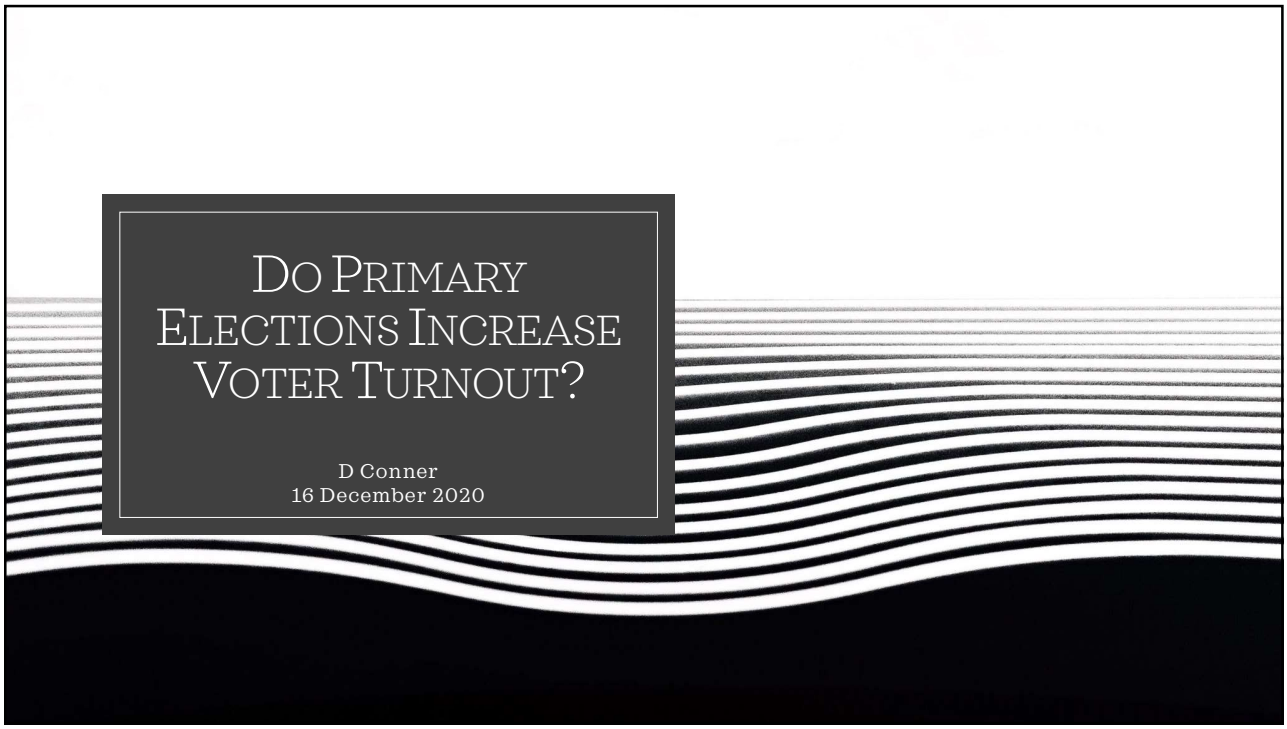



1

## Project Motivation & Focus

- "Do primary challengers increase electoral turnout in primary and general elections?"
- Does how we choose candidates (appointments & incumbents vs primary elections) affect participation?
- Focus on one state, Delaware
  - Generate valid comparisons: Election systems differ drastically by state – electoral cycles, offices, and primary rules
  - Keep data pre-processing manageable: Manual collation of data from multiple years and formats
- Rephrase to two questions that can actually be answered
  - Are primary challenges associated with increased turnout in primary elections?
  - Are primary challenges associated with increased turnout in general elections?

2

# Delaware Electoral System

- Delaware has general elections every 2 years
- Federal election schedules
  - US House Representative (1): Every 2 years
  - President: Every 4 years
  - US Senate (2): Every 6 years, staggered
- Statewide offices are split into cycles
  - Presidential years: Governor, Lt. Governor, Insurance Commissioner
  - Midterm years: Attorney General, Treasurer, Auditor
- History
  - Primaries became permissible (vs party leadership appointment) in 1970
  - Minimum voting age was lowered from 21 to 18 in 1970, effective for 1972

