ELECTION LAW JOURNAL
Volume 17, Number 3, 2018
Mary Ann Liebert, Inc.
DOI: 10.1089/elj.2017.0478

Cost of Voting in the American States

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ABSTRACT

Our research uses principal component analysis and information on 33 different state election laws, assembled in seven different issue areas, to create a Cost of Voting Index (COVI) for each of the 50 American states in each presidential election year from 1996 through 2016. In addition to providing detailed description of measurement and coding decisions used in index construction, we conduct sensitivity analyses to test relevant assumptions made during the course of index construction. The COVI reported in the article is the one that is the most theoretically sound and empirically indistinct from the other index construction options considered. We also test the construct validity of the COVI using both state-level and individual-level voter turnout. After controlling for other considerations, we find aggregate voter turnout is lower in states with higher index values and self-reported turnout also drops in states with larger index values.

Keywords: voter registration, photo ID laws, state election law, voting by mail, automatic registration

In recent years, American state legislatures have been busy changing state laws to either make it more difficult or easier to cast a vote on Election Day. Scholarly work routinely elaborates on one or more of these changes (Ansolabehere and Konisky 2006; Bentele and O'Brien 2013; Biggers and Hanmer 2015; McGhee et al. 2017), seeking to learn the influence these policy variations have on voter turnout and election outcomes (see also Highton 2004; Hershey 2009). However, since James King (1994), in the early 1990s, developed a cost of registering to vote index for the 50 American states, academics have been less inclined to tackle the creation of a composite score to represent the totality of the time and effort associated with casting a vote in each American state.[1]

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Anthony Downs spurred the contemporary discussion on the cost of voting when he argued "… time is the principal cost of voting: time to register, to discover what parties are running, to deliberate, to go to the polls, and to mark the ballot" (1957, 265). But it was Riker and Ordeshook who drove the point home when they developed the equation $R = (BP) - C$ (1968, 25). These authors suggest it is only deemed rational to vote when the value of R is positive. More specifically, R equals the reward an individual receives from voting, and C is the cost an individual must pay to vote. B is the differential benefit which

[1]Importantly, Heather Gerken (2009) has advocated for the reform of state election laws by suggesting a Democracy Index for the American states, and Charles Stewart III and the Massachusetts Institute of Technology (MIT) Election Data Science Lab have worked with the Pew Charitable Trust to construct an Elections Performance Index, which measures adept state election administration. The Election Performance Index measures the competence of state elections by focusing on things that occur during or after the election, considering indicators such as voter turnout, voter registration rates, and the average length of time people spend at polling locations. Our effort differs appreciably in that our concern is state law and the electoral climate those laws create versus the actual administration of elections. *See also* Burden and Gaines (2015) for a recent effort to measure the relative convenience of "early voting" versus "absentee voting," paying special attention to the administration of these laws.

an individual voter receives when their preferred candidate wins, and P is the probability that a citizen's vote will bring about that benefit.

Importantly, the values of the different variables presented in Riker and Ordeshook's (1968) equation are dynamic. In particular, the institutional costs associated with voting (the C) have been fluid throughout the history of the United States. Official changes to the process of casting a ballot routinely occur at the sub-national level and occasionally at the national level. One significant alteration made by the national government occurred in 1993 with the passage of the National Voter Registration Act (NVRA). The legislation, commonly referred to as "Motor-Voter," tried to reduce the cost of registering to vote by mandating that states allow citizens to register at driver licensing facilities, but included other changes as well (Knack 1995).

Considering the other modifications, it is no longer admissible for states to purge voter registration rolls for nonvoting in national elections. In addition, mail-in voter registration is now admissible in all 50 states. Notably, other factors have replaced considerations addressed by NVRA, and there is still considerable dissimilarity from one state to the next in terms of the time and effort it takes to vote. In more recent years, allowing mail-in registration has been replaced as a contentious issue by allowing online voter registration and voting by mail, which some states permit and others do not.[2] Particularly, since 2008, there has been a flurry of new laws which change the relative cost of voting in each state. Some changes, such as mail-in voting, have reduced costs while others, like registration drive restrictions and more stringent voter identification laws, have increased the "cost" of voting.

With the ability to either increase or decrease costs, each state maintains the ability to alter the rational calculus of casting a ballot. From a theoretical perspective, if one assumes the values of B and P vary randomly for individuals, over time and across states, any increase in the value of C will alter the value of R, making it either more or less rational to vote. The primary focus of this research is to create a single index value for each American state in each presidential election year since the NVRA was passed in 1993.[3] Index values are intended to capture the assorted institutional arrangements which existed in each state that determine the electoral climate and the overall "cost of voting."

The importance of this topic should not be left unstated. Electoral participation has been a significant concern of noted scholars who define and describe competent democratic systems (Dahl 1971; Powell 1982). Others have recognized for some time that political elites have less concern for the policy preferences of nonvoters (Almond and Verba 1963; Berelson 1952). William Riker argues "… the essential democratic institution is the ballot box," and that therein lies democratic accountability (1965, 25). Accordingly, failure or success in approaching the ballot box, because of the variable costs of voting, arguably has important sociopolitical implications. What follows is the largest assemblage of state election laws, to date, that address in a straightforward manner the various costs associated with voting throughout the American states during the past six presidential election cycles.[4]

CREATING THE COST OF VOTING INDEX FOR RECENT PRESIDENTIAL ELECTION YEARS

Based on the scrutiny of previous research, we identify 33 institutional arrangements, representing state laws, with the potential to systematically influence across state variation in the cost of voting in the United States. Because many new laws were created during the time period of this study (1996–2016),

[2]In the 2016 presidential election cycle, 34 states allowed online voter registration (<http://www.ncsl.org/research/elections-and-campaigns/electronic-or-online-voter-registration.aspx>, last accessed July 19, 2017), but this number was not nearly as high in earlier years. For instance, in 1996 no states allowed online voter registration, and in 2012 only 14 states allowed for voter registration via the Internet.

