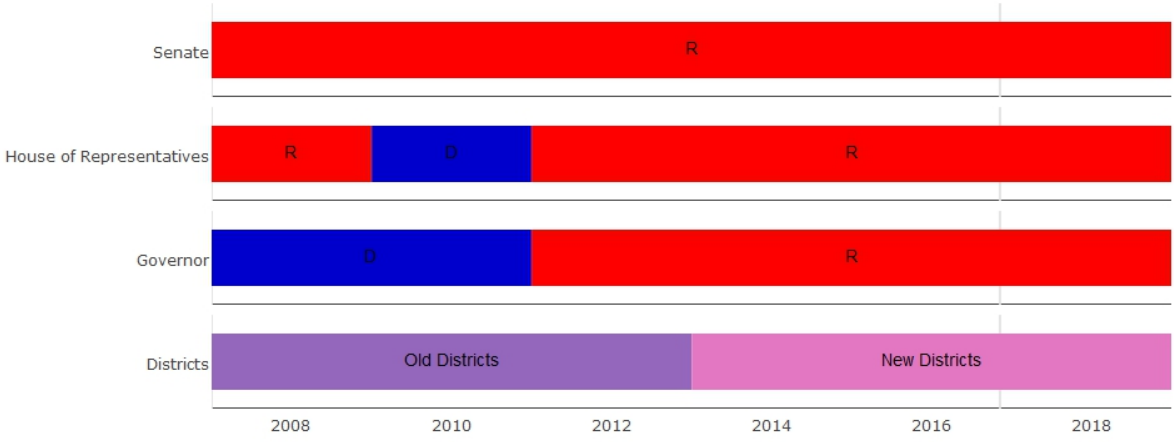


Figure 2.2: House Districts in Ohio

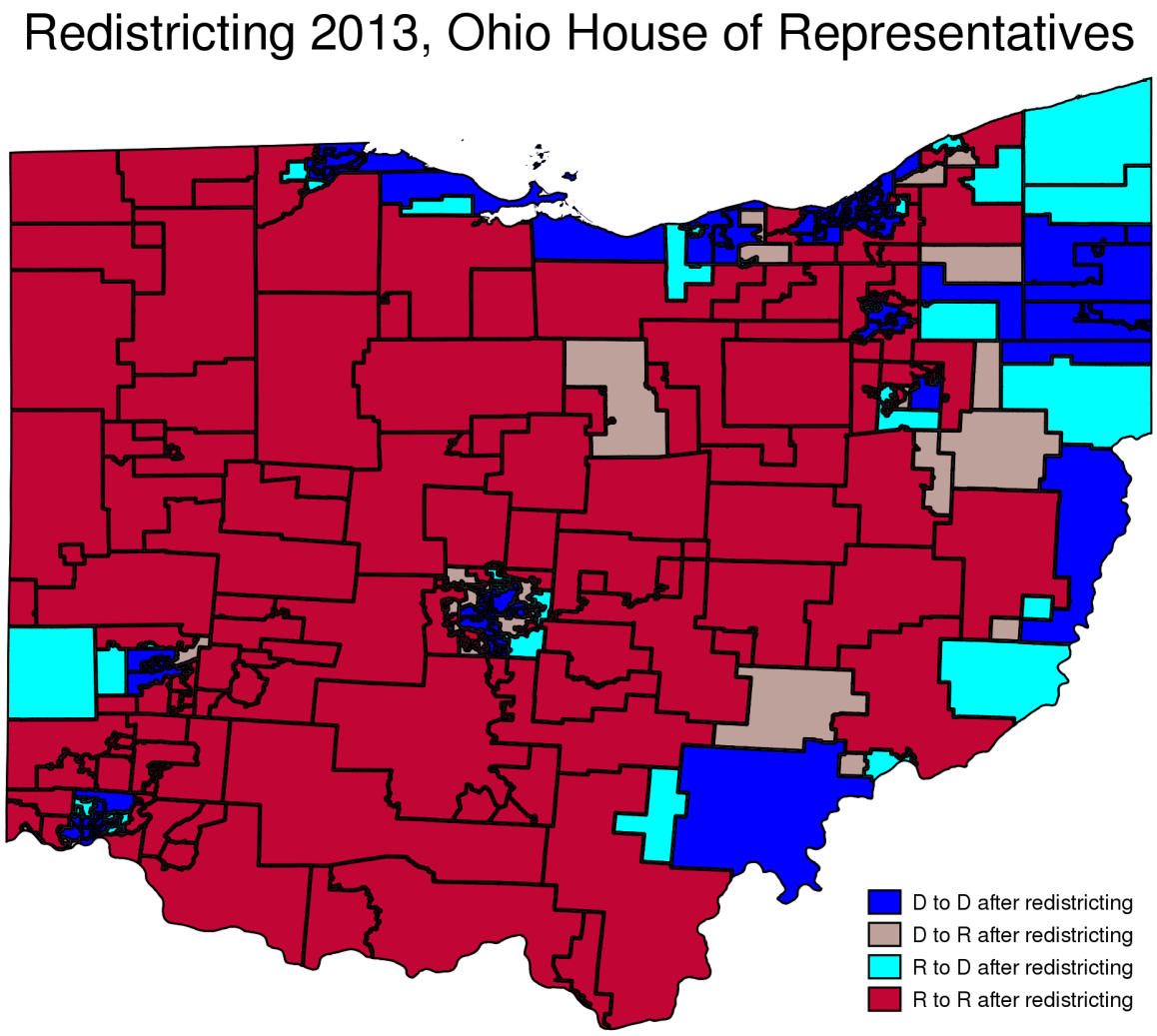