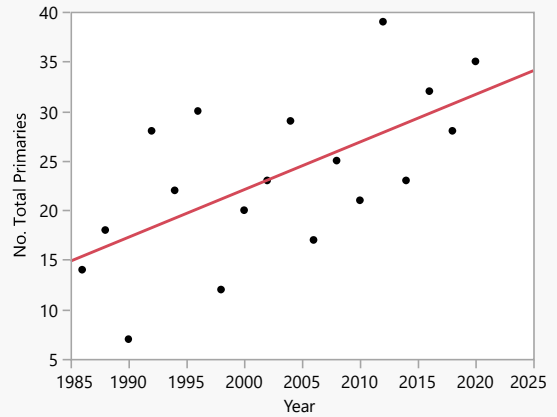
3

# Data Sources

- Delaware State Department of Elections
  - Voting tally data at office level
  - Voter registration data
  - Time period: 1986-2020
  - Data formats: Text, delimited text, CSV, PDF
- Simplification of data
  - Regular primary and general elections only (no special elections or school board)
  - Statewide offices (not local legislators, county offices, city council)
  - One table of summary data – one line per year
  - Third party candidates consolidated to a single line, whether 1 or 6
  - For analysis, third party candidates were excluded: Frequent, low support, & no primaries

4

# Primary Prevalence over Time




- Overall trend for increasing number of party primaries
- Total Primaries = statewide & local
- Linear fit
  - No. Total Primaries = -936.6584 + 0.4793602*Year
  - R2 (adj) = 35%
  - p < 0.01 for linear parameters

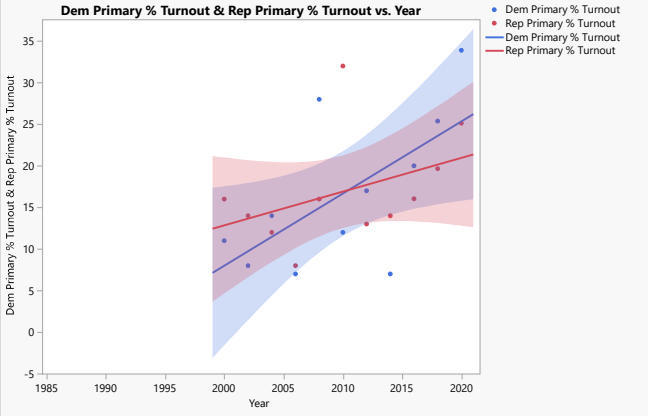
5

# Q1. Are primary challenges associated with increased turnout in **primary** elections?

- Primary turnout data were available from 2000-2020
- Summary Data
  - Ys: Party % Turnout in the presidential or state primary election
  - Xs: Year, Election cycle (pres, midterm), Number of primaries (statewide, local, city of Wilmington)
- Detailed Data
  - Ys: Party % Turnout in the presidential or state primary election
  - Xs: Year, Primary for race

6

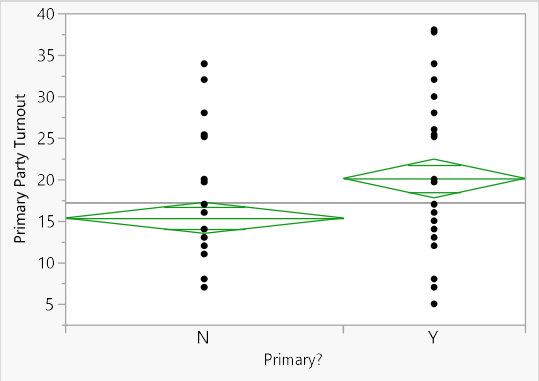
# Primary Election Turnout over Time




- Overall trend for increasing primary participation
- No significant difference between trends for Democratic & Republican parties
  - Dem line appears steeper
  - Strong overlap of 95% CI of lines

7

# Primary Turnout vs Number of Primaries




- ANOVA:
  - Y: Primary % turnout for the party
  - Factor: Did race (from general election) have a primary?

| Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F |
|---|---|---|---|---|---|
| Primary? | 1 | 615.3840 | 615.384 | 10.0038 | 0.0020* |
| Error | 112 | 6889.7020 | 61.515 | | |
| C. Total | 113 | 7505.0860 | | | |

