

LINEAR MODELING OF ELECTION RESULTS FOR U.S. HOUSE OF  
REPRESENTATIVES CANDIDATES AND STATE EXECUTIVE OFFICES FOR IOWA,  
MINNESOTA, AND NORTH DAKOTA

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**Title**

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State University's regulations and meets the accepted standards for the degree of

**MASTER OF SCIENCE**

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## ABSTRACT

Better understanding the relationship between the results for the U.S. House of Representatives and for state executive offices could potentially be useful in predicting outcomes if a significant relationship is present and if one has more information about either the election for the U.S. House of Representatives candidate or the state executive office candidate.

To better understand this relationship, election results were analyzed using regression models for three upper Midwest states - Iowa, Minnesota, and North Dakota - to compare the outcomes of the state executive office elections and the U.S. House of Representative elections. Additionally, median income was included in the models to see if this affected the relationship.

Each state had a statistically significant relationship between the results of the state executive offices and the U.S. House of Representatives. Median income either was not statistically significant or not practically significant in overall effect on the relationship.

## ACKNOWLEDGMENTS

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## CHAPTER 1. INTRODUCTION

For this research thesis, we investigated whether the election results for the candidates in the U.S. House of Representatives had a positive linear correlation with the election results for candidates for state executive offices such as Governor and Secretary of State for the states of North Dakota, Minnesota, and Iowa from 2010-2012.

We also investigated whether election year had a significant effect on the linear correlation as the relationship between Congressional election results and state executive election results may vary from year to year.

Additionally, we investigated whether the median household income (MHI) as identified by the U.S. Census Bureau had a significant effect on the linear correlation between the election results as it was hypothesized the economic standing may be a factor in any differences in the election results between the elections for state executive offices and U.S. House of Representatives.

The goal of this research was to better understand the relationship between the election races at the state executive and Congressional levels. Such knowledge may help clarify how election races might be connected within the context of the three states analyzed and whether this connection holds up across multiple years. While the results may not necessarily have strong predictive value for future elections, this could still be potentially useful if there's a tendency toward consistent voting that has existed in the past, which may better inform messaging and strategy when establishing campaign strategy and goals for future races. There is a consistent desire to better understand past behavior by the voters to gauge what may be viable strategies for the future. Additionally, the lack of information for state executive and state legislative races, along with less resources, created additional challenges.



## CHAPTER 2. LITERATURE REVIEW

Upon researching previous work done that compared outcomes of state executive office elections to Congressional elections in the United States, no studies could be located. However, there are various studies that compared different ways that Congressional election results could be impacted that may be possibly beneficial in understanding a relationship between state executive and Congressional races.

Most directly, Pew Research did a study comparing U.S. Senate elections to the Presidential race, and it found that election results were positively correlated with party identification (Desilver, 2018). While mismatches between elections still can occur, they were less frequent and states were more likely to elect Senators from the same party as their Presidential choice (Desilver, 2018). If this holds up consistently with state executive elections and the U.S. House of Representatives, this could indicate a consistency with those elections.

Indirectly, several studies have also given other possible things to look out for in the analysis. One such study has shown that voting behavior has trended toward voting for political parties more so than candidates (Tausanovitch and Warshaw, 2018). This is based on survey-based studies, which aligns well with the finding from Pew Research. A study by Joesten and Stone (2014) found that voters tend toward spatial voting models where voters are more likely to make decisions based on issues and parties as opposed to decisions based on the candidates themselves. Braha and de Aguiar (2017) found that voting behavior is more subject to social influence on a high level, which may lead to more consistent results on Presidential results; this effect could possibly translate to more consistent results in federal and state executive elections due to the scale.

There was difficulty in finding any research that compared federal election results with election results for state offices. This research is an attempt to start these comparisons.

## CHAPTER 3. METHODS

The election results from three states were selected for the study. These states included Minnesota, North Dakota, and Iowa. Separate models were set up for each of the states collected from 2002 to 2014 on the following variables.

- The overall vote totals for the governor elections and secretary of state elections for each candidate that ran. The percentage of the Republican vote of this total formed the dependent variable. If both a governor election and a secretary of state election was held the same year for a state, these were analyzed separately in two different models for that state. This data was collected from the ND Secretary of State election results websites for 2000-2009 and 2010-2019 (2019), Iowa Secretary of State election results website (2019), and Minnesota Secretary of State election results website (2019).
- The overall vote totals for the U.S. House of Representative elections for each candidate that ran. The percentage of the Republican vote of this total formed the primary independent variable. In the event of a county having multiple Congressional districts within its borders, the vote totals were combined by party.
- Median household income information was also recorded in the dataset as pulled from the Small Area Income and Poverty Estimates (SAIPE) Project conducted by the U.S. Census Bureau for each of those years (2002-2014) for each county in those three states. (*Small Area Income and Poverty Estimates (SAIPE) Program, 2019*). This formed an additional independent variable.

