Understanding voter choice through political values in New Zealand

Introduction

This research note explores the role political values and beliefs play in determining which party New Zealand voters choose during general elections. It begins by briefly noting different theories relating to voter behaviour, before exploring the New Zealand political context and policy platforms of the four largest parties. Data from the 2017 New Zealand election study is then used to assess the extent to which voters' political values and beliefs impact their choices at general elections and whether they align with parties' policy agendas. It concludes that voters' political values and beliefs do play a substantial role in New Zealand elections but more work is needed to improve the predictive accuracy of the models used.

Background

One of the most intuitive determinants of voter choice in elections is to what extent the parties or candidates on the ballot reflect an individual's political values and beliefs. However, some argue that other factors may actually be more important in predicting voter choice, such as class (Bean, 2009), race (Greaves et al., 2020), or more generally by which party themselves, or their family, has been affiliated with in the past (Bartels, 2000). Moreover, Palfrey and Poole (1987) suggest that voters may often be largely uninformed about candidates' and parties' ideologies and policy positions, making their own political beliefs have little bearing on their vote choice.

In New Zealand, class has traditionally been viewed as being strongly associated with party support, although Clive Bean (2009) suggests that this has weakened since the 1960s in a similar way to other countries. Greaves et al. (2020) argue that ethnic identity is a "key predictor of political behaviours for indigenous peoples" in New Zealand, with the Maori population's identity being associated with left-wing parties.

New Zealand's political history is closely tied to the United Kingdom and is similarly a constitutional monarchy with a parliamentary democracy (New Zealand Government, 2023). Its political system differs from the UK though in two key ways: it has a unicameral legislature (there is no equivalent to the House of Lords or senate as in other countries); and it has a proportional voting system. The latter was introduced in 1996 following referendums in 1992 and 1993 in which New Zealanders voted to replace the traditional first past the post (FPTP) with a mixed member proportional (MMP) voting system. (Simpson, 2022)

The current system (MMP) gives each member of the electorate two votes: one to determine their local MP; and a second national vote to determine the overall number of seats each party receives. There are 72 local MPs who are elected through FPTP to represent their area. The remaining 48 MPs (which together form a Parliament of 120 legislators) are then chosen according to a party list system, with each party receiving the number of additional seats needed to reach the national proportion of the vote determined by the electorate's second vote. (Electoral Commission, 2024)

Since MMP was introduced for the 1996 election, four political parties have generally been the most successful: National, Labour, Green, and New Zealand First (NZ First). However, in the two most recent elections, 2020 and 2023, ACT overtook NZ First as the fourth largest party (Electoral Commission, 2023). This research note though will primarily focus on New Zealand politics before the covid-19 pandemic to avoid any voting biases specific to the unique context of the pandemic; the 2020 election was widely regarded as being impacted by the pandemic and Labour won the only outright majority of any party under MMP (Guardian, 2020).

The National Party and Labour Party have generally been regarded as representing the centre-right and centre-left respectively, and have dominated New Zealand politics throughout its history. In the 2017 election, some specific policy issues included: education, with Labour promising a transition to free tertiary education; immigration, with both parties seeking to reduce it in different ways; child poverty, with Labour promising to provide additional support for families in need and take 100,000 children out of poverty; and abortion, which Labour promised to decriminalise and National supported the status quo (Guardian, 2017).

The Green Party has grown significantly since 1996 and has emphasised environmental policies and reducing inequality (Green, 2024). In 2017, their manifesto committed to climate change action, cleaning New Zealand's rivers, reducing poverty, and achieving a spending surplus to reduce government debt (Green, 2017).

NZ First was formed by Winston Peters in 1993 when he left the National Party having been an MP since 1979. Some commentators suggest that, although NZ First appear to be a typical "rightwing populist" party with an anti-immigration policy platform, the party has supported and formed coalitions with both Labour and National Governments (Guardian, 2023). Moreover, the party's early years were spent opposing the neoliberal policies of both major parties (Guardian, 2023).

Although Mr Peters is regarded as New Zealand's "most prominent Māori politician", he advocates for english to be the "primary official language of New Zealand", for the country to withdraw from the UN Declaration on the Rights of Indigenous Peoples (NZ First, 2023), and has previously campaigned for the removal of references to the Treaty of Waitangi from New Zealand Law (New Zealand Herald, 2005). The Treaty of Waitangi was a document signed in 1840 between the British Crown and Māori chiefs. It gave the indigenous Māori population specific rights and is seen as a founding document of New Zealand (Palmer, 2008).

