EXPLAINING TRANSPORTATION FUNDING BALLOT MEASURE SUCCESS

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ABSTRACT
Transportation infrastructure is expensive, costs are increasing, and across the United States, federal spending on transportation is decreasing as a proportion of overall national spending. Local governments are under increasing pressure to generate revenue to meet project needs. In response, they have turned to ballot measures as one method to raise funds. It remains unclear which characteristics of transportation funding measures and the communities they are held in increase the likelihood of passage. Using regression modelling, this study analyzes what variables explain measure passage of local transportation funding measures on ballots in California, Oregon, and Washington from 1990-2015. Results indicate that sociodemographic features do not help explain passage of measures and that other unobserved factors may be driving measure passage.

Keywords: ballot measure, measure, voting, funding
INTRODUCTION

The Increasing Importance of Local Transportation Funding

Transportation infrastructure requires vast expenditures, but across the United States federal funds are increasingly unavailable to meet this demand. This lack of federal funding is a relatively new phenomenon. In fact, prior to the advent of automobile-dominated personal transport in the 1920s, local communities primarily generated their own funds through property taxes and transit was funding by private entities looking to generate wealth. The federal government increased its role in transportation finance to accelerate the build-out of roads for automobiles and shifted revenue generation to user-based fees like the gasoline tax and vehicle registration fees (1). However, over the past several decades, the convergence of several trends has strained the capacity of these user-based taxes and fees to meet funding needs. First, the increasing and unplanned cost of maintaining the vast automobile-focused transportation system has resulted in inadequate long-term strategies for sustaining revenue-raising capabilities based solely on user-based fees (1–5). Second, attempts to raise user-based taxes and fees in Congress has been met with staunch public opposition and remain a political nonstarter. Finally, increasing fuel efficiency, stagnate and by some measures declining per-capita travel, and general monetary inflation has shrunk the real revenue-generating strength of fuel taxes and vehicle fees (6).

To compensate for funding shortfalls, the trend over the past several decades has been a shift of the burden of funding project improvements and repair back to states and especially municipal governments (1, 4). The Congressional Budget Office has tracked transportation expenditures by federal, state, and local governments since 1956. The percent of total transportation funding provided by the federal government has decreased steadily since its 1980 high of 59 percent to present day 42 percent (Figures 1-3). Since 1980, the federal government has increased transportation spending by 14 percent, but state and local governments have increased spending by 61 percent. Exacerbating the shift in funding source is the ever growing funding gap as project need costs grow faster than revenue generation (7). Nationally, the U.S. Department of Transportation estimates there is a $836 billion backlog of road and bridge capital investment needs (8). Additionally, there is a $90 billion backlog of just maintenance of transit infrastructure and assets; at current spending levels, the backlog will grow to $122 billion by 2032 (8). The American Society of Civil Engineers estimates that from 2016 to 2025 the national transportation funding gap will grow to $1.1 trillion (9). While the exact magnitude of the automobile-related funding gap is contested (i.e., what constitutes a “need” and strategies to solve them) (10), the pressure on local and state governments to meet more of transportation funding needs is not.
FIGURE 1 All transportation spending. Adapted from Congressional Budget Office “Public Spending on Transportation and Water Infrastructure, 1956 to 2014.”
FIGURE 2 Highway spending. Adapted from Congressional Budget Office “Public Spending on Transportation and Water Infrastructure, 1956 to 2014.”
State and Local Government Response

State and local governments have two options in meeting revenue demand: raise more revenue or implement new financing tools. A number of financing options are gaining popularity in the transportation sector including public-private partnerships and debt financing (11, 12). These financing tools are often more popular with elected leaders than revenue-raising taxes and fees because voters do not feel their impacts directly (6). However, financing tools on their own are often not sufficient in meeting the revenue needs of local governments. Thus, understanding public support of revenue sources and financing efforts is important for governments seeking to fund their transportation projects.

Revenue is raised either from users of the transportation infrastructure by directly assessing taxes and fees to them or from the population at large, irrespective of how much they use the infrastructure. Table 1 summarizes the different forms of revenue generation.