- The election years themselves were documented and formed indicator variables to measure the possible impact of specific years on the dependent variable - the state executive office results.

Linear regression models were formed for each state as stated earlier, with the percentages of those voting Republican for the state executive offices as the dependent variable. The independent variables analyzed were the percentages of those voting Republican for the U.S. House (Federal) elections and from the Median Household Income (MHI), with indicator variables formed from the year 4 year periods and Presidential election years as previously mentioned. This formed the following linear model with the following variables.

$$Y_1 = B_0 + X_1 * B_1 + X_2 * B_2 + I_{(\text{PresYear})} * B_3 + I_{(2000-2003)} * B_4 + I_{(2004-2007)} * B_5 + I_{(2008-2011)} * B_6$$

$Y_1$  = Prediction of State Executive Office Results (Republican percentage of total vote)

$X_1$  = U.S. House of Representatives Results (Republican percentage of total vote)

$X_2$  = Median Household Income (MHI)

$I_{(\text{PresYear})}$  = Indicator for the years 2004, 2008, 2012

$I_{(2000-2003)}$  = Indicator for the years 2000-2003

$I_{(2004-2007)}$  = Indicator for the years 2004-2007

$I_{(2008-2011)}$  = Indicator for the years 2008-2011

The specific state executive office results being analyzed will vary by state and by year due to inconsistencies in what office is up for election that year, which will be detailed in greater detail in the respective sections for each state. There is no indicator for 2012-2015 because this is represented when the other year indicators are set to zero.

## CHAPTER 4. RESULTS

### North Dakota Results

For North Dakota, a single model was able to be created as, for the dependent variables, the state executive office elections of Governor and Secretary of State alternated election years with Governor elections occurring in 2004, 2006, 2008, and 2012 and Secretary of State elections occurring in 2002, 2006, 2010, and 2014.

A univariate multiple linear regression procedure was performed in SAS with the following results. That null hypothesis was rejected ( $P < .0001$ ) and the parameters were all significant at  $P=.05$ . The reported  $R^2$  value is .6726 indicating 67.26% of the variation in responses is explained by the model.

$$\text{N.D. State Executive Results} = .118 + .706*(\text{ND U.S. House Result}) + .00000135*\text{MHI} + .0673*I_{(\text{PresYear})} + .06250*I_{(2000-2003)} + .15499*I_{(2004-2007)} + .14142*I_{(2008-2011)}$$

Table 1: ND Model Results - Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 7   | 4.85052        | 0.69293     | 137.63  | <.0001 |
| Error           | 469 | 2.36136        | 0.00503     |         |        |
| Corrected Total | 476 | 7.21187        |             |         |        |

Table 2: ND Model Results - Summary of Fit

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.07096  | R-Square | 0.6726 |
| Dependent Mean | 0.64551  | Adj R-Sq | 0.6677 |
| Coeff Var      | 10.99229 |          |        |

Table 3: ND Model Results - Parameter Estimates

| Variable          | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-------------------|----|--------------------|----------------|---------|---------|
| Intercept         | 1  | 0.11791            | 0.03304        | 3.57    | 0.0004  |
| Fed_R             | 1  | 0.70560            | 0.03105        | 22.72   | <.0001  |
| MHI               | 1  | 0.00000135         | 4.349156E-7    | 3.10    | 0.0021  |
| Presidential_Year | 1  | 0.06733            | 0.00699        | 9.64    | <.0001  |
| 2000_2003         | 1  | 0.06250            | 0.01747        | 3.58    | 0.0004  |
| 2004_2007         | 1  | 0.15499            | 0.01806        | 8.58    | <.0001  |
| 2008_2011         | 1  | 0.14142            | 0.01540        | 9.18    | <.0001  |