This research note explores to what extent the political beliefs and values of the electorate influence their vote choice and whether they broadly match the party they choose. It also assesses to what extent an individual voter's political beliefs and values can be used to predict the party they actually vote for in a New Zealand general election.

Data

To assess this research question, I use the 2017 New Zealand Election Study (Vowles et al., 2022). An equivalent study takes place during every general election and is funded by various New Zealand universities and the New Zealand Electoral Commission. The most recent survey results to be published relate to the 2020 general election. However, as already noted, this election was significantly impacted by the Covid-19 pandemic which began earlier that year. I have therefore chosen to use data from the most recent election available that was not impacted by this unique context.

The data was collected shortly after the 2017 general election which took place in September. The study included 3,455 respondents and questions on a wide variety of topics to create 484 variables. This research note will use the variables related to which party the respondent voted for (if at all) as well as those focussed on political values that relate to the largest parties. Of the 3,455 respondents, 3,208 voted and 2,957 voted for one of the four largest parties. The distribution of votes in the dataset (for the four largest parties) are as follows:

Table 1 - Party vote distribution

Labour	National	Green	NZ First
1,203 (37.5%)	1,251(39.0%)	263 (8.2%)	240 (7.5%)

This corresponds to the results of the general election which were 36.9% for Labour, 44.5% for National, 6.3% for the Greens, and 7.2% for NZ First. Questions in the study relating to political values and beliefs include topics such as climate change, government debt, income inequality and the Treaty of Waitangi. These questions pose a statement to the respondent and allow them to respond on a five point likert scale. For example: “To act against climate change, stronger government policies are needed to reduce carbon emissions”, with the possible responses “strongly agree”, “somewhat agree”, “neither”, “somewhat disagree”, “strongly disagree” and “don’t know”. This scale is used to measure a respondent’s political beliefs and values on a particular topic.

Method

To estimate the effect of a voter’s political values and beliefs on their vote choice, I use multiple logistic regression. As vote choice is a categorical variable, it is recoded into four binary variables to represent each of the four largest parties at the 2017 New Zealand general election. Each binary variable is then used as the dependent variable for four separate multiple logistic regression models. For example, if a respondent voted for the Labour party, the binary variable representing Labour would have a value of 1 and the binary variables representing National, Green and NZ First would have a value of zero.

Logistic regression is generally regarded as a better model than ordinary least squares regression (OLS) when using a binary dependent variable. This is because OLS assumes heteroskedascity (variance of the errors is not constant) which cannot be true if the dependent variable is only ever 1 or 0. Moreover, as OLS assumes the dependent variable to be

continuous, it will likely produce predicted values of the dependent variable which are outside the 1 to 0 range, which is not valid when the output is taken to be a probability.

For the independent variables in the model, topics are chosen to represent a key policy agenda of each of the four main parties (as discussed in the 'Background' section) whilst also avoiding including too many variables that may increase the chance of crossover and therefore risk multicollinearity.[1] The initial model specification for each of the four multiple logistic regression models is as follows:

$$Y_{\mathrm{p}} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where for each respondent Y_{p} is whether they voted for the party corresponding to the model, X_1 is their view on whether "reference to the Treaty of Waitangi should be removed from the law", X_2 is their view on whether the "government should reduce its debt asap even if less money for public services", X_3 is their view on whether the "government should take measures to reduce differences in income levels", and X_4 is their view on whether "to act against climate change policies are needed to reduce carbon emissions".That is:

$$Y_{party} = \alpha + \beta_1(\textit{Treaty of Waitangi}) + \beta_2(\textit{government debt}) + \beta_3(\textit{income inequality}) + \beta_4(\textit{climate change}) + \varepsilon$$

As well as using each individual model to assess the effect of each variable on voter choice, the models can also be combined to predict which of the four major parties any individual respondent would have voted for. This is done by comparing the predicted probability of supporting each party, with whichever model produces the highest probability used to determine the party any given respondent is predicted to have voted for based on their political beliefs and values. For example, if the predicted outputs for a particular respondent were as follows, then the combined model would predict that they voted for the Labour Party:

Labour Party model: 0.6
National Party Model: 0.2
Green Party model: 0.25
NZ First model: 0.1

An alternative to this model specification could include more variables that also relate to each party's policy positions such as abortion, immigration, and spending on education. These additional variables will also be discussed below (in the 'Results' section) to assess their effect on voter choice and whether they improve the predictive power of the combined model.