Figure 2.3: Summed Road Construction Funding, 2007-2012 vs. 2013-2018

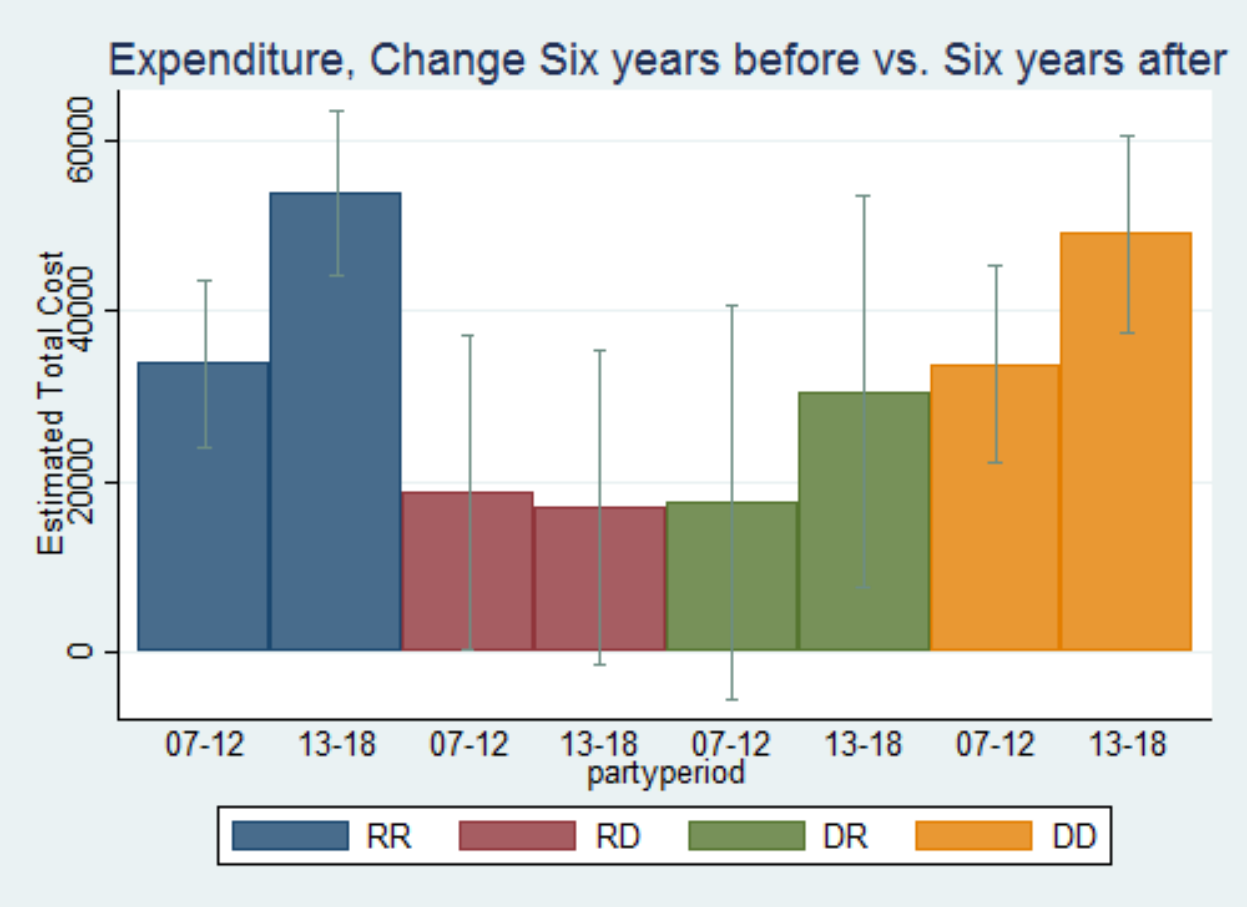


Figure 2.4: Trends in Expenditure