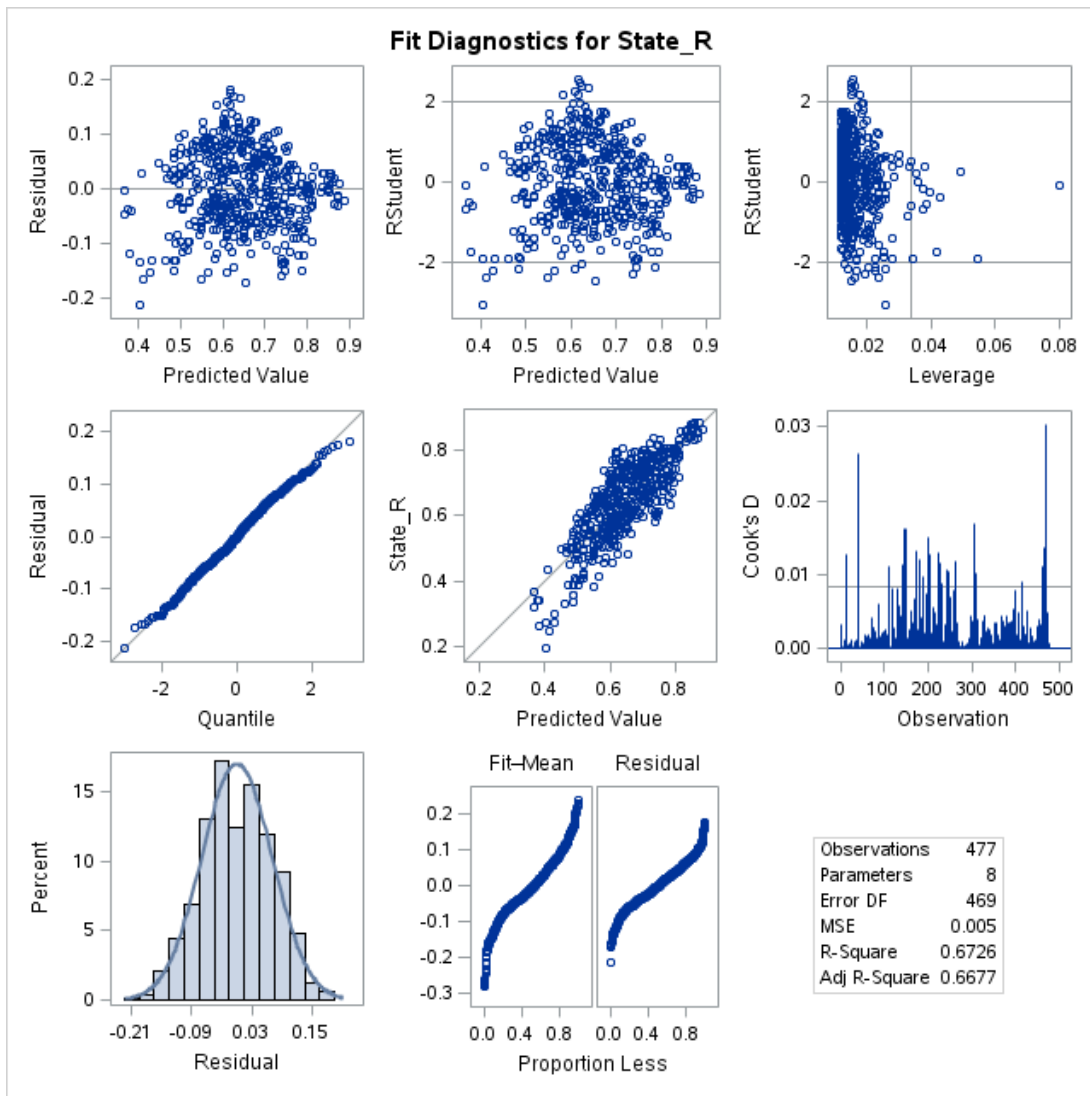


Figure 1: ND Model Results - Fit Diagnostics

The linear model for North Dakota showed, as expected, the largest impact from the ND U.S. House of Representatives At-Large election result indicating that there's a close relationship between the two results. However, there was a significant impact of each election cycle through the indicators except for 2012 - 2015; the election cycles from 2002 to 2011 saw an additive effect that increased the percentage results of the state executive office at the top of the ticket, indicating that on the average that office outperformed the federal race in the counties of ND. Notably, 2012-2015 was insignificant - that was the period when both the ND U.S. House of Representatives At-Large office and all state executive offices were held by Republicans instead of the previous election cycles that had a Democratic-NPL politician hold the ND U.S. House of Representatives At-Large office.

Presidential year also played a significant role indicating that Presidential years correlate to stronger results for the lead State Executive office up for election in a given Presidential year.

Finally, median household income, while significant, was small in overall impact on the model indicating that there is some connection between median household income and election results, but, on the average across all counties, there was stronger predictive performance in the other variables available.

#### Minnesota Models

For Minnesota, separate models were constructed for the Governor's results from 2002-2014 and Secretary of State's results from 2002-2014 as the elections for both occurred in the same years (2002, 2006, 2010, 2014).