FIGURE 3 Transit spending. Adapted from Congressional Budget Office “Public Spending on Transportation and Water Infrastructure, 1956 to 2014.”
TABLE 1 Revenue Generation

<table>
<thead>
<tr>
<th>Source of Transportation Revenue Generation</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td>Assessed on transportation-related products</td>
<td>Fuel tax, vehicle fee, parking fee, tolls</td>
</tr>
<tr>
<td>Non-User</td>
<td>Assessed on unrelated or indirectly-related products</td>
<td>Sales tax, property tax, bond sales</td>
</tr>
</tbody>
</table>

In Oregon and Washington, state and local governments are not obligated to refer any type of legislation to voters. California, however, has a number of requirements for voter-approval of revenue generation codified by constitutional amendments and statutory initiatives. Of note, Propositions 13 in 1978, 62 in 1986 and 218 in 1996 created a majority vote requirement for any increase in taxes and a two-thirds majority for “special” taxes that fund a general purpose (15).

In states where it is allowed, voter-approved ballot measures have emerged as a popular means for local jurisdictions to raise revenue. In 2006, the Center for Transportation Excellence found an increase in both the number and success rate of transportation-related ballot measures nationwide from 2000 to 2005 (13). This popularity is in part due to the reluctance of federal and state legislatures to raise user-based taxes and fees. The burden has shifted to local jurisdictions to raise funds. This has been accomplished primarily through nonuser taxes and fees placed on ballots. A report for the Surface Transportation Policy Project by Ernst et al. (2) found that from 1995 to 1999, the largest increase in non-federal transportation revenue source came from non-user fees. Local non-user fee revenues increased by 27 percent and state non-user fee revenues increased by 46 percent. In contrast, federal gas tax revenues increased by 87 percent and state gas tax revenues increased by only 19 percent, and much of that increase was due to increased driving rather than an increase in the state gas tax (2).

What are Ballot Measures and How Do Local Governments Use Them?

Ballot measures (henceforth referred to as “measures”) are pieces of legislations that are voted on by citizens (14). Legislation can either be proposed by voters as initiatives or reviewed by voters as referenda. Table 2 summarizes the types of measures.

TABLE 2 Types of Measures

<table>
<thead>
<tr>
<th>Measure Type</th>
<th>Referral Method</th>
<th>Process</th>
<th>States in Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiative</td>
<td>Direct</td>
<td>Qualifying proposals go directly on ballot</td>
<td>CA, OR, WA</td>
</tr>
<tr>
<td></td>
<td>Indirect</td>
<td>Qualifying proposals first go to state legislature</td>
<td>WA</td>
</tr>
<tr>
<td>Referendum</td>
<td>Popular</td>
<td>Voters refer existing legislation back to voters</td>
<td>CA, OR, WA</td>
</tr>
<tr>
<td></td>
<td>Legislative</td>
<td>State legislature refers to voters</td>
<td>CA, OR, WA</td>
</tr>
</tbody>
</table>

NOTE: Source, National Conference for State Legislatures
In the three states in this study, all types of ballot measures can occur at the state or municipal level. Each state has different requirements for ballot measure appearance and qualification. Citizen-led direct or indirect initiatives and popular referenda make up a small percentage of total ballot measures. In the dataset for this study, only one measure was citizen-led: Seattle’s 2014 Citizen Proposition 1 initiative for monorail funding and development. The other 110 measures were legislatively referred by governmental bodies and make up virtually all of the ballot measures reviewed in this study.

Measures on a ballot consist of a title and a concise, impartial summary of the measure’s main points. The official language to appear on the ballot is most often prepared by the state’s attorney general (this is the case for all three states in this study). Figure 4 depicts an example of a ballot measure.

To preserve and maintain funding for essential city services, including fire and other emergency response services, pothole repair, street and storm drain maintenance, graffiti removal, on-duty police staffing, street lighting, park maintenance, emergency reserves maintenance and other general city services, shall an ordinance establishing a temporary transactions (sales) and use tax of one-half of one percent (½%) for a period of five years be adopted?

FIGURE 4 Example ballot measure text from 2008 general election – Measure GG, El Monte, CA.