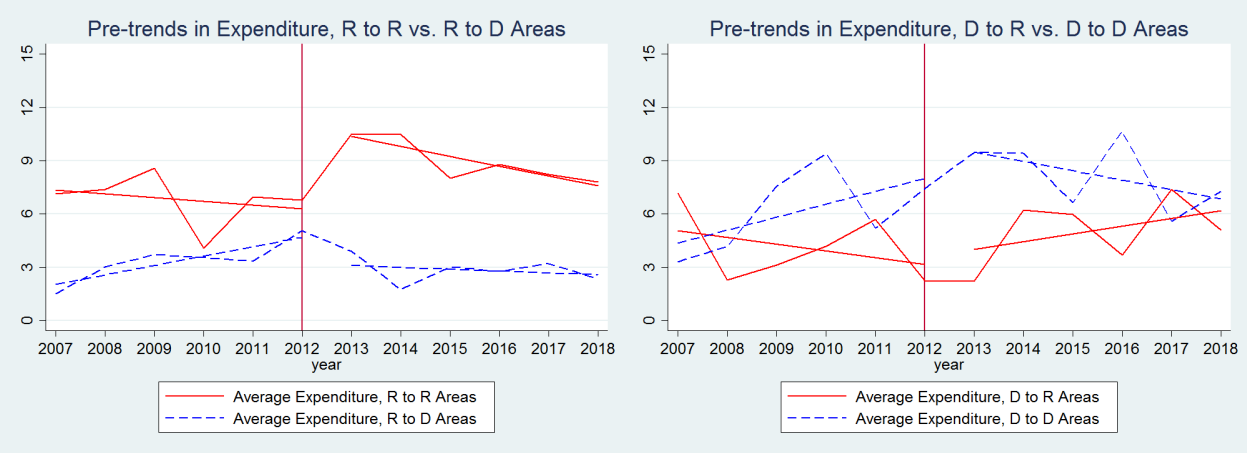


Figure 3.1: Job Loss in Mass Layoffs as Percent of Population, Ohio Municipalities 2009