Both models are significant. For the MN Gov model, the 2000-2003 indicator and 2008-2011 indicators are non-significant. For the MN SOS model, all indicator variables are non-significant. For both models, the MHI variable, while significant, is close to zero. The  $R^2$  for the

MN Gov model was .3206 while the R<sup>2</sup> for the MN SOS model was .1755, indicating that roughly 32% and 18% of the variation in responses was explained by the respective models.

$$\text{MN Gov Results} = .2922 + .26589 * (\text{MN U.S. House Result}) + .00000121 * \text{MHI} - 0.01942 * I_{(2000-2003)} + .03549 * I_{(2004-2007)} - .01109 * I_{(2008-2011)}$$

$$\text{MN SOS Results} = .39664 + .21924 * (\text{MN U.S. House Result}) + .000000517 * \text{MHI} - 0.01809 * I_{(2000-2003)} - .01188 * I_{(2004-2007)} - .01626 * I_{(2008-2011)}$$

Table 4: MN Gov Model Results - Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 5   | 0.61528        | 0.12306     | 32.28   | <.0001 |
| Error           | 342 | 1.30373        | 0.00381     |         |        |
| Corrected Total | 347 | 1.91901        |             |         |        |

Table 5: MN Gov Model Results - Summary of Fit

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.06174  | R-Square | 0.3206 |
| Dependent Mean | 0.46580  | Adj R-Sq | 0.3107 |
| Coeff Var      | 13.25496 |          |        |

Table 6: MN Gov Model Results - Parameter Estimates

| Variable  | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|----|--------------------|----------------|---------|---------|
| Intercept | 1  | 0.29222            | 0.02092        | 13.97   | <.0001  |
| MHI       | 1  | 0.00000121         | 3.89251E-7     | 3.11    | 0.0020  |
| CONG_R    | 1  | 0.26589            | 0.03206        | 8.29    | <.0001  |
| 2002      | 1  | -0.01942           | 0.01045        | -1.86   | 0.0641  |
| 2006      | 1  | 0.03549            | 0.00989        | 3.59    | 0.0004  |
| 2010      | 1  | -0.01109           | 0.00958        | -1.16   | 0.2477  |