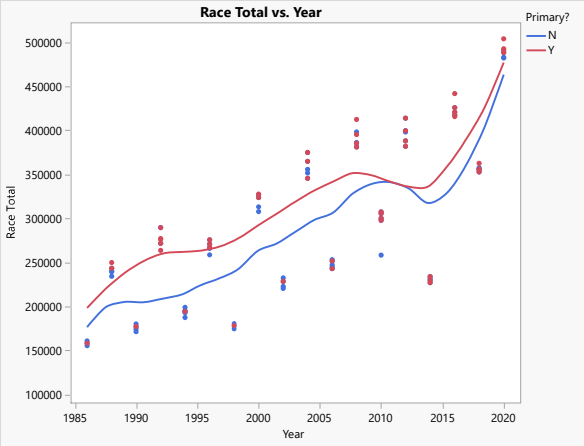
8

# Q2. Are primary challenges associated with increased turnout in **general** elections?

- General election turnout data are available from 1986-2020
- Summary Data (comparisons not shown)
  - Ys: Total % Turnout
  - Xs: Year, Election cycle (pres, midterm), Number of primaries (statewide, local, city of Wilmington)
- Detailed Data
  - Ys: Total % Turnout, Race total votes
  - Xs: Year, Primary for race, Office, Incumbent
  - Unused data: Registered voters in party, Registered voters total, Primary turnout, Total voted (incomplete source data)

9

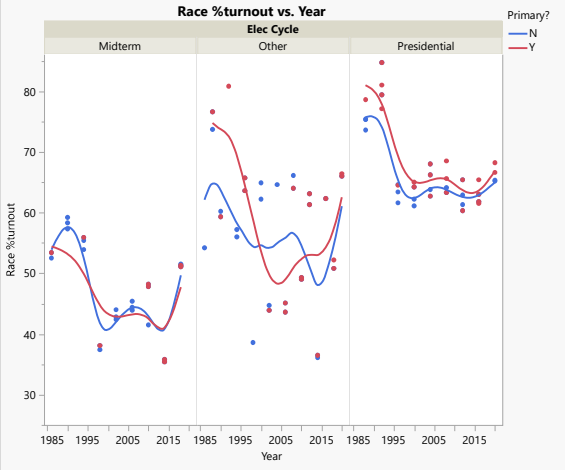
# General Election Turnout over Time




- Trends:
  - Overall: Increasing number of total votes cast
  - Cyclic: Higher turnout in presidential election years than midterms
- Confounding variables
  - Election cycle
  - Increased total votes simply because of increased number of eligible residents

10

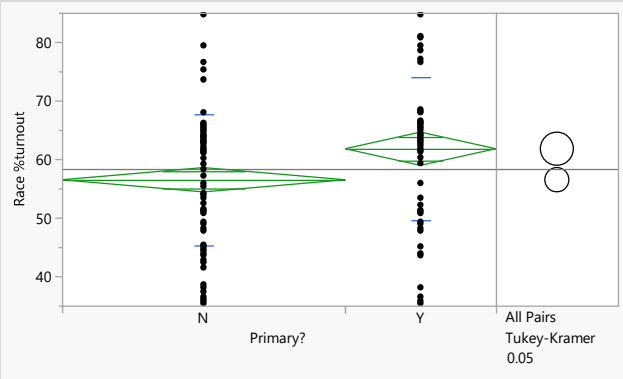
# General Election Turnout over Time




- Confounding variables
  - Election cycle
  - Increased total votes simply because of increased number of eligible residents
- Reduction of impact
  - Split view by election cycle
  - Use % turnout instead of raw votes.
- Percent turnout is highest with primary in presidential years
- Turnout % has been steady since 1995

11

# But, really, is turnout different?

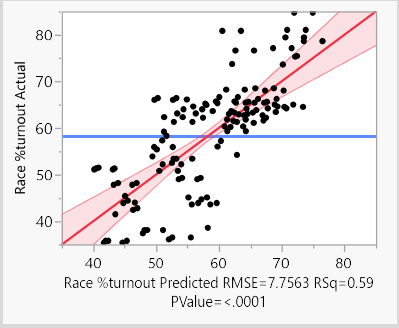



- ANOVA and means analysis on races with primaries (187 pts)
- Variances are equal
- R2 ~ 4% -- broad data spread
- Turnout for races with primaries IS slightly higher than races without

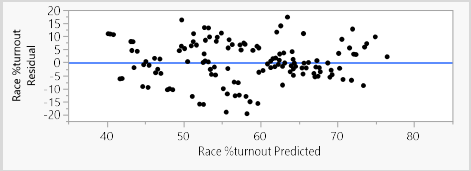
| Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F |
|---|---|---|---|---|---|
| Primary? | 1 | 1187.085 | 1187.08 | 8.8888 | 0.0033* |
| Error | 185 | 24706.445 | 133.55 | | |
| C. Total | 186 | 25893.529 | | | |