For each independent variable included in the models, any "don't know" or NA responses are recoded as "neither" to maintain the likert scale and avoid losing a large number of responses in the analysis. This is based on the intuition that someone who doesn't know how they feel about

[1] Multicollinearity is assessed in appendix 2.

a statement is likely to neither agree nor disagree with it. However, I recognise that this may not be valid for all respondents who “don’t know” and may affect the results.

Results

The results of the four multiple logistic regressions, using the model specification outlined above, are displayed in Table 2 with the odds ratio for each variable in brackets. The results show that the coefficient calculated for all four independent variables included in the models have a statistically significant effect on the probability of the respondent voting for the corresponding party across all four models (p-value less than 0.05).

Table 2: Multiple logistic regressions

	Voter choice			
	Labour	National	Green	NZ First
	(1)	(2)	(3)	(4)
Treaty of Waitangi	0.163***	-0.363***	0.423***	-0.216***
Odds ratio (OR)	(1.18)	(0.70)	(1.53)	(0.81)
Government Debt	0.089*	-0.131***	0.343***	-0.196**
OR	(1.09)	(0.88)	(1.41)	(0.82)
Income Inequality	-0.529***	0.709***	-0.219**	-0.355***
OR	(0.59)	(2.03)	(0.80)	(0.70)
Climate Change	-0.251***	0.305***	-0.856***	0.400***
OR	(0.78)	(1.36)	(0.42)	(1.49)
Constant	0.242	-1.090***	-3.367***	-1.389***

Note: *p<0.05; **p<0.01; ***p<0.001

An odds ratio of above 1 means that the respondent is more likely to have voted for the corresponding party for every additional unit on the five point likert scale, with an odds ratio of less than 1 indicating the opposite. Looking at the Treaty of Waitangi variable, the odds ratio is above one for the Labour and Green models and below one for National and NZ First. As the likert scale is coded as 1 representing “Strongly agree” and 5 representing “Strongly disagree”, this can be interpreted as: the more the respondent disagrees with removing references to the Treaty of Waitangi from the law, the more likely they are to have voted Labour or Green and the less likely they are to have voted National or NZ First, and vice versa.

The same pattern is also present in relation to whether the government should reduce its debt as soon as possible. In relation to climate change though, respondents who disagreed that policies are needed to reduce carbon emissions were more likely to have voted National and NZ First and less likely to have voted Labour and Green; the probability that respondents would have voted Green more than halved for each point along the likert scale from “Strongly agree” to “Strongly disagree”. In relation to income inequality, however, respondents were less likely to vote Labour, Green and NZ First, and significantly more likely to vote National the more they disagreed that the government should take measures to reduce differences in income levels.

As previously discussed, the four models can also be combined to predict which party each respondent voted for. This produces the following result for all respondents together:

Table 3: Party prediction

	Labour	National	Green	NZ First
Predicted vote	1736	1719	0	0

The party each respondent is predicted to have voted for can be compared with the party they actually voted for to assess overall predictive accuracy of the combined model. When looking only at respondents who actually did vote for one of the four major parties (i.e. excluding those who did not vote or who voted for a smaller party), the combined model correctly predicts the voter choice for 1775 respondents and incorrectly predicts for 1182; this gives a predictive accuracy of 60%.

However, as shown in Table 3, the combined model predicts that none of the respondents voted for the Greens or NZ First, whereas in reality these parties received 263 and 240 votes respectively. This is because a relatively low proportion of respondents in the dataset voted for these parties, making the model unlikely to predict a high probability that any individual respondent voted for them; the highest predicted probability is 0.35 and 0.37 for the Greens and

NZ First respectively across all respondents. One way to address this bias towards the larger two parties, is to adjust how the combined model compares the predicted probabilities for each party. Rather than the probability of voting Green or NZ First having to be higher than the other parties in order to predict that the respondent voted for them, the threshold can be adjusted to just needing to be above 0.3. For example, if a respondent has a predicted probability of voting Green of 0.34, and a lower probability of voting NZ First, then they will be predicted to have voted Green regardless of the likelihood of them voting Labour or National. The results from this adjustment can be seen in Table 4.