[3]Significant changes associated with the new law render across-state comparisons of the cost of voting pre- and post-1993 problematic.

[4]In Section 1 of the Supplementary Appendix (supplementary materials are available online at <http://www.liebertpub.com/elj>) we elaborate and summarize many of the previous works associated with the cost of voting, which are used to justify the inclusion of variables used in the construction of a Cost of Voting Index (COVI). Section 2 of the Supplementary Appendix discusses the data collection processes which were used to obtain the different measures and elaborates why certain variables were not included in index construction. In Section 3 of the Supplementary Appendix we discuss, specifically, the measurement strategies employed to capture the unique state election laws, which we sort into seven different issue areas. Section 4 provides actual COVI values for each state in each of the six most recent presidential election years. Section 5 explains how the control variables were measured that are used in the construct validity test, which uses individuals as the unit of analysis.

there is considerable unevenness in the number of variables included in the building of the Cost of Voting Index (COVI) each presidential election cycle. Table 1 provides a summary of the different variables included in the 2016 COVI. Notes provided at the bottom of the table spell out specifics about when different considerations were first used in the building of index values.

As can be noted, our seven issue areas are defined in a way that four of them deal with registration laws and three deal with voting laws. So, we could theoretically develop two unique indices to gauge registration and voting difficulties. However, our thinking was that we wanted an index that spoke to the overall electoral climate in each state (and the dynamic nature of that climate as new laws were adopted).

Table 1. Component Parts of the Cost of Voting Index

Issue area	*Cost of voting consideration*
1. Registration deadline (ratio variable)	No. of days prior to election that registration must occur
2. Voter reg. restrictions (additive indicator)	Same day registration not allowed for all elections
	Same day registration not located at poll locations
	Felons not allowed to register
	Mental competency req. for voter registration[a]
	No online voter registration[b]
	Same day registration not allowed in presidential election[c]
	No automatic voter registration[d]
3. Reg. drive restrictions[e] (additive indicator)	Official certification required by state
	Participation in state training course required
	Group required to submit documents to state
	Penalty imposed for any violation of deadline or rule
4. Preregistration laws (0–5; Likert scale)	0 = 16-year-olds allowed to preregister
	1 = 17-year-olds allowed to preregister
	2 = 17.5-year-olds allowed to register
	3 = allowed to register 90 days prior to 18th birthday
	4 = allowed to register 60 days prior to 18th birthday
	5 = no preregistration allowed
5. Voting inconvenience (additive indicator)	No early voting
	Excuse required for absentee voting
	State sanctioned excuse required for absentee voting
	No in-person absentee voting
	No all mail voting[f]
	No "ask once and always able to vote absentee"[g]
	No time off from work for voting[h]
	No time off from work with pay for voting[h]
	Reduced number of polling stations[i]
6. Voter ID laws[j] (0–4; Likert scale)	0 = no ID required to cast a ballot, only signature
	1 = non-photo ID required not strictly enforced
	2 = photo ID required not strictly enforced
	3 = non-photo ID required strictly enforced
	4 = photo ID required strictly enforced
7. Poll hours (ratio variable)	Min. and max. poll hours (averaged and reversed)

[a]Uneven within-state enforcement and uneven state reporting limits the use of this variable prior to the 2004 index. The variable is not included in the 1996 and 2000 indices.
[b]Arizona becomes the first state to allow online voter registration in 2002; the variable is not included in the 1996 and 2000 indices.
[c]Rhode Island passed and implemented Election Day registration for presidential elections in 2011 and the variable is not included in the index prior to 2012.
[d]Oregon implemented automatic voter registration for the 2016 election; the variable is not included in the index prior to 2016. California passed a similar law prior to 2016, but the policy change was not yet implemented for the 2016 election cycle.
[e]Registration drive restrictions were passed after the 2008 presidential election. The entire issue area is not included in the index construction prior to 2012.
[f]Oregon is the first state to institute all mail voting for the 2000 presidential election and the variable is not included in the 1996 index.
[g]California becomes the first state to allow voters permanent absentee voting status in 2007 and the variable is not included in the voting inconvenience additive scale prior to 2008.
[h]Reliable data is not available prior to 2008 and the variable is not included in the voting inconvenience additive scale prior to 2008.
[i]Seven states reduced the number of polling locations prior to the 2016 election (AL, AZ, LA, MS, NC, SC, and TX) and the variable is not included in the voting inconvenience additive scale prior to 2016. The specific decrease in the number of polling locations is not publicly known because following the ruling in *Shelby County v. Holder*, 570 U.S. 2 (2013), districts are no longer required to report changes or seek preclearance for such changes.
[j]Enforcement level ("strict" versus "non-strict" is provided by the National Council of State Legislatures; <http://www.ncsl.org/research/elections-and-campaigns/voter-id.aspx>, last accessed July 19, 2017).

Therefore, we chose to examine all seven issues areas holistically and to develop a single index.

In each presidential election year, the assortment of relevant state laws is subject to principal component analysis (PCA), which has been used for many years now "to reduce the dimensionality of a data set consisting of a large number of interrelated variables" (Jolliffe 2002, 1). More specifically, PCA is a statistical procedure that uses an orthogonal transformation, which converts a set of observations of potentially correlated variables into a set of values of linearly uncorrelated items called principal components. This method, which measures the extent to which a single basic continuum underlies a set of theoretically linked considerations, has been used by political scientists to calculate everything from mass belief systems or ideologies (Carmines and Stimson 1982) to central bank independence (Banaian et al. 1998) to groups of like-minded senators (Jakulin et al. 2009).

