Structural and Trial-Heat Model Combinations to Forecast US Elections

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Type of Data

Forecasting elections makes use of mainly two different types data:

- **Fundamental indicators**, that is economic or political variables
- **Trial-heat polls**, that is surveys with trail-heat questions issued by official pollsters' agency

Fundamental Indicators

The **economy** strongly affect and anticipate election results. Among the most used economic indicator there are GDP, GNP, unemployment, inflation at national or state level.

The **political dimension** of election is also of high relevance and it is usually measured by incumbency, time-for-change, votes of previous elections, presidential home-state advantage, president approval rating.

Many models have been developed using only such data and predicted the results within few percentage points.

Trial-Heat Polls

Survey responses are related to actual voting process, meaning that polls are connected to observable political behaviours and incorporate the process of updating information of individuals, so that can be used to track the evolution of preferences over time and states.

Election polls data suffers of some well-known problems such as sampling errors, house effect, question wording, response errors and high variability.

Nowadays many pollster agencies exist, producing surveys both at the national and state levels, in particular during the election year.

3. Methods

Type of Models

Over the years, mainly three types of election forecasting models evolved:

- **Structural models**, econometric models based on fundamental indicators
- **Trial-heat models**, econometric models relying on polls data
- **Bayesian models**, models that use polls data to update historical forecasts, improving the performance of structural models through the incorporation of voters preferences' evolution.

The variable of interest is usually the percentage election outcome of one of the two major parties.

Structural Models

The **Time-for-change model** is one of the most successful and was proposed by Abramowitz in 1988 (and again in 1996 and 2008).

$$Y_t = \beta_0 + \beta_1 GDP_{t-1} + \beta_2 Approval_t + \beta_3 TC_t$$

It assumes that voters positively evaluate periodic government alternation of the two major parties.

It relies only on previous elections' data without incorporating the opinion about the current election.

Trial-Heat Models

Using trial-heat polls as literal forecast produce very poor results, because the accuracy of election polls depends enormously on when the poll is conducted.

Gelman and King incorporated current polls information within a more complex structural model considering the aggregate trial-heat two months before the election, incumbency, GNP rate, approval rating and state variables.

Campbell, instead, improved the poor trial-heat literal prediction suggesting a simple regression model that used only trial-heat polls at national level and the second quarter growth rate of GDP.

Bayesian Models

Since the late 90s, methods implementing a Bayesian approach have been introduced also in the context of election prediction.

Bayesian models naturally follow the **"voters' enlightenment"** hypothesis because the weights voters attach to fundamental variables are allowed to change during the campaign, accounting for changes in public opinion.

- **Core idea**: to use polls data to update historical forecasts, accounting for current voters' preferences and improving the performance of structural models.

Bayesian Models - Rigdon et al.

- Assumes that the beliefs about election's outcomes are based on historical voting trends
- Considers the proportions of third-party candidates and undecided
- Uses informative prior (based on previous election results) and current likelihood (based on ongoing poll data) for each state to estimate the posterior distribution, that is each candidate's probability of winning that state.

Bayesian Models - Rigdon et al.

$$X = (X_1, X_2, X_3, X_4) \sim MULTINOMIAL(n, p_1, p_2, p_3, p_4)$$

$$p = (p_1, p_2, p_3, p_4) \sim DIRICHLET(b_1, b_2, b_3, b_4)$$

where X_i are the sample proportions in a state poll and p_i are the shares in a state of candidate i

$$P(p|X) \sim C \cdot P(p) \cdot P(X|p)$$

$$P(p|X) \sim DIRICHLET(x_1 + b_1, x_2 + b_2, x_3 + b_3, x_4 + b_4)$$

Bayesian Models - Linzer

4. Conclusions

Conclusions

- Using the Bayesian approach, it is possible to produce **continuously revised forecasts** as new poll data is released
- **Comparing performances** of different models is difficult (different elections, different horizons, different levels)
- In general, forecasts are accurate **within 2 months** before the election day and forecasting using both structural variables and poll data outperform others
- It is **still difficult** to produce timely and accurate forecasts
- **Problems** arise in forecasting accuracy and uncertainty for states that are polled few and in those days with no polls at all

Conclusions

- **Web data** as a source of spontaneous public opinions to solve lack of data issues (as *Rizk et. al, 2023*)
- **Correlated vote intentions** across states (for example, if a candidate is performing bad in a state, this might indicate that he will also underperform in other states)

These factors may help to improve early forecast accuracy of the models.

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Thank you!