Ballot measures are an increasingly important method used by municipal and state governments for raising funds for transportation (1, 16). In the face of higher stakes resting on successful passage of transportation ballot measures, this project provides policymakers and citizens insights and recommendations to increase the likelihood of passage of transportation funding ballot measures. Recommendations are based on analysis of a comprehensive database of local, county, special district, and state transportation funding ballot measures. The two areas of analysis are:

- Socio-demographic variables of the communities in which transportation measures are on the ballot. These include population, population density, income, race, education, age, commute to work time and percent of commuters driving alone
- Characteristics of the measures themselves. These include type of revenue generation (tax, bond, etc.), government level, and transportation mode for which revenue is being raised.

A salient example of the difficulty in explaining measure success comes from Eugene, OR. In 2007, voters rejected measure that would increase the local gasoline tax. The 3 cent per gallon increase would have generated an estimated $2 million per year and would have been used to address a backlog of street maintenance. The following year, voters approved a $35.9 million 5-year bond. Bond revenue ($6.5 million annually) was specified for primarily street repair but also allotted $350,000 to off-street bicycle and pedestrian paths. These two measures, held in the same community, in subsequent years, and generating similar scales of revenue had two different outcomes. Which of the characteristics of the measures, the different funding types,
the modes listed, the existing or new funding source, might help explain why two seemingly
similar measures had different outcomes?

**LITERATURE REVIEW**

Literature for the present study draws from three main bodies of research: ballot measure
analysis in general, open space and conservation (OSC) measures, and transportation measures.
Studies that employ regression analysis of ballot measures outcomes are highlighted.

**Ballot Measure Analysis**

Ballot measures can be conceptualized as an expression of the public’s willingness to pay for
collective goods. To this end, research has largely followed two pathways: interviewing and
surveying individuals for stated preferences and analysis of actual voting outcomes. The latter
method better reflects individual revealed preferences, which sets a more robust methodological
foundation of analysis, but is extremely difficult to extend to wider geographic areas.

Analysis of ballot measure outcomes has primarily been conducted using regression
analysis to estimate the relationship between voting outcomes and a wide variety of independent
variables further explored below. Deacon and Shapiro (17) pioneered regression-based analysis
of the effects of funding mechanism type and socio-demographic characteristics on ballot
measure outcome. Heckman (18) introduced the two-step method to control for appearance bias
(i.e., are voters in communities that have transportation funding measures on their ballot the kind
of voters that are more likely to pass ballot measures)？Many of the subsequent studies of ballot
measure outcomes use some variation of Heckman two-step method.

**Open Space Measures**

To date, transportation ballot measure outcome analysis has been limited; few have attempted to
analyze outcomes in a comprehensive manner and methodological development has not been a
focus. Rather, much of the robust ballot measure outcome analysis has been on open space and
conservation (OSC)-related ballot measures. This is likely due to two primary reasons. First,
OSC ballot measure funding nationwide has totaled nearly $76 billion from 1988 to present and
are thus the subject of interest for researchers. Second, the Land Trust Alliance has maintained a
national database of OSC ballot measures, LandVote, which dramatically simplifies data
acquisition for researchers. The Center for Transportation Excellence (CFTE) has attempted to
create a similar database, but it is not comprehensive and lacks many of the variables contained
in LandVote.

Early studies of OSC ballot measures outcomes used non-spatial regression models. Later
work adjusted for spatial error that may be introduced from neighbors’ influence on other
neighbors, targeted political advertising, or other spatially related variables (19). Several other
studies extended analysis methods, including Shanahan (20), who utilized principal component
analysis to further refine variable predictors.

**Transportation Measures**

Previous studies have found a number of favorable variables for transportation funding
measures. The methods utilized in determining the likelihood of appearance, support, and
passage of transportation funding measures have varied widely. Case studies have been used to
look at particularly important referenda. Peterson et al. (21) found that in funding for
transportation infrastructure improvements like the Seattle monorail that spatial proximity to the
improvement plays a significant role in voting yes. They also find that collective considerations
are significantly related to party affiliation; Democrats were more likely to support the monorail even if their spatial relationship to the development meant little or no personal use. Paget-Seekins (22) used discourse analysis to determine that the Atlanta region’s $8.5 billion transportation referendum in 2012 failed to pass due to an alliance of opposition from the Tea Party, NAACP, and the Sierra Club.