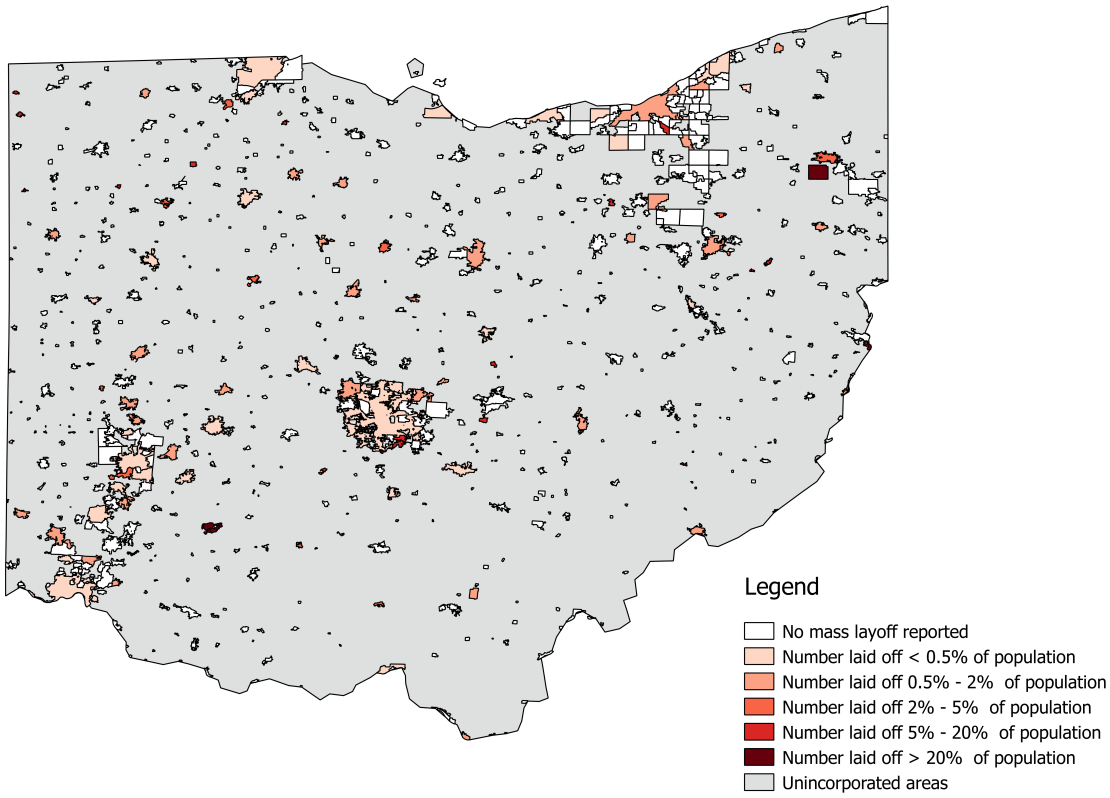


Figure 3.2: Percentage Change in Income Tax Base and Employment after Mass Layoff