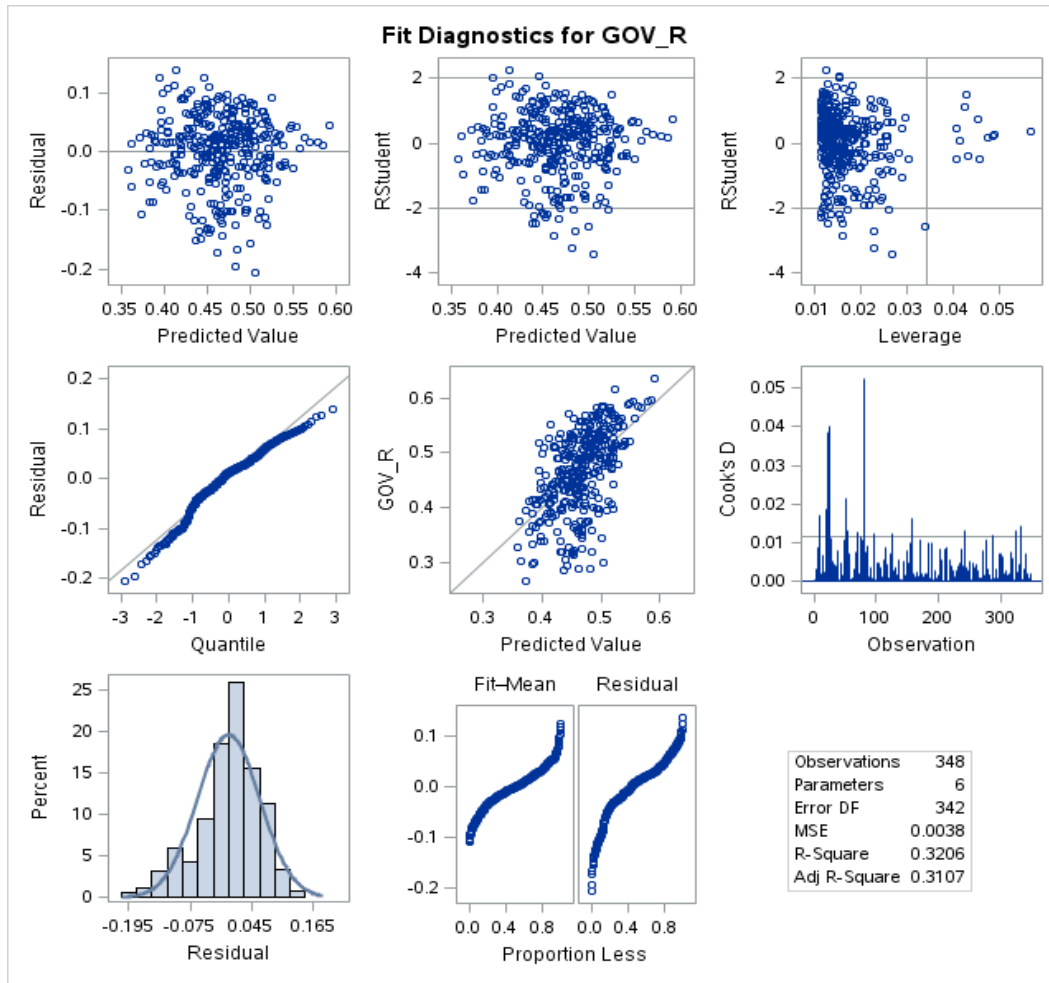


Figure 2: MN Gov Model Results - Fit Diagnostics

Table 7: MN SOS Model Results - Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 5   | 0.27696        | 0.05539     | 14.56   | <.0001 |
| Error           | 342 | 1.30120        | 0.00380     |         |        |
| Corrected Total | 347 | 1.57817        |             |         |        |

Table 8: MN SOS Model Results - Summary of Fit

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.06168  | R-Square | 0.1755 |
| Dependent Mean | 0.48199  | Adj R-Sq | 0.1634 |
| Coeff Var      | 12.79733 |          |        |

Table 9: MN SOS Model Results - Parameter Estimates

| Variable  | DF | Parameter Estimate | Standard Error | t Value | Pr >  t | Standardized Estimate |
|-----------|----|--------------------|----------------|---------|---------|-----------------------|
| Intercept | 1  | 0.39664            | 0.02090        | 18.98   | <.0001  | 0                     |
| FedR      | 1  | 0.21924            | 0.03203        | 6.85    | <.0001  | 0.38835               |
| MHI       | 1  | 5.177212E-8        | 3.888737E-7    | 0.13    | 0.8942  | 0.00813               |
| 2000_2003 | 1  | -0.01809           | 0.01044        | -1.73   | 0.0841  | -0.11634              |
| 2004_2007 | 1  | -0.01188           | 0.00988        | -1.20   | 0.2298  | -0.07640              |
| 2008_2011 | 1  | -0.01626           | 0.00957        | -1.70   | 0.0902  | -0.10452              |