Table 4: Party prediction v2

	Labour	National	Green	NZ First
Predicted vote	1607	1708	129	11

The result of this version of the combined model is more reflective of the actual voting seen in the dataset, with more respondents voting National than Labour and a substantial number voting Green. However, it still only predicts 11 respondents to have voted NZ First and the predictive accuracy is actually reduced slightly to 59%.

An alternative way to improve the model, and its predictive accuracy, is to add some other variables that are relevant to the parties' policy platforms as discussed above. Including respondent's views on immigration, education spending and abortion, marginally improves the predictive accuracy from 60.0% to 60.3%. Moreover, when also using the 0.3 threshold method, this combined model predicts a higher number of Green and NZ First voters which is more reflective of the reality:

Table 5: Party prediction v2 with additional variables

	Labour	National	Green	NZ First
Predicted vote	1514	1660	191	90

Using an Anova Chi test to compare each set of models (the model for each party with the additional variables and the one without), there is a statistically significant reduction in the residual sum of square for all four model sets, suggesting that the additional variables improve the model fit (see appendix 2). However, as can be seen in Table 6, the coefficients for each variable are no longer all statistically significant. For example, the Education Spending coefficient is not statistically significant for the Green or NZ First models This suggests that the

additional variables would not all necessarily change the likelihood of voting for each party in the population, when controlling the other variables.

Table 6: Multiple logistic regressions with additional variables

	Voter choice			
	Labour	National	Green	NZ First
	(1)	(2)	(3)	(4)
Treaty of Waitangi	0.159***	-0.386***	0.414***	-0.188***
Odds ratio (OR)	(1.17)	(0.68)	(1.51)	(0.83)
Government Debt	0.091*	-0.148***	0.266***	-0.112
OR	(1.09)	(0.86)	(1.31)	(0.89)
Income Inequality	-0.500***	0.680***	-0.227**	-0.273***
OR	(0.61)	(1.97)	(0.80)	(0.76)
Climate Change	-0.234***	0.299***	-0.802***	0.344***
OR	(0.79)	(1.35)	(0.45)	(1.41)
Immigration	0.055	-0.361***	-0.107	0.866***
OR	(1.06)	(0.70)	(0.90)	(2.34)
Education Spending	-0.240***	0.297***	0.024	0.049
OR	(0.79)	(1.35)	1.02)	(1.05)

Abortion	-0.032	-0.002	0.373***	-0.126*
OR	(0.97)	(1.0)	(1.45)	(0.88)
Constant	0.571	-0.225	-4.386***	-4.835***

Note: *p<0.05; **p<0.01; ***p<0.001

Discussion

The results from this analysis suggest that a New Zealand voter's political values and beliefs do indeed have an impact on which party they vote and, in some cases, this impact is substantial. Moreover, looking at the first model (with four variables), how each respondent's political values impact their voter choice appears to broadly match the policy agenda of each party, at least in some instances. For example, believing that the Treaty of Waitangi should be removed from New Zealand law makes voters more likely to vote National and New Zealand First, a policy which has been supported by members of both parties. Likewise, the model suggests voters are more than twice as likely to vote Green, the more they agree that policies are needed to reduce carbon emissions, the central policy platform of the party.

However, it also suggests that voters are significantly more likely to vote Green if they disagree with prioritising reducing government debt, despite achieving a reduction actually being a pledge the party made in 2017. There also appears to be a disconnect in relation with abortion (included in the second model), with views on whether it is "always wrong" having no statistically significant impact on the likelihood of voting for Labour or National. This is despite, as discussed previously, Labour pledging to liberalise abortion law and National promising to keep the status quo during the 2017 election campaign. These apparent disconnects may indicate that New Zealand voters' views on some issues may play less of a role in determining the party they vote for compared to other factors. Alternatively, there could be a relationship between the extent to which a party's policy position on a certain topic has been publicised, or the length of time the party has advocated for the position, and its impact on voter choice. Understanding this disconnect could be a fruitful avenue of further research.

Turning to the predictive power of the models, all versions explored are only able to correctly predict which party each respondent voted for around 60% of the time. This suggests that, although the political values and beliefs included explain a significant amount of voter choice, other factors may need to be included to explain more of the variance and improve the predictive power of the model.These could be factors like class/income level or ethnicity as

discussed in the ‘Background’ section of this research note. In addition, the process of comparison between predicted probabilities of each party could be made more sophisticated which may also improve the predictive power of the combined model. Alternatively, other regression techniques could be explored, including multinomial logistic regression or a machine learning approach. These could all also be potential avenues of further research to better understand what drives voter choice in New Zealand, and improve prediction of it.