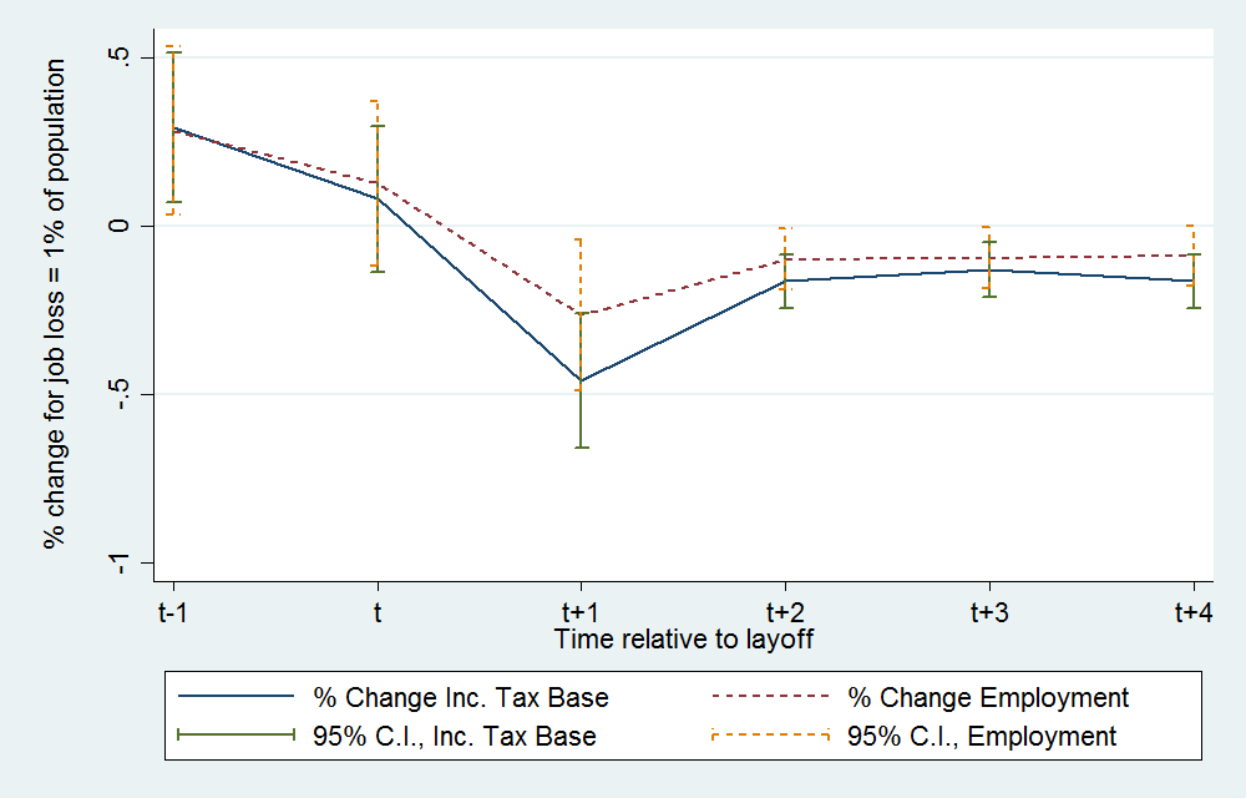
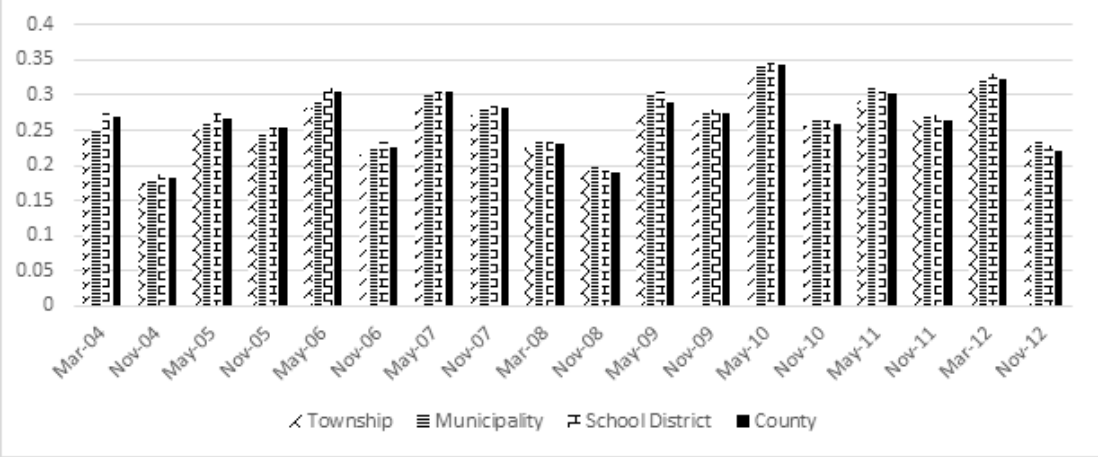
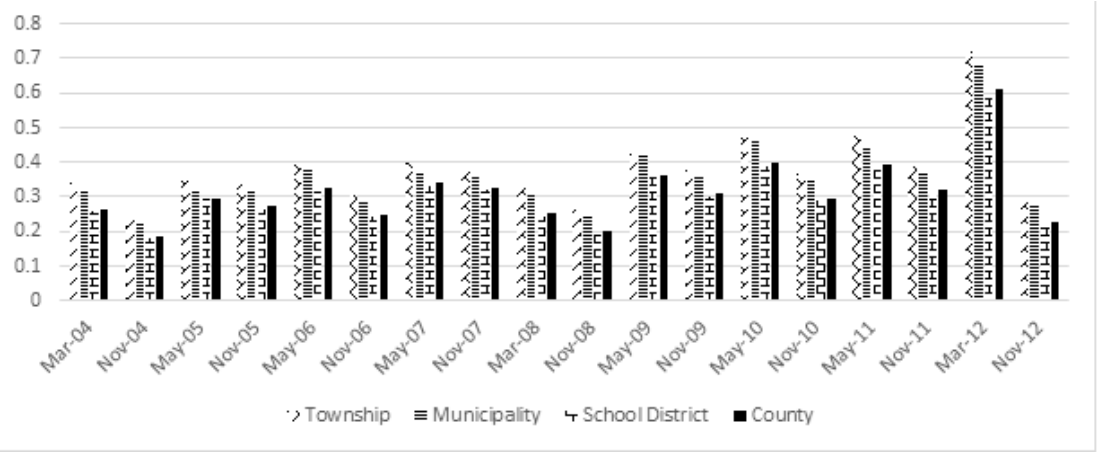