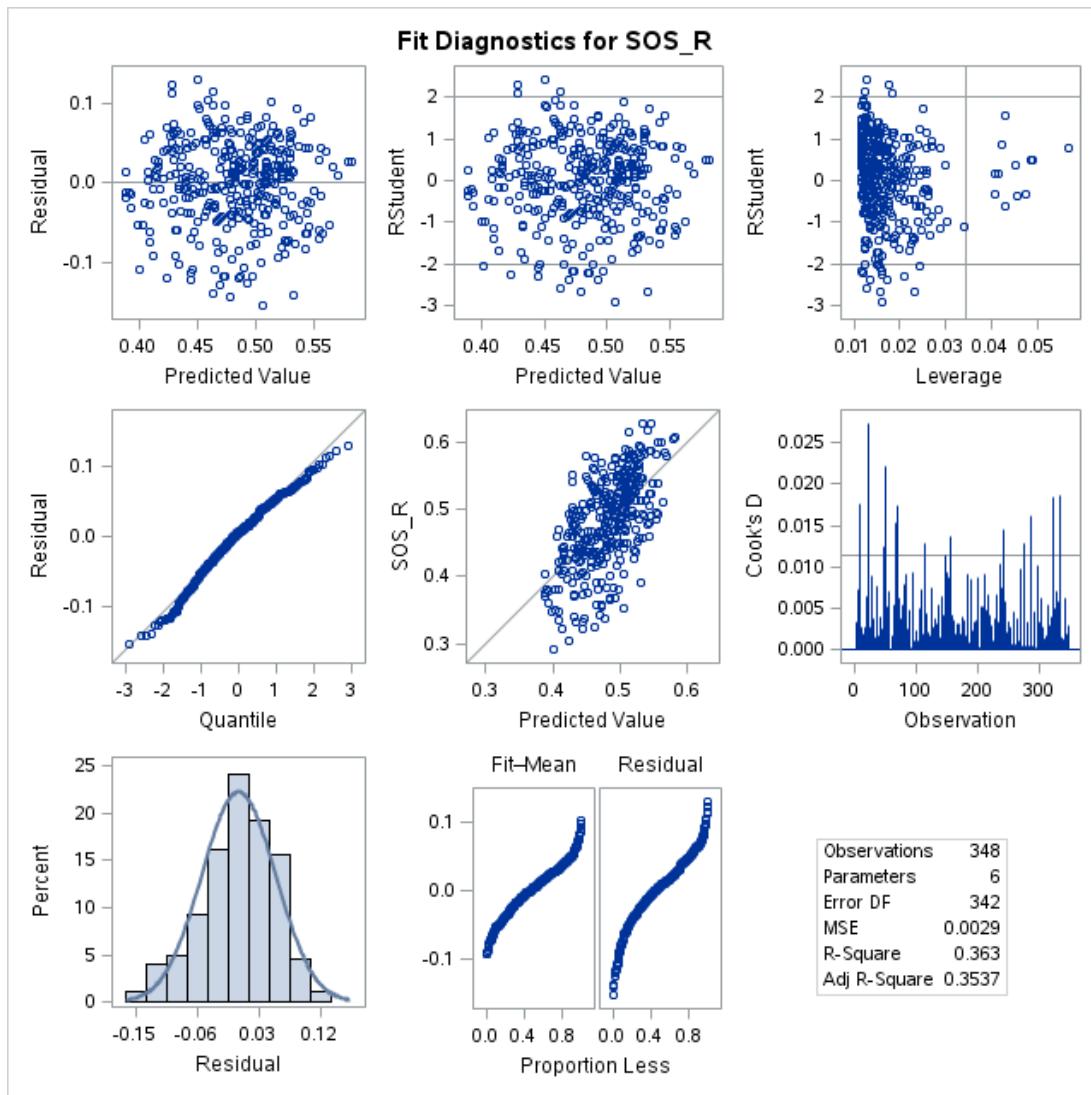


Figure 3: MN SOS Model Results - Fit Diagnostics

Both models did not explain a lot of variation in responses between the state executive races and the congressional races, with the Secretary of State results being particularly low with an R<sup>2</sup> of 17.55%. A possible explanation may be due to the years that had a competitive independent run for both state executive offices - one even won with Jesse Ventura in the 1999 election - while most Congressional races were two-party affairs. The increased competition may have caused too much variance in the models, despite the models being significant, to hold strong explanatory value. This, however, could be useful in that it may be worthwhile to consider the impact of third-party candidates and significant independent candidates are involved.

#### Iowa Models

For Iowa, separate models were constructed for the Governor's results and SOS results for 2002-2014. Both models are significant. For the IA Gov model, the 2000-2003 indicator and 2008-2011 indicators are significant. For the IA SOS model, only the 2002 indicator is significant. For both models, the effect of the MHI, while significant, is close to zero. The R<sup>2</sup> for the IA Gov model was .7881 while the R<sup>2</sup> for the IA SOS model was .6622, indicating that roughly 79% and 66% of the variation in responses was explained by the respective models.

$$\text{IA Gov Results} = .24252 + .71277 * (\text{IA U.S. House Result}) + .00000014 * \text{MHI} - 0.17785 * I_{(2000-2003)} - .14596 * I_{(2004-2007)} - .08545 * I_{(2008-2011)}$$

$$\text{IA SOS Results} = .04042 + .74410 * (\text{IA U.S. House Result}) + .00000109 * \text{MHI} - 0.05871 * I_{(2000-2003)} - .00898 * I_{(2004-2007)} - .00966 * I_{(2008-2011)}$$

Table 10: IA Gov Model Results - Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 5   | 3.86209        | 0.77242     | 289.38  | <.0001 |
| Error           | 389 | 1.03833        | 0.00267     |         |        |
| Corrected Total | 394 | 4.90042        |             |         |        |

Table 11: IA Gov Model Results - Summary of Fit

|                |         |          |        |
|----------------|---------|----------|--------|
| Root MSE       | 0.05166 | R-Square | 0.7881 |
| Dependent Mean | 0.54409 | Adj R-Sq | 0.7854 |
| Coeff Var      | 9.49563 |          |        |

Table 12: IA Gov Model Results - Parameter Estimates

| Variable  | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|----|--------------------|----------------|---------|---------|
| Intercept | 1  | 0.24252            | 0.02933        | 8.27    | <.0001  |
| MHI       | 1  | -1.41748E-7        | 4.739972E-7    | -0.30   | 0.7651  |
| CONG_R    | 1  | 0.71277            | 0.02928        | 24.34   | <.0001  |
| 2002      | 1  | -0.17785           | 0.00974        | -18.25  | <.0001  |
| 2006      | 1  | -0.14596           | 0.00863        | -16.91  | <.0001  |
| 2010      | 1  | -0.08545           | 0.00775        | -11.02  | <.0001  |