In using PCA, the number of principal components extracted is always less than or equal to the number of original variables included in the analysis; in our case, seven different indicators each representing different issue areas. The first principal component accounts for as much of the variability in the data as possible, and each of the succeeding components has the topmost variance possible under the limitation that it is orthogonal to the previous components. The first "*few*" (Jolliffe 2002, ix *emphasis in the original*) components are then normally weighted and combined to illuminate the internal structure of the data, in a way that best clarifies variance in the data. It should be emphasized that with each update of the COVI there is the possibility that additional considerations will need to be incorporated or removed from the analysis to keep pace with the dynamic nature of state and national election law. This may result in a different number of components being used each year. W. John Braun writes: "Remember that the objective is to use only the first few components. The usual technique is to look for where there is a sharp drop in the component variance."[5] We follow these directions and use three components for election years 1996, 2000, 2004, and 2008, and four components for the construction of the 2012 and 2016 indices (*see* footnote 11 for weights).

Each of the seven issue areas is discussed in more detail in Section 3 of the Supplementary Appendix (supplementary materials are available online at <http://www.liebertpub.com/elj>).[6] Importantly, all considerations, in all issue areas, are coded so that larger values indicate a greater level of restriction or an increase in the cost of voting. As noted in Table 1, two of the seven issues areas are captured by standalone ratio level variables, three issue areas make use of additive scales where the number of policies in a specific issue area are simply counted, and two issue areas are captured by Likert scales. An alternative to each of the five scales employed would be to use correspondence analysis to convert our binary considerations into correspondence scores. Binary considerations cannot be used in standard principal component analysis because the method assumes variables are continuous and follow a multivariate normal distribution.[7] The correspondence scores, like all factor scores, are interval level measures. However, the additional step of creating correspondence scores to use in PCA adds a layer of analysis that some critics might find puzzling. At minimum, the layering of two types of factor analyses, one on top of the other, makes index composition more opaque.[8] In a sensitivity analysis, which follows, we make the case for the additive and Likert scales return index values that are more intuitive or, theoretically, more accurate.

SENSITIVITY ANALYSIS

Before settling on a particular mode of index construction, we consider many possible approaches to combining the available data in a meaningful manner. Each approach requires making a set of assumptions; hence we assemble a series of cost of voting indices. The index reported in this article is the one that is most like all of the other versions and is based on a set of suppositions we think have

[5]W. John Braun was a professor in the Department of Statistical and Actuarial Sciences at Western Ontario University when he provided his notes on principal component analysis via the World Wide Web (<http://www.stats.uwo.ca/faculty/braun/ss3850/notes/sas10.pdf>, last accessed May 7, 2018).

[6]Only six issue areas are used for election cycles prior to 2012, because voter registration drive restrictions (issue area 3) were not in place until after the 2008 presidential election.

[7]"How can I perform a factor analysis with categorical (or categorical and continuous) variables?" <http://www.ats.ucla.edu/stat/stata/faq/efa_categorical.htm> (last accessed July 19, 2017). *See also* Jolliffe (2002).

[8]The resulting correspondence scores weigh each of the included variables, but do so in an a-theoretical manner, based on each variable's relationship to the other variables in the test.

Table 2. Sensitivity Analysis: Different Weights and Aggregation Methods

	1996 Corr. with current index	*2000 Corr. with current index*	*2004 Corr. with current index*	*2008 Corr. with current index*	*2012 Corr. with current index*	*2016 Corr. with current index*
Linear combination-Equal weights	$r = .95$	$r = .99$	$r = .98$	$r = .98$	$r = .96$	$r = .92$
Linear combination-Random weights	$r = .82$	$r = .94$	$r = .88$	$r = .81$	$r = .94$	$r = .88$
Geometric combination-Equal weights	$r = .93$	$r = .98$	$r = .97$	$r = .97$	$r = .80$	$r = .87$
Geometric combination-Random weights	$r = .94$	$r = .97$	$r = .97$	$r = .82$	$r = .80$	$r = .79$
	Average change in state rank	*Average change in state rank*	*Average change in state rank*	*Average change in state rank*	*Average change in state rank*	*Average change in state rank*
Linear combination-Equal weights	3.40	1.56	2.04	1.80	3.28	4.16
Linear combination-Random weights	6.70	3.40	5.44	7.12	4.00	5.52
Geometric combination-Equal weights	3.56	1.68	2.48	2.24	6.26	5.54
Geometric combination-Random weights	3.48	2.40	2.48	6.40	6.50	7.62

the most face validity. More specifically, we test alternative weighting schemes, aggregation methods, and also test correspondence scores for each issue area not captured by a ratio variable, instead of Likert or additive scales. We settle on the "proportion of variance explained," by each included principal component as our weighting strategy, a linear aggregation, and the Likert and additive scales.

Weighting is a prominent concern for index construction. Our intuition is that the "proportion of variance explained" by each principal component, representing different issue areas, would be the soundest strategy. This approach privileges the issue areas that are most useful in extracting an underlying dimension. But we also test equal and random weights for each of the principal components. With respect to aggregation methods, we added geometric aggregation to test the suitability of our initial choice of a linear or additive approach. We prefer the simpler linear aggregation because the range of numbers representing each of the issue areas is quite similar and each of the seven indicators is theoretically related, so the "normalization" of the data achieved by a geometric, or nonlinear, aggregation is not necessary.[9]

Using the index values from our preferred approach as our benchmark, we conduct pairwise comparisons of indices but also test the absolute value of the average change in state rank given different tallying approaches. Because each index for each presidential election year is constructed independently, the actual COVI values are not comparable from one election cycle to the next. However, state rank or how states compare to one another is comparable across time. Charles Stewart III and the Massachusetts Institute of Technology (MIT) Election Data Science Lab, in conjunction with the Pew Charitable Trust, also use "change in state rank" when they calculate overtime change in the Election Performance Index, which measures the competent administration of state elections.[10]

Table 2 displays the results of this analysis. The use of a geometric combination with random weights in 2016 produces an index that is the most distinct from the baseline COVI. The pairwise correlation for the remaining 23 indices is always greater than or equal to .80, and 15 of the 24 indices are correlated with our baseline index at .90 or greater. In the one instance where the correlation drops below .80 ($r = .79$), the pairwise correlation to the baseline index is still easily statistically significant using the

[9]For a discussion of the value of a nonlinear extension of principal component analysis, see Jolliffe (2002, 373–81).