12

# Predicting Turnout: Linear Model




Residual by predicted value




- Y term: Race % Turnout
- X terms: Office, Year, Primary

832.14438851
+ -0.386022936 • Year
+ Match(Office, "Attorney General" ⇒ -11.21432425, "Auditor of Accounts" ⇒ -11.48612468, "Governor" ⇒ 9.1677979259, "Insurance Commissioner" ⇒ 6.9293945696, "Lt Governor" ⇒ 8.8833861788, "President" ⇒ 10.271896884, "Treasurer" ⇒ -10.79723579, "US House" ⇒ -1.142496711, "US Senate" ⇒ -0.612294119, else ⇒ .)
+ Match(Primary?, "N" ⇒ -1.477184897, "Y" ⇒ 1.4771848965, else ⇒ .)

| Fit Quality | Value (%) |
|---|---|
| Fit R2 | 59.1 |
| Fit R2 (adj) | 56.8 |
| PRESS | 54.4 |

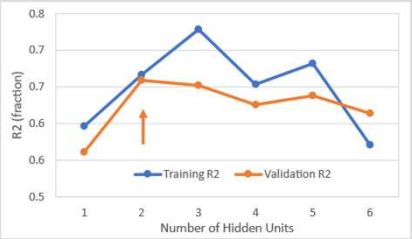
| Source | LogWorth | PValue |
|---|---|---|
| Office | 24.054 | 0.00000 |
| Year | 9.917 | 0.00000 |
| Primary? | 1.545 | 0.02851 |

| Group | Offices |
|---|---|
| A | Pres, Gov, Lt Gov, Ins Com. |
| B | US House, US Senate |
| C | Atty Gen, Treas, Auditor |

13

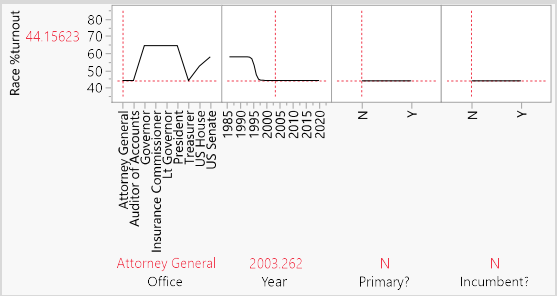
# Predicting Turnout: Neural Model

- Y: Race % Turnout
- Xs: Office, Year, Primary, Incumbent
- Neural network model:
  - Created fixed validation column
  - Params: TanH model, no penalty, 10 tours
  - Run model with varying number of HUs
  - Best validation R2 with 2 HUs (R2 65.9%)




- Prediction profile shows similar year and office trends to linear model
- Variable importance: Primary smaller effect than in linear model

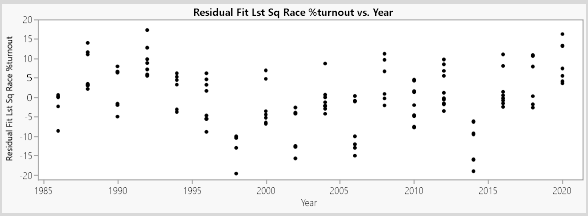
| Column | Main Effect | Total Effect |
|---|---|---|
| Office | 0.722 | 0.805 |
| Year | 0.191 | 0.272 |
| Primary? | 0.002 | 0.006 |
| Incumbent? | 2e-4 | 0.001 |




14

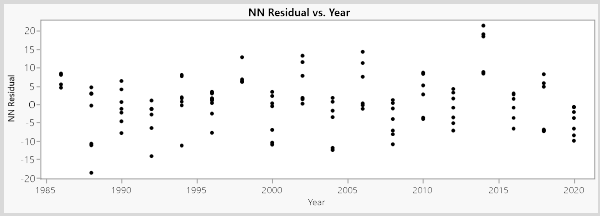
# Which model is superior? Model Residuals vs Year

**Linear Model**




- R2 (adj) = 56.8%
- Residuals have some complex structure

**Neural Network**




- R2 (validation) = 65.9%
- Residuals less structured than linear model, consistent with inclusion of nonlinear effects

15

# Conclusions

- Q1. Are primary challenges associated with increased turnout in primary elections?
  - Yes, primaries are associated with higher primary turnout
  - Primary contests have also increased in frequency and turnout over time
- Q2. Are primary challenges associated with increased turnout in general elections?
  - Yes, but effect is small; year and office have the strongest association with turnout
  - A neural network model predicts turnout rate better than a linear model with similar terms
- Further exploration
  - Would different models improve understanding? (e.g. time series analysis)
  - Are these conclusions the same for local races (state legislators, county and city officials)
  - What other factors impact turnout?
  - What are the trends for neighboring states?