Of all the transportation measures studies, none have used the more robust analytical methods found in the OSC measure literature. Several studies use community characteristics to model transportation measure outcome. Dixit et al. (23) and Rainville (24) examined transit ballot measures across the U.S. Hannay and Wachs (25) examined three measures in Sonoma County, CA. Manville and Cummins (26) explicitly rejected the examination of voting outcome due to its aggregate nature. Haas et al. (27) examined a dataset of transit-related measures from 1990-1998, but these were neither exclusively funding-related nor covered other modes of transportation. Surveys that utilize individual-level data have also been used to explore fewer measures in detail (28). Table 3 outlines variables that have been examined in the literature and how they influence measure success.

### TABLE 3 Variables that may influence measure outcome explored by previous studies and their observed effects.

<table>
<thead>
<tr>
<th>Increases Likelihood</th>
<th>Decreases Likelihood</th>
<th>Mixed results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bond as funding mechanism (25)</td>
<td>Tax as funding mechanism (25)</td>
<td>Income (25)</td>
</tr>
<tr>
<td>Percent Hispanic (29)</td>
<td>Existing tax burden (30)</td>
<td>Percent black (21)</td>
</tr>
<tr>
<td>Percent Democrat (21, 25)</td>
<td>Percent Republican (29)</td>
<td>Percent elderly (23)</td>
</tr>
<tr>
<td>Continuation of existing funding (29)</td>
<td>Other funding measure(s) on ballot (31)</td>
<td>Percent renters (23)</td>
</tr>
<tr>
<td>Citizen oversight committees (29)</td>
<td>Previous attempts to pass similar measures (29)</td>
<td>Percent young (23)</td>
</tr>
<tr>
<td>Population density (23)</td>
<td>Public perception of good transportation conditions (29)</td>
<td></td>
</tr>
<tr>
<td>Transit user (21)</td>
<td>Existing measure (25)</td>
<td></td>
</tr>
<tr>
<td>Close proximity (25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multimodal (25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set duration for funding (29)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This study, with an aggregated dataset of transportation funding measures and methods adopted from OSC analysis, extends existing research to apply these methods to a comprehensive transportation ballot measure dataset.
METHODS

This study analyzed ballot measure outcomes to determine which variables explained the passage of transportation funding measures and the nature of the relationship between the explanatory variables and passage. A multiple logistic regression mode with elastic net regularization was used to determine what variables were related to measure passage and the direction and magnitude of their relationship. This chapter first explains the rationale of using a multiple logistic regression model. It then explores the specification of predictor variables. It concludes with a description of the data sources used.

Model

Regression analysis describes the relationship between a dependent outcome or response variable and one or more independent explanatory variables. Multiple regression is used when more than one explanatory variables are used. Logistic regression is used when the response variable is categorical.

The response variable in this study was the binary outcome of pass or fail (not pass). Some studies have used the percent yes vote as a continuous outcome variable. However, the question being investigated in this study is what factors influence passage (i.e., pass or fail) of a measure. Logistic regression analysis addresses this question more directly by using the discrete binary categories of passage or failure as the outcome rather than percent yes vote. Furthermore, California has several different thresholds of percent yes votes needed to pass a measure for different types of funding mechanisms (15). Logistic regression of passage is agnostic to vote requirement thresholds.

Due to the different thresholds for passage, the binary choice of pass/fail was used as the dependent variable instead of the proportion of yes votes or the log-odd ratio of yes votes typically employed in ballot measure analysis. Proportion yes votes as the dependent variable is appropriate when the measure passage threshold is the same for all votes. However, given California’s two-thirds and fifty-five percent thresholds for revenues for specific purposes, measure passage as a binary outcome sidesteps evaluation challenges presented by varying threshold requirements.