[10]*Go to* <http://www.pewtrusts.org/en/multimedia/data-visualizations/2014/elections-performance-index#indicator> (last accessed May 10, 2018). The 2016 Election Performance Index is being produced solely by the MIT Election Data Science Lab.

most conservative criteria ($p < .001$). Notably, in the one instance where there is a greater difference, a random weighting method is employed. There is no similar consistency in the difference as it relates to the aggregation method (whether linear or geometric). Considering the weighting decision, all things being equal, we hold a "proportion of variance explained" rule is theoretically more pleasing than a random weights rule.[11]

Considering the bottom half of Table 2, we find that six of the 24 alternative indices would result in an average change in state ranking of more than six places. A geometric combination with random weights in 2016 is the most distinct from our baseline estimation, and this index results in an average change in state rank greater than seven places. However, the median change in state rank when considering the 24 different sets of measurement assumptions is only 3.40 places, and, most importantly, no other set of weighting or aggregating assumptions produces values that perform better than the one we choose.

Weighting and aggregation methods aside, we put our measurement strategies to another test. Some might be skeptical of our use of Likert and additive scales to tap concepts such as "registration restriction" or "voting inconvenience." To address this, we check ourselves by conducting correspondence analyses for each of the five sub-indicators which make use of scales. In this contrast, the two issue areas captured by ratio variables (the registration closing day and poll hours) are unchanged. The other five issue areas are now captured by correspondence scores instead of scale values.[12] The correspondence scores, along with the two ratio variables, create another possible cost of voting index.

Importantly, the two indices pairwise correlation is .74 ($p < .001$), and the Kendall rank correlation coefficient is 0.56, which further demonstrates the two indices are strongly related. Nevertheless, we learn that specific rankings for some states change rather dramatically in certain election cycles. For example, considering the 2016 index and using the Likert and additive scales, the state of Florida is ranked as the 30th most costly state to vote in; when using the correspondence scores in the principal component analysis, the state is ranked 7th. Florida, in 2016, still required voters to register to vote a full 28 days out from Election Day, and Florida had all seven of the registration restrictions enumerated in Table 1. Ranking Florida the 7th most easy state to vote in does not make sense. It seems the a-theoretical use of correspondence scores is in some way confounding the analysis.[13] Based on our judgment, of the two approaches, the more parsimonious and more intuitive Likert and additive scales are better. When using scales, we find the states where voting is the easiest in 2016, in rank order, to be Oregon, Colorado, California, North Dakota, and Iowa. This rank makes good sense given recent changes in state laws like mail-in voting in Oregon and Colorado and automatic voter registration in Oregon. It also makes sense that North Dakota is in the top five given the state does not require voter registration. Using the correspondence scores, North Dakota drops to 12th.

SHARING COVI VALUES

Table 3 reports descriptive statistics for the seven different indicators, representing different issue areas, which are ultimately used in the principal component analysis (PCA). The minimum and maximum values, in each presidential election year, are shown along with the mean value in parentheses. The table displays poll hour quantities as they exist in the real world although these values are subtracted from the maximum value in each election

[11]Letting the data speak for itself, and using the "proportion of variance explained" by each component, we employ the following weights: 1996—1st dimension (.4304), 2nd dimension (.3843), and 3rd dimension (.1853); 2000—1st dimension (.4270), 2nd dimension (.3470), and 3rd dimension (.2260); 2004—1st dimension (.4039), 2nd dimension (.3667), and 3rd dimension (.2294); 2008—1st dimension (.4204), 2nd dimension (.3112), and 3rd dimension (.2684); 2012—1st dimension (.3585), 2nd dimension (.2468), 3rd dimension (.2009), and 4th dimension (.1937); 2016—1st dimension (.4289), 2nd dimension (.2296), 3rd dimension (.1863), and 4th dimension (.1551). Most importantly, when we use other weighting and aggregation methods as a baseline index, subsequent sensitivity analyses do not produce any evidence that other schema are more appropriate than the COVI reported in the article

[12]Correspondence scores are derived from correspondence analysis. The type of correspondence analysis we use is also called reciprocal averaging. The method extracts an underlining dimension from a series of nominal variables, which in our case are used to represent different state laws.

[13]In particular, the two issue areas we capture with Likert scales might be problematic for the correspondence analysis which looks for the relationship between nominal variables while simultaneously describing the relationships between the categories for each variable. Relevantly, there is no sound theoretical basis for the correspondence scores produced by the procedure. We hold both preregistration and voter identification laws are more sensibly thought of as ordinal considerations (*see* Table 1) where states make voting progressively more difficult relative to other states.

Table 3. Descriptive Statistics of Sub-Indicators Used to Create the Cost of Voting Index

	1996	*2000*	*2004*	*2008*	*2012*	*2016*
Reg. deadline (days)	0/30 (21.58)	0/30 (21.64)	0/30 (21.14)	0/30 (20.62)	0/30 (18.64)	0/30 (17.86)
Voter reg. restrictions	1/3 (2.68)	1/3 (2.68)	1/5 (4.38)	1/5 (4.30)	1/6 (4.84)	1/7 (5.22)
Reg. drive restrictions	N/A	N/A	N/A	N/A	0/4 (.94)	0/4 (.92)
Preregistration scale	0/5 (4.58)	0/5 (4.58)	0/5 (4.58)	0/5 (4.48)	0/5 (3.56)	0/5 (3.26)
Voting inconvenience	0/4 (2.32)	0/5 (3.22)	0/5 (2.96)	0/8 (4.32)	0/8 (4.08)	0/9 (3.82)
Voter ID scale	0/2 (.26)	0/2 (.26)	0/3 (.52)	0/4 (.74)	0/4 (.96)	0/4 (1.28)
Poll hours	10/15 (12.47)	10/20 (12.60)	10/20 (12.64)	10/20 (12.68)	9/20 (12.71)	9.5/20 (12.97)

Mean value in parentheses.

cycle, before conducting the PCA, so that larger values indicate greater cost.