16


17

## Supporting Files

Project Proposal Revised

Statewide Elections 1986-2020_JMP.jmp

Elections Summary 1986-2020_JMP.jmp

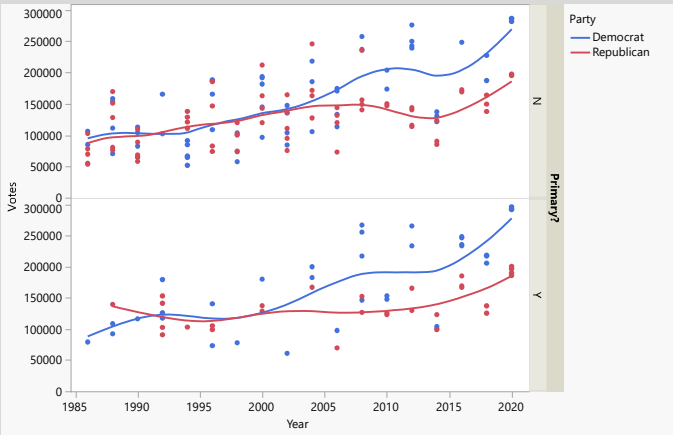
JMP files contain scripts for all figures/models (and then some)

Linear Model

Neural Network Model

18

# Differences in Votes Cast by Party and Primary

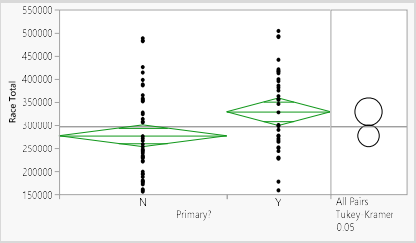



- Votes cast for statewide candidates from different parties …
  - … are similar up to year 2002
  - … differ after 2002.
- This trend appears unaffected by primaries

19

# Differences in Total Turnout by Party and Primary

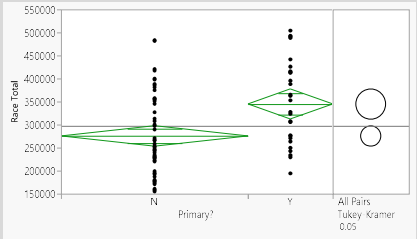
**Democratic**




| Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F |
|---|---|---|---|---|---|
| Primary? | 1 | 6.0904e+10 | 6.09e+10 | 7.4931 | 0.0074* |
| Error | 92 | 7.4778e+11 | 8.128e+9 | | |
| C. Total | 93 | 8.0868e+11 | | | |

- Means and difference are similar to overall

**Republican**



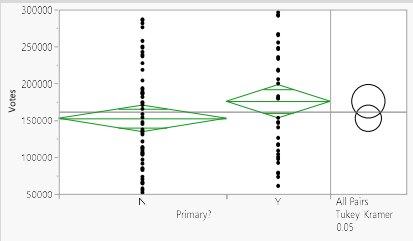

| Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F |
|---|---|---|---|---|---|
| Primary? | 1 | 9.5471e+10 | 9.547e+10 | 12.2067 | 0.0007* |
| Error | 91 | 7.1173e+11 | 7.8212e+9 | | |
| C. Total | 92 | 8.072e+11 | | | |

- Means and difference are similar to overall
- Separation looks slightly stronger

20

# Differences in Party Votes by Primary

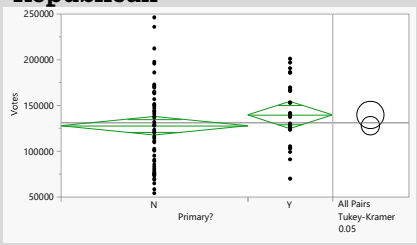
**Democratic**




| Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F |
|---|---|---|---|---|---|
| Primary? | 1 | 1.1867e+10 | 1.187e+10 | 2.5209 | 0.1158 |
| Error | 92 | 4.3308e+11 | 4.7074e+9 | | |
| C. Total | 93 | 4.4494e+11 | | | |

- Difference becomes insignificant when examining only votes cast for the primary winner, for both R and D parties

**Republican**




| Source | DF | Sum of Squares | Mean Square | F Ratio | Prob > F |
|---|---|---|---|---|---|
| Primary? | 1 | 2786587868 | 2.7866e+9 | 1.7148 | 0.1937 |
| Error | 91 | 1.4787e+11 | 1.625e+9 | | |
| C. Total | 92 | 1.5066e+11 | | | |

- Approx. 30% of registered voters are unaffiliated with a party
- Primary voters are a small portion of total voters -- at most 34% of the party

21