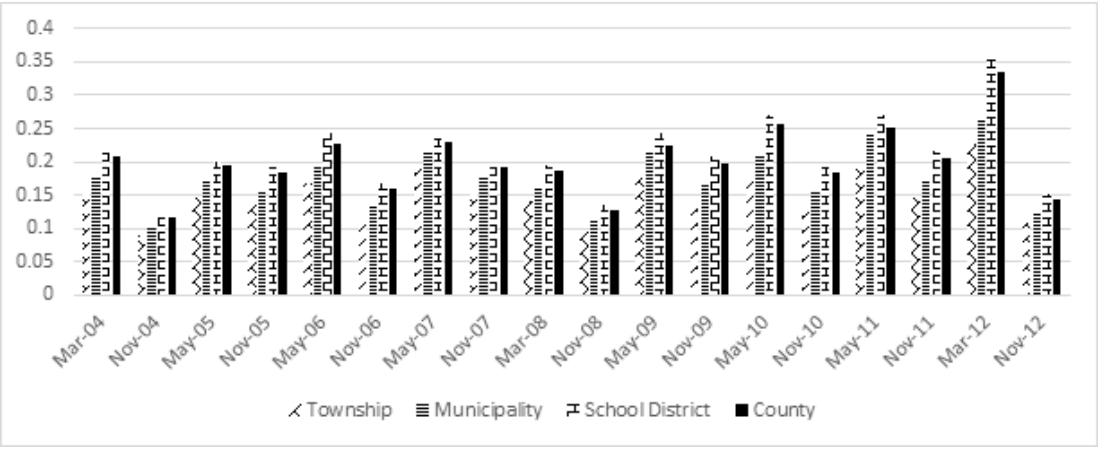
Figure 4.1: Voter Characteristics by Election Date and Jurisdiction



(a) Fraction of Voters over 65



(b) Fraction of Voters Registered as Republicans



(c) Fraction of Voters Registered as Democrats

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