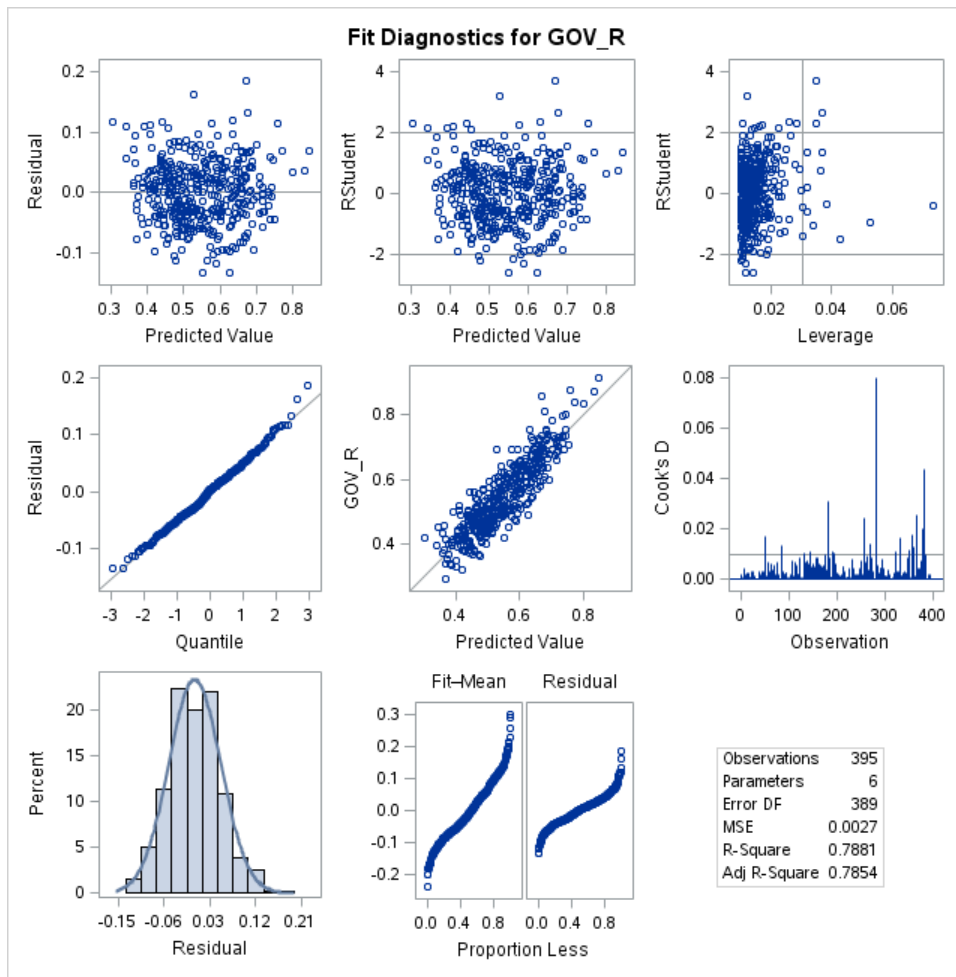


Figure 4: IA Gov Model Results - Fit Diagnostics

Table 13: IA SOS Model Results - Analysis of Variance

| Source          | DF  | Sum of Squares | Mean Square | F Value | Pr > F |
|-----------------|-----|----------------|-------------|---------|--------|
| Model           | 5   | 2.17865        | 0.43573     | 152.54  | <.0001 |
| Error           | 389 | 1.11119        | 0.00286     |         |        |
| Corrected Total | 394 | 3.28984        |             |         |        |

Table 14: IA SOS Model Results - Summary of Fit

|                |          |          |        |
|----------------|----------|----------|--------|
| Root MSE       | 0.05345  | R-Square | 0.6622 |
| Dependent Mean | 0.49802  | Adj R-Sq | 0.6579 |
| Coeff Var      | 10.73179 |          |        |

Table 15: IA SOS Model Results - Parameter Estimates

| Variable  | DF | Parameter Estimate | Standard Error | t Value | Pr >  t |
|-----------|----|--------------------|----------------|---------|---------|
| Intercept | 1  | 0.04042            | 0.03034        | 1.33    | 0.1835  |
| MHI       | 1  | 0.00000109         | 4.903446E-7    | 2.23    | 0.0265  |
| CONG_R    | 1  | 0.74410            | 0.03029        | 24.56   | <.0001  |
| 2002      | 1  | -0.05871           | 0.01008        | -5.82   | <.0001  |
| 2006      | 1  | -0.00898           | 0.00893        | -1.01   | 0.3151  |
| 2010      | 1  | -0.00966           | 0.00802        | -1.20   | 0.2291  |