Specification

A regression model is fitted or estimated by calculating values based on the sample data for the unknown population data. There are a number of techniques to estimate models. The most common method for logistic regression is Maximum Likelihood Estimation (MLE), which determines estimators that maximize the likelihood of the sample observations given the explanatory variables used. However, MLE is limited in its ability to adjust for collinearity of explanatory variables and for low sample sizes relative to the number of explanatory variables. As the ratio of explanatory variables to sample size increases, variability of the estimators increases. This results in overfitting of the model. Given the high explanatory variable candidates to sample size ratio in this study, the elastic net regularization was also used to penalize extreme estimator values balanced against the goodness of fit of the estimation.

Data

California ballot measures were collected from the California Elections Data Archive (CEDA) for the years 1995-2015. Ballot measures from Oregon and Washington were primarily retrieved from the state’s Secretary of State Office for the years 2005-2015. In Oregon, some measures
were retrieved in person from the county election’s clerk. Only cities with populations greater
than 100,000 or counties with cities of that size were included in the study.

Sociodemographic data were obtained from the U.S. Census Bureau 1990 Decennial
(ACS) 1-year Estimates. Linear interpolation was used for calculating between decennial census
years and between 2000 Decennial Survey and 2006 ACS Survey.

RESULTS

55% of measures (55 of 91) passed. 96% of measures (87) used taxes as the funding mechanism.
53% of measures (48) were held in cities. All 91 measures contained a road component. 14
measures had transit component, 10 had a pedestrian component, and 5 had a bicycle component.
Figures 5-8 depict these descriptive statistics.

FIGURE 5 Counts of measure results by pass or fail.
FIGURE 6 Counts of funding mechanisms specified in measures.

FIGURE 7 Counts of government type holding measures.
A multiple logistic regression model with the socio-demographic covariates Total Population, Population Density, Percent Male, Percent Elderly, Percent White, Percent High School Education, Median Household Income, Percent Commute By Car, and Percent Average Commute Time found that the percent elderly population of a community was significantly associated with measure outcome. A 1 percent increase in the percentage of elderly residents decreased the odds of measures passing by 0.68% ($p = 0.03$) (Figure 9).
FIGURE 9 Standardized regression coefficients plot depicts relative influence of variables. Only percent elderly variable is significant.

CONCLUSIONS
The work of explaining measure passage with measure characteristics and socio-demographic characteristics of communities requires further development before it can be a useful tool for policymakers considering transportation funding strategies.

Local governments and states should carefully consider the role of ballot measures. As Goldman (32) points out, while raising much-needed revenue, local or specific measures may undermine or conflict with regional or comprehensive planning goals and may have unintended, or intended, negative equity implications.

States and municipalities should also remain cautious about relying too heavily on ballot measures. Increases to local taxes and bond sales deprive jurisdictions of funds for other core projects (2).

Future research could extend the ballot measures by both time and state. Some initial work has been done by Green (33) on how governments decide to place referenda on ballots.
Combining research on government decision making with referenda outcome analysis may result in more targeted and strategic legislative referrals.

OSC measure studies hold many exciting research possibilities as well. Banzhaf, Oates, and Sanchirico (34) examined whether local leaders, environmental organizations, or both were targeting OSC measures in communities where they were more likely to succeed and where there was more ecological value. Similar investigations could be made for whether sustainable transportation measures are being strategically targeted.

Organizations that track transportation funding ballot measures, including Center for Transportation Excellence, The Eno Center for Transportation, Transportation 4 America, National Conference of State Legislatures (NCSL), and Ballotpedia should coordinate data collection and dissemination. Government leader and policymaker membership organizations like NCSL would do well by their members if they helped create a database that would set the stage for discovering more actionable findings for their members. The Trust for Public Land’s LandVote database provides an excellent model for ballot measure tracking.

Model modification could be improved by examining how different thresholds of yes percent needed may influence outcome. Logistic regression controls for different thresholds assuming that voters respond the same way to a simple majority, 55%, or two-thirds threshold, but threshold may influence voter behavior (i.e., a higher threshold encourages more voters to try and clear the threshold or discourages them from attempting to). Additionally, the analysis performed assumed a linear relationship. Non-linear regression modeling could be compared to this study’s model to determine if non-linear relationships exist.
REFERENCES