Conclusion

This research note concludes that New Zealand voters’ individual political values and beliefs do impact their choice of party during general elections and, in some cases, this impact is substantial. However, the role political values and beliefs play do not always seem to be aligned with the corresponding party’s policy platforms. Moreover, the models used are not able to correctly predict which party each respondent voted for with a high degree of accuracy. Further research is needed to improve the predictive power of the model and better understand voting behaviour in New Zealand directly before the covid-19 pandemic.

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Appendix 1 - Testing multicollinearity

Ensuring that none of the independent variables are highly correlated with each other, is an important diagnostic test for any regression model with multiple variables. This is because a multiple regression model is meant to determine the impact of one variable changing whilst the others stay the same. This is not valid if two or more variables are highly correlated as changing one would require the other variables it is highly correlated with to also change.

Multicollinearity can be tested by calculating the variance inflation factor (VIF). If the VIF for a given variable is between 1 and 5, this demonstrates a moderate correlation with another variable in the model, with a value closer to 1 indicating a weaker correlation. A VIF above 5 indicates a severe correlation.

The VIF for each independent variable used in this research note are:

Variable	**Variance inflation factor (VIF)**
Treaty of Waitangi	1.098868
Government debt	1.082202
Income inequality	1.070715
Climate change	1.128301
Immigration	1.025529
Education spending	1.056515
Abortion	1.065717

Appendix 2 - Model comparison

An anova test is used to compare the two versions of the multiple logistic regression model for each of the four largest New Zealand parties (one with four variables and one with the additional three). As can be seen below, the residual sum of squares is lower for the second version of the model for all four parties. This result is statistically significant (p-value < 0.05) for all four anova tests.

Labour

```
Model 1: votelabour ~ treaty + govtdebt + govincdiffs + climatepolicy
Model 2: votelabour ~ treaty + govtdebt + govincdiffs + climatepolicy + immigrants + spendeduc
+ abortion

  Resid. Df Resid. Dev Df Deviance   Pr(>Chi)
1      3203     3851.8
2      3200     3829.5  3   22.335 0.00005557 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

National

```
Model 1: votenational ~ treaty + govtdebt + govincdiffs + climatepolicy
Model 2: votenational ~ treaty + govtdebt + govincdiffs + climatepolicy +
    immigrants + spendeduc + abortion

  Resid. Df Resid. Dev Df Deviance             Pr(>Chi)
1      3203     3496.9
2      3200     3403.7  3   93.228 < 0.00000000000000022 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Green

```
Model 1: votegreen ~ treaty + govtdebt + govincdiffs + climatepolicy
Model 2: votegreen ~ treaty + govtdebt + govincdiffs + climatepolicy +
    immigrants + spendeduc + abortion

  Resid. Df Resid. Dev Df Deviance      Pr(>Chi)
1      3203     1527.3
2      3200     1488.3  3   38.968 0.00000001763 ***
```

NZ First

```
Model 1: votenzfirst ~ treaty + govtdebt + govincdiffs + climatepolicy
Model 2: votenzfirst ~ treaty + govtdebt + govincdiffs + climatepolicy +
    immigrants + spendeduc + abortion
```

```
  Resid. Df Resid. Dev Df Deviance             Pr(>Chi)
1      3203     1607.0
2      3200     1478.6  3   128.42 < 0.00000000000000022 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

Appendix 3 - R code

```
getwd()
setwd("/Users/mac/documents/")

library(haven)
library(stargazer)

#Preparing data
NZ2017data <- read_sav("NZ2017data.sav")

partyvote <- ifelse(NZ2017data$rpartyvote > 4, NA, NZ2017data$rpartyvote)

#independent variables
immigrants <- ifelse(NZ2017data$rimmigrants == 9, 3, NZ2017data$rimmigrants)
govincdiffs <- ifelse(NZ2017data$rgovincdiffs == 9, 3, NZ2017data$rgovincdiffs)
spendeduc <- ifelse(NZ2017data$rspendeduc == 9, 3, NZ2017data$rspendeduc)
climatepolicy <- ifelse(NZ2017data$rclimatechange == 9, 3, NZ2017data$rclimatechange)
abortion <- ifelse(NZ2017data$rabortion == 9, 3, NZ2017data$rabortion)
treaty <- ifelse(NZ2017data$rtreaty == 9, 3, NZ2017data$rtreaty)