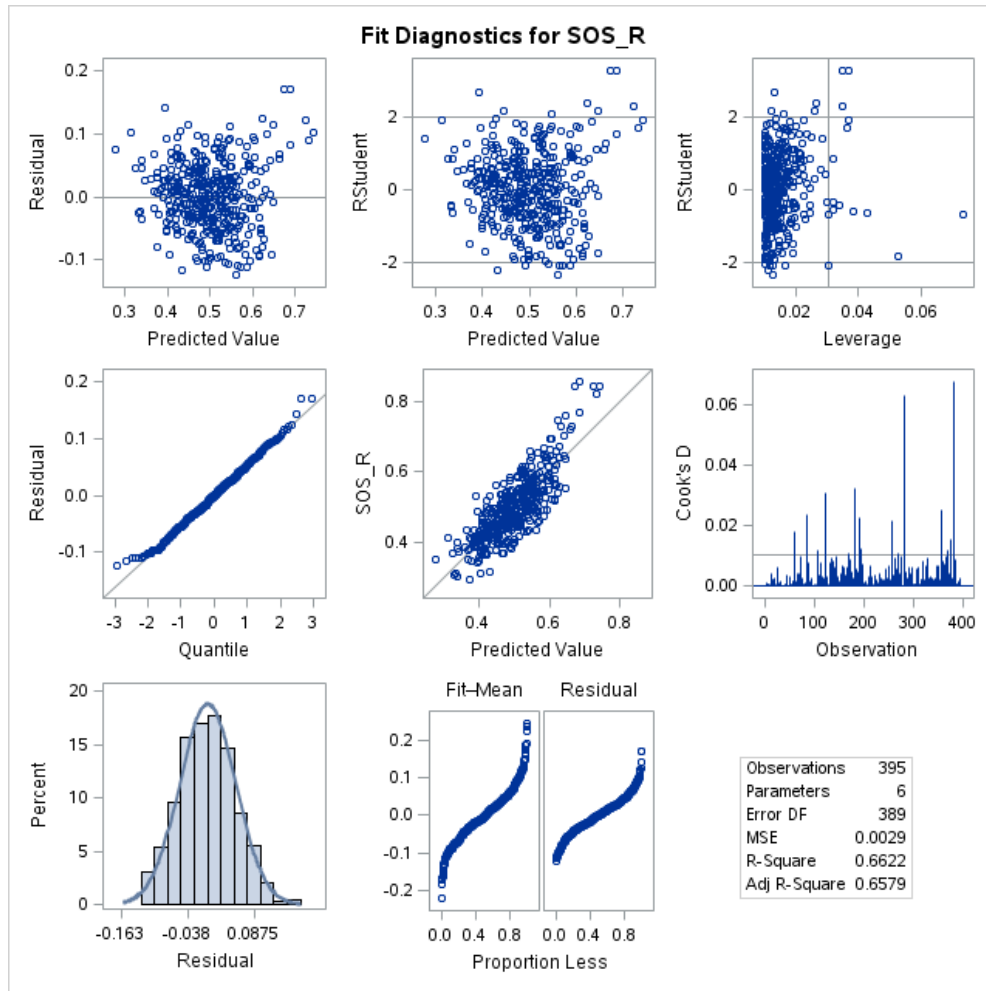


Figure 5: IA SOS Model Results - Fit Diagnostics

Both models were significant and accounted for some explanation in the variation of the percentage of voters who voted Republican for the state office. There were more consistent results than Minnesota, though the individual years still impacted the percentage. However, for each year of the Governor’s model, the indicator coefficients decreased in how much they impact the model which means the federal election result contributes more directly to the prediction of the state election result for Governor. For the SOS, this isn’t necessarily the case, but the indicator coefficients were also smaller and had less of an impact on predictions.

## CHAPTER 5. SUMMARY

Consistently across all three states, the election results for U.S. House of Representative races could be used to predict the general outcome of the state executive races, though the consistency for Minnesota was weakest due to the independent party races. However, median household income was either not significant or had no practical effect on the overall outcome. This held up across all indicators though the effect of certain years was stronger than other years.

While the practical applications of this information may be limited, it can assist with gauging expectations within a state in terms of the likelihood of state and federal races differentiating from each other when evaluating the possible performance of a new candidate in comparison to candidates with electoral history.

Future research could focus on other races - such as state legislative - and possibly on the impact of other variables such as fundraising and expenditures. Additionally, U.S. Senate elections which are less frequent and have increased national attention may be a worthwhile investigation as voters may be more likely to vote outside of their party choice for U.S. House or state executive offices.

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