As one can note from Table 3, it is not the case that states in tandem are either raising or lowering the cost of voting. Instead there is a mixed picture. For instance, considering the registration deadline, the mean number of days has been decreasing since 2000. This occurs because in 1996 only seven states allowed same day voter registration, and this grows to 12 states by 2016. Considering the voter ID scale, the maximum value in 1996 was a "2" representing a photo identification law that was not strictly enforced. By 2016, nine states scored "4" representing a photo identification law that is strictly enforced. These changes cause the mean score for the voter ID scale to grow from .26 in 1996 to 1.28 by 2016. Still more recently adopted mail-in voting policies in three states have contributed to the drop in the mean value of the voting inconvenience additive scale in the two most recent election cycles.

As noted, we study six different presidential election years (1996–2016) and conduct the PCA for each year, independently. Importantly, in each presidential election cycle, the analysis returns either two, three, or four components with eigenvalues greater than one. In order to not discard useful information from the underlying variables, we also examined the cumulative variance explained by the components and select the number of components so that their cumulative variance is greater than 70 percent.[14] Accordingly, for the elections from 1996 to 2008 we use three components and for 2012 and 2016 we use four components.

Notably, we also ran a factor analysis exploring the latent factors for our measures. After rotating the factor loadings matrix obtained from the factor analysis, for each election cycle, we learn two out of the four registration issue areas always load on the first dimension, and two of the three voting issue areas are always represented on the second dimension. More specifically, the issue areas of registration deadline (issue area 1), which taps the number of days registration must take place before Election Day, and the additive voter registration restriction scale (issue area 2) always have very high loadings on the first factor (above 0.7). As for the second dimension, the voter ID scale (issue area 6) has a relatively high loading (above 0.5) in each election year, and the voting inconvenience scale (issue area 5) is loading on the second dimension in each of the six iterations of the COVI, as well. So conceptually, it is reasonable to infer that the measures we chose to construct the COVI conform to the two stages of voting in U.S. elections: registering to vote and actually casting the ballot.

A complete list of all state values for each election cycle is provided in the Supplementary Appendix (Section 4). Figure 1 displays each state's 2016 value. We can see straightaway, at the top of the figure, that voting was most difficult in Mississippi and, from the bottom of the figure, that voting was easiest in Oregon, which was the only state to make use of automatic voter registration in 2016. Note also that in both Mississippi and Oregon the relative distance between these state values and the next closest state is quite substantial. In the case of Mississippi, COVI construction creates a value that is nearly one-third (31%) of a standard deviation (.57) above the next most costly state (Virginia). At the other end of the spectrum, Oregon's

[14]The 70 percent consideration is somewhat arbitrary; however, the remaining components began to account for much smaller amounts of variation and are consequently not retained, interpreted, or further analyzed. In index construction, however, whatever variance *is* explained by components that are not included is shared proportionally among the included components. For instance, if the first three components explain roughly 80 percent of the variation, the remaining 20 percent is divvied up proportionally and added to the weight of the included components. When we add a fourth dimension in 2012 and 2016, the eigenvalues for the fourth component also justify inclusion. In the 2012 index the eigenvalue for the fourth component is greater than one, and in 2016 it is very close to one.

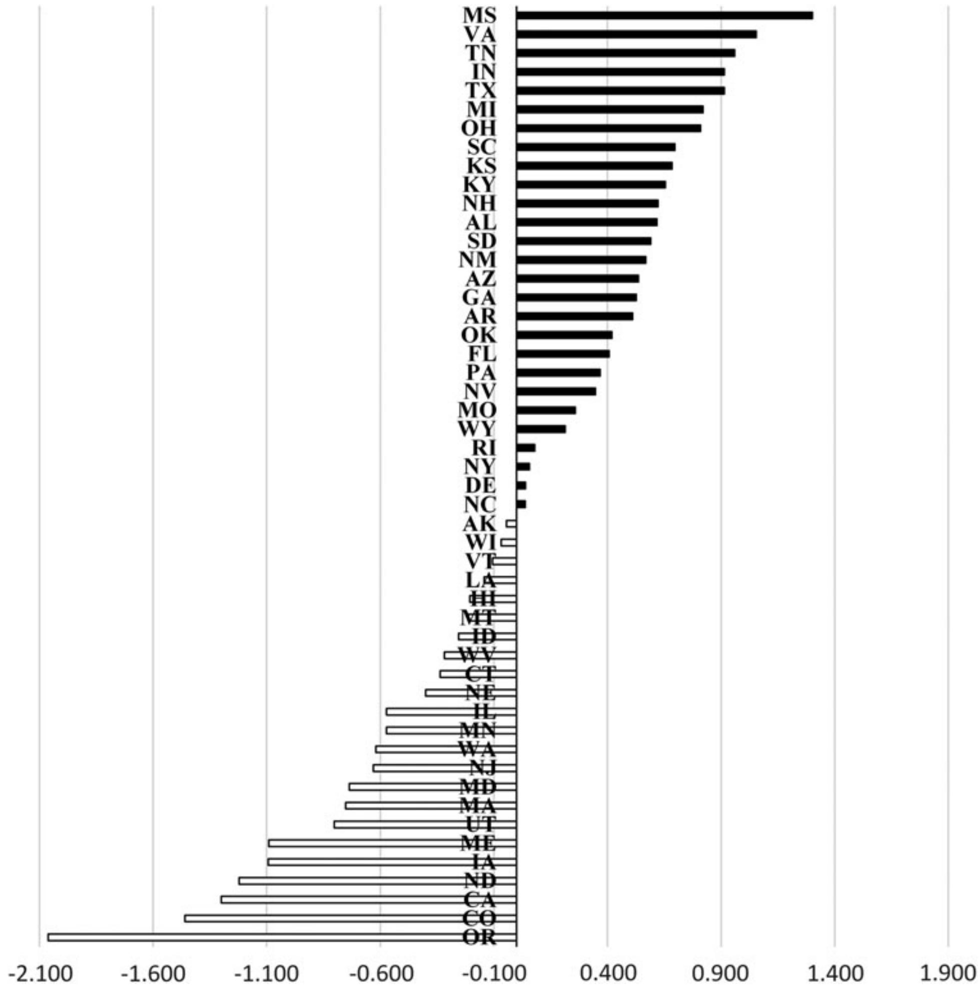

FIG. 1. Cost of Voting Index values for all 50 American states in 2016.

value is over two-thirds (71%) of a standard deviation lower than the state with the next smallest COVI value (Colorado).

Much popular interest has been paid, in recent years, to states making it more difficult to vote with the adoption of photo identification laws and by reducing the number of polling stations. There has been some attention to states that have made voting easier via the adoption of mail-in voting procedures and early voting. To address this public debate, we calculate the change in state rank from 1996 to 2016. As noted, it is not possible to simply compare COVI values from one election cycle to the next because there is a different set of laws in each of the 50 states, each election cycle, and the COVI scores derived are not comparable. However, we can test changes in relative state rank. To illustrate, if in 1996 a state was ranked as the 10th least costly state and then by 2016 it became the 30th most costly state, we can assume that it has either failed to play catch up in terms of making voting easier, has gone out of the way to make voting more costly (relative to other states), or there is some combination of both explanations.

Figure 2 displays the result of these calculations. We can note that Tennessee had the largest drop in rank; in 1996 it was ranked as the 10th easiest state to vote in, and by 2016 it had become the 47th ranked state, with only three states having more "costly" voting policies. Most notably, from 2008 to 2012 Tennessee began strictly enforcing their photo ID law. At the other end of the spectrum, the state of Washington has made voting much easier, relative to other states in the time period studied. In 1996 it was the 46th most costly state to vote in, and by 2016 it was ranked 11th, a change in rank of 35. Between 2012 and 2016 Washington adopted same day voter registration and a mail-in voting option.

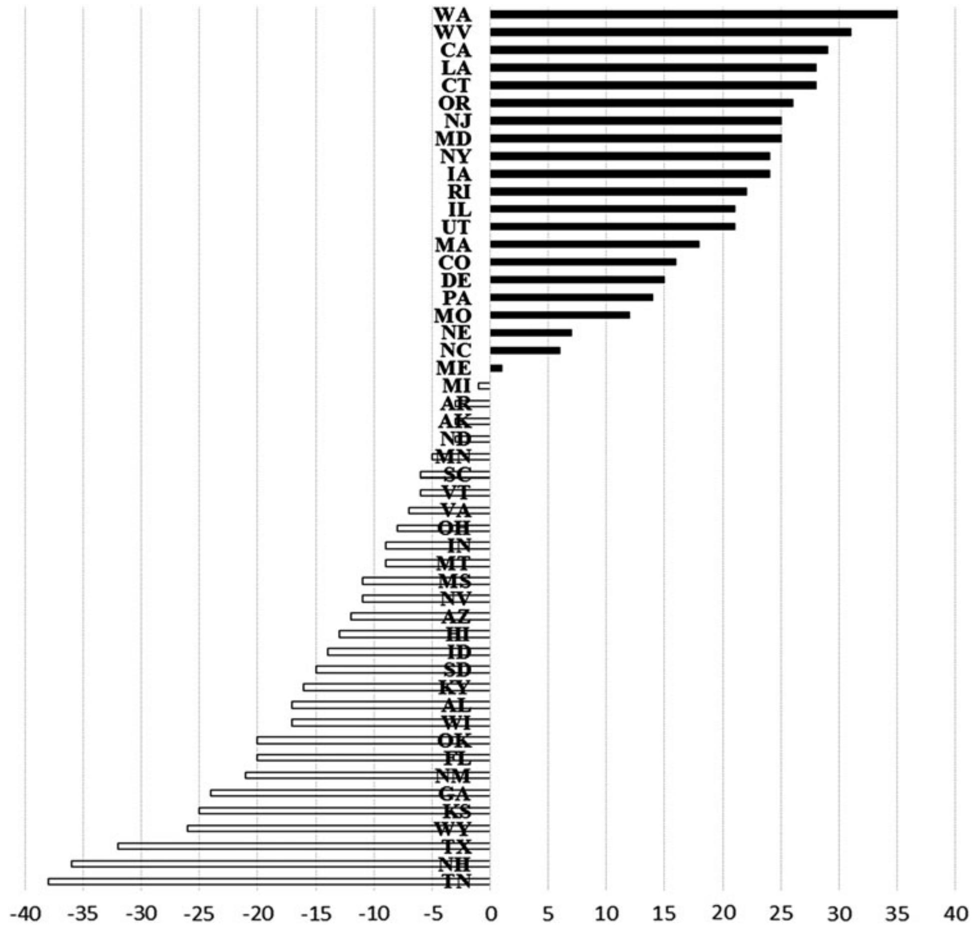

FIG. 2. Change in state rank on the Cost of Voting Index from 1996 to 2016. Negative values indicate a drop in state rank.

CONSTRUCT VALIDITY CHECKS

We feel the Cost of Voting Index takes on intuitive values. But to better test the construct validity of the index, we put our measurement strategy to task by checking the relationship between index values and voter turnout, using both state-level and individual-level analyses. Since the COVI was constructed in a manner in which larger numbers indicate greater cost, we expect a negative relationship between index values and voter turnout. We first check the pairwise correlation between COVI values and aggregate voter turnout of the voting eligible population in each of the 50 states over the six presidential election cycles ($n = 300$). We learn there is a negative and statistically significant correlation ($r = -.27$; $p < .001$), suggesting the COVI comports with expectations. When we examine the correlation with turnout of the voting age population, the correlation grows to $-.38$. One might imagine that these correlations would be higher, but it is important to remember that the Cost of Voting Index does not capture anything about the "benefits" of voting. For instance, it is recognized that the perceived benefit of voting increases when there is greater electoral competition (Stevens 2006).

USING THE COVI TO PREDICT STATEWIDE VARIATION IN VOTER TURNOUT

In the tests which follow, we use turnout of the voting eligible population because, arguably, this is a more substantively relevant consideration since some part of the voting age population in each state is not allowed to vote. In the modeling we take into account the *most competitive race* at the top of the ballot, whether it be the presidential race, a gubernatorial race, or a Senate race. As noted, the "benefits" of voting are perceived higher

Table 4. Cost of Voting and Turnout of the Voting Eligible Population in Presidential Elections

	1996–2016	*2016*
Variable name (expected direction)	Coef. (Bootstrap s.e.)	Coef. (s.e.)
Cost of Voting Index (-)	−2.53 (.73)***	−3.31 (1.04)**
Most competitive race (-)	−.28 (.08)***	−.29 (.06)***
Multiple races (top of ticket) (+)	−4.84 (2.92)	−1.77 (1.58)
State per capita income (in thousands $) (+)	.13 (.09)	.15 (.09)
State high school graduation rate (+)	.32 (.13)*	.20 (.13)
Constant	36.42 (9.75)***	47.77 (11.63)***
Wald chi^2/F-Statistic	51.45***	8.82***
R^2 (between state effects)/ adjusted R^2	.45	.44
n	300	50

Column 1: Generalized Least Squares-Between Effects Model; Column 2: Ordinary Least Squares Regression.
*$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed tests).

when the outcome of the electoral contest is in question (Stevens 2006; see also Aldrich 1993, 252). In our case, a larger post-election margin at the top of the ballot will serve as a surrogate for a less competitive state election cycle, which we hypothesize will depress voter turnout in the aggregate, and a negative coefficient is anticipated.

We also control for whether there are multiple races at the top of the ballot. In some states, some years, there is only a presidential election that is a high profile statewide race, but in other states there may be both a Senate and a gubernatorial race in addition to the presidential race. We create a dummy variable scored "1" to capture *multiple races* or instances when there are either two or three races at the top of the ballot; other cases are scored "0."

We also control for *state per capita income* and *state high school graduation rate*(s), which are both expected to positively influence state voter turnout. We normally think of income and education as individual-level predictors of voter turnout; yet, we note in this analysis the two considerations are statistically linked to aggregate turnout. State median income as reported by the Census Bureau correlates with state voter turnout at $r = .36$ ($p < .01$; n = 300), and state high school graduation rates correlate with turnout at $r = .14$ ($p < .02$; n = 300). These control variables will better ensure that any relationship we uncover between the COVI and voter turnout is not the product of higher or lower COVI values being correlated with either state income or education.

Because data are arrayed over time, and across states, with more variation between states and much less within-state variation, we use generalized least squares and the between estimator to test our hypotheses. We control for heteroskedasticity in our panel data using bootstrapped standard errors.[15] We also report, in the last column of Table 4, results using 2016 data only. In this case, we use an ordinary least squares model specification. The COVI is statistically linked in a vigorous manner to state voter turnout, in the hypothesized direction, in the entire time period and in the most recent election cycle. Specifically, the tests suggest that a one unit increase in the COVI associates with a drop of about 2.5 percentage points in voter turnout when considering all six election cycles and 3.3 percent when considering the model which tests the effect using only 2016 data. To illustrate, in 2016, the difference between the "least costly" state (−2.06, Oregon) and the "most costly" state (1.30, Mississippi) equals 3.36. Using the coefficient from the 2016 model, voter turnout is expected to decrease by approximately 11 percentage points (−3.31 * 3.36) with a move from the least restrictive state to the most restrictive state. The decrease in voter turnout can be attributed to state policies which increase the time, energy, and hassle of voting. It is worth noting the electoral competition variable is, also, easily statistically significant, which suggests the "benefits" of voting can, likewise, be consequential. In this case, a 10-percentage-point increase in the electoral margin, considering the most competitive race at the top of the ballot in each state in 2016, is associated with a decrease in voter turnout of 2.9 percentage points (10 * .29), on average, all else being equal.

USING THE COVI TO PREDICT SELF-REPORTED VOTER TURNOUT: 1996–2012

The COVI is put to a second test by analyzing data drawn from the American National Election

[15]The bootstrap procedure has become a widely accepted way to get reliable estimates for standard errors and confidence intervals. If we cluster errors by state or use a random effects model, we return the same statistically significant association between turnout and the COVI. However, the substantive significance of the COVI is reduced some with a random effects model specification.

TABLE 5. USING THE COST OF VOTING INDEX TO PREDICT REPORTED VOTER TURNOUT: 1996–2016

Variable name	Coef. (robust s.e.)	% Change in odds[a]
COVI	−.13 (.06)*	−12.02
Most competitive race	−.006 (.002)*	−.01
Multiple races	−.04 (.07)	
Party identification		
Strong Democrat	1.34 (.08)***	283.37
Democrat	.80 (.08)***	122.67
Independent Leaning Democrat	.50 (.08)***	64.71
Independent Leaning Republican	.59 (.09)***	80.46
Republican	.77 (.09)***	116.00
Strong Republican	1.24 (.11)***	246.25
Other individual-level considerations		
Home ownership	.58 (.06)***	78.82
Married	.17 (.06)**	18.22
Campaign involvement: None	−1.61 (.04)***	−79.92
Campaign involvement: High	.81 (.25)***	123.88
Household income: Lowest 33%	−.22 (.05)	−19.95
Household income: Top 5 %	−.21 (.11)	−19.32
Education: Less than H.S. diploma	−.63 (.08)	−46.62
Education: At least 4-year degree	.63 (.05)***	88.86
African American	−.05 (.10)	
Latin American	−.52 (.09)***	−40.48
Female	.10 (.06)	
Unemployed	−.33 (.09)***	−28.13
Constant	.90 (.09)***	
Wald chi^2	5548.54***	
Pseudo R^2	.19	
n	12,936	

*$p<.05$, **$p<.01$, ***$p<.001$ (two-tailed tests).
[a]The percent change in odds is calculated using the following formula (odds ratio – 1) * 100.
COVI, cost of voting index.

Study (ANES) in presidential election years from 1996 to 2016.[16] To determine if the COVI influences the probability of reported turnout we use a binary dependent variable scored “1” if the survey respondent claims to have voted and “0” otherwise.[17] Because the dependent variable is dichotomous, a logistical regression model is used. COVI values for each state are added to the ANES database for each presidential election cycle. Although all 50 states are not represented in the survey, in every presidential election year studied, all states were surveyed in 2016. Therefore, we use as many state values as we can in earlier years and all 50 COVI values in 2016. Throughout, COVI values are repeated for each individual from each state.[18]

An unqualified model of individual-level voter turnout is beyond the scope of this inquiry, yet we do want to provide a reasonably rigorous test of the construct validity of the COVI using a wholly distinct approach than the test of state-level voter turnout. We, again, include the electoral margin of the most competitive race at the top of the ballot and the dummy variable which captures multiple high profile races in this model. Values are repeated for each survey respondent from a given state in a particular year. The analysis also controls for several individual-level considerations, some of which capture the perceived “benefits” of voting. A full accounting of these variables is provided in Section 5 of the Supplementary Appendix.

Table 5 reports the model estimates and the percent change in odds based on the model run. The first thing to note is that the COVI is easily statistically significant. The percent change in odds shows a decrease of about 12 percent in the odds of reported voter turnout for an increase in the COVI from 0 to 1. A one standard deviation change in the COVI equals .40; hence, all else being equal, there is almost a 5% decrease (−12.02 * 0.40) in the odds an individual will report they voted when one considers a move from a state like Delaware (COVI in 2016 = .039) to a state like Oklahoma (COVI in 2016 = .419). Importantly, most of the other control variables in the model are performing as hypothesized. Only the multiple races, household income: Top 5 %, African American, and female variables are not statistically linked in the hypothesized manner to reported turnout, on average, after controlling for other considerations (see Section 5 of the Supplementary Appendix for a discussion of the hypothesized effects of the different variables).

[16]Although the American National Election Study does not sample at the rate the Bureau of the Census does for the Current Population Survey, it is deemed a better source because it asks questions associated with an individual’s involvement in the election, which we include in the model. These considerations have been reported to effect individual-level voter turnout (Abramson and Aldrich 1982; Lake and Huckfeldt 1998; Shaffer 1981).

[17]Self-reported turnout is a problematic way to measure overall turnout rates. Yet, scholars argue, “the use of self-reported turnout to analyze the correlates of voting … is much less problematic” (Highton 2005, 113). *See also* Brady (1999), Katosh and Traugott (1981), and Sigelman (1982).

[18]Because the COVI values for individual states each year are repeated, we use the variance-covariance estimate (VCE) option and cluster the errors by state, which specifies that the standard errors allow for intragroup correlation, relaxing the requirement that the observations be independent but controlling for any within-group correlation.

CONCLUSION

In this work we have constructed the most comprehensive Cost of Voting Index to date for each American state in each presidential election year from 1996 through 2016. The intention is to update the COVI on a regular basis to keep pace with the dynamic nature of state election laws. This initiative will be comparable to the efforts of the MIT Election Data Science Lab that has kept abreast of changes to the competent administration of elections in the 50 states by updating the Election Performance Index every two years. But we will also need to keep abreast of legal challenges to new laws, which can cause the adoption and rescinding of a law within a single election cycle. In 2016, a total of 33 different variables were included in the index. The different state laws designating unique electoral processes were sorted into seven different issue areas, and principal component analysis was used to create the index. We learn that the seven different issue areas load primarily on three or four dimensions and that the first two dimensions approximate the cost of registering to vote (component 1) and the cost of actually casting a ballot on Election Day (component 2). Importantly, each dimension was weighted according to the proportion of inter-item variation explained. Notably, states which receive the lowest COVI values generally allow voters to register on Election Day and do not have a strictly enforced photo identification law. On the other hand, states which receive higher values on the COVI commonly have registration deadlines closer to 30 days out and lack convenient early voting procedures.

Although passage of the NVRA in 1993 standardized some costs associated with registering to vote, states still have significant opportunities to increase or decrease the inconvenience of voting through both the voter registration process and the actual polling experience. This research has identified numerous policies which states could adopt to decrease the "cost" of either process. Some scholars might like to analyze these two processes (registering and voting) independent of one another, and as theory develops that indicates unique implications of the two considerations, this is a promising avenue for future research. For now, we can safely argue that if states desire higher citizen participation rates in elections, a reasonable place to start would be a same-day voter registration policy. It is common for people to move, and the burden of getting reregistered to vote a predetermined number of days before the general election makes voting costlier. Allowing people to register at the actual polling station would do still more to reduce the cost of voting. Beyond voter registration considerations, early voting polling stations and longer poll hours will, on average, increase citizen participation in elections.

Notably, it is our hope that the COVI will have value beyond helping to explain variability in voter turnout rates. For instance, one might imagine the cost of voting will affect subpopulations of eligible voters differently, which might have a corresponding effect on the people who actually win elections. This may be all the more likely in low information elections. If so, it is not difficult to imagine that across-state variation in the cost of voting will influence the ethnic, gender, or age makeup of state and local legislatures. Moreover, the COVI may have civil rights implications if it is learned that historically underrepresented subpopulations are disproportionately affected by the variable costs of voting. Furthermore, the COVI might serve as an interesting dependent variable. One might test for regional or partisan influences on the cost of voting. Overall, we hope the new COVI will spur the imaginations of scholars who will find unique uses for the index as they seek to better understand across-state variation in sociopolitical outcomes.

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