Is Civic Engagement Related to Fiscal Health?

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Introduction

California is a key staple in the overall fiscal health of the United States. This economic backbone is built by the diverse industries present across its many cities, each possessing its own distinct socioeconomic and political characteristics. As such, it is important to discern which key characteristics are maintaining and bolstering the economic well-being of this vital state.

In this study, we investigate the relationship between historical voter turnout rates and the fiscal health of California cities. To this end, we compared 2008 voter registration data with a variety of variables regarding the fiscal health of California counties from 2018. By comparing voter registration information with fiscal health data 10 years in the future, we can control for the impact of economic cycles and focus on the long-term impact of voter registration on fiscal health.

The Three Types of Correlations

Correlation measures the strength of the relationship between two variables and the direction of said relationship. Perfect correlation translates to a numerical value of 1 or -1, while perfectly uncorrelated variables result in a score of 0. A negative value insinuates an inverse relationship. The converse is true of positive correlation values.

- **Kendall's Tau Coefficient**

$$\tau = \frac{n_c - n_d}{n(n-1)/2} \tag{1}$$

- **Spearman's Rank Correlation Coefficient**

$$\rho = 1 - \frac{6\sum_{i=1}^{n}(R(x_i) - R(y_i))^2}{n(n^2-1)} \tag{2}$$

- **Pearson's Correlation Coefficient**

$$r = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sum(x-\bar{x})^2\sum(y-\bar{y})^2} \tag{3}$$

Holistically, Pearson's correlation test is a stronger method of analysis in comparison to Spearman's Rank Correlation Coefficient and Kendall's Tau Coefficient due to it being a parametric test; however, the assumptions of Pearson's Correlation test stipulate that the variables must be normally distributed. Given that many of our predictors in the subsetted data fail to be normally distributed and are non-linear in nature, we deferred to Spearman and Kendall's method of analysis.

Exploratory Data Analysis

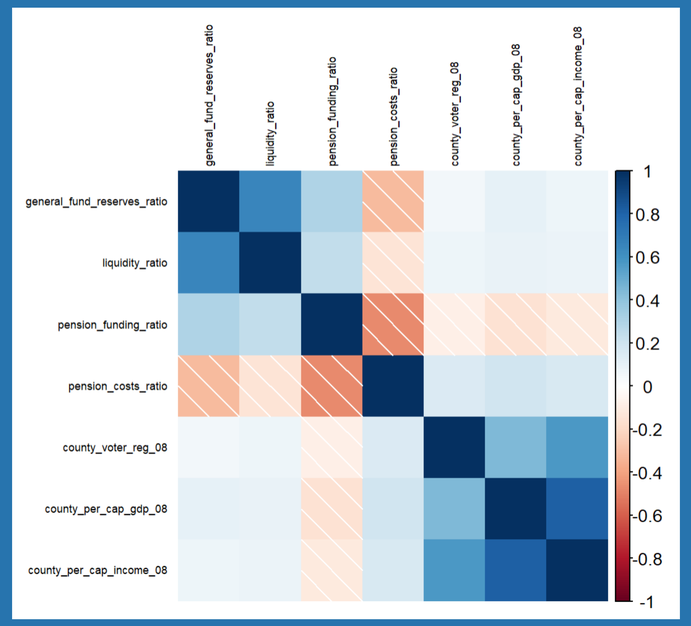

Fig. 1 Correlation Plot - Includes only a select few of all our variables.

- Aliased coefficients occur as a result of perfect correlation between predictor variables. The correlation plot above was used to remove these variables before initial modeling.
- Further simplification of model was achieved by removing predictors with VIF > 5.

Normality Testing

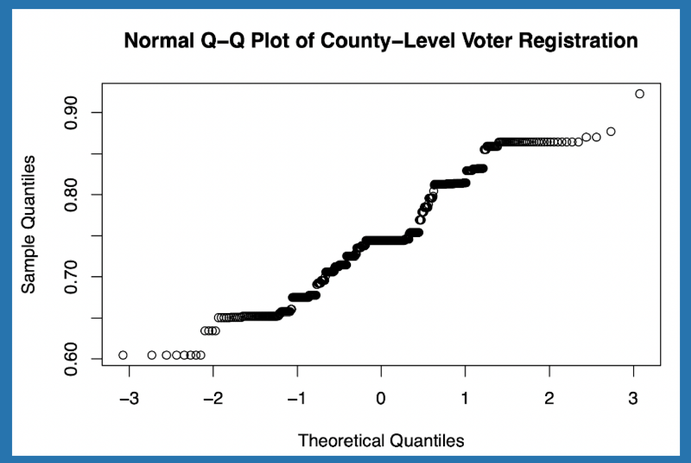

Fig. 2 QQ Plot - From Kolmogorov-Smirnov Test

- In a QQ plot, all points must line on the 45 degree reference line plotted for the predictor in question to be considered normally distributed.
- The non-linear pattern in points signify that County-Level Voter Registration feature is not normally distributed.
- The p-value for the Kolmogorov-Smirnov test is approximately 4.92e-08, which is less than 0.05 indicating that the normality assumption is violated.

Results

From the correlation plot, we found that many fiscal health indicators were highly uncorrelated with voter engagement features as figure 1 suggests. Note, however, that the Pearson Correlation Coefficient is a measure of association that examines whether there exists a linear relationship between two variables that are roughly normally distributed. In light of this definition, we applied the Kolmogorov-Smirnov test on numerous voter turnout features in our data and found that most variables indeed failed to be normally distributed.

With the normality assumption violated, we turn our attention to Spearman and Kendall's method of correlation testing. From running correlation tests on 17 fiscal health and civic engagement variables, we found that all pension related metrics were significantly correlated with voter registration and turnout rates with the exception of pension funding ratio. An example of the results of both tests is shown in figure 3.

General Fund Reserves Ratio		
	Spearman	**Kendall**
Turnout	0.039	0.036
Registration	0.149	0.158

Fig. 3 Table of p-values from correlation testing

Discussion and Recommendation

Our findings suggest that there exists little to no linear association between voter turnout indicators and overall fiscal health of a state; however, in analyzing the various quantitative variables, we found many were non-normally distributed with outliers scattered in the mix. The consideration was to perform a Box-Cox transformation on said data before further analysis, but this procedure was unable to be conducted due to time constraints. With non-normality corrected by this transformation, a stronger correlation may result between fiscal health and voter turnout features. In future studies, we suggest performing this transformation before attempting any causal relationship analysis between these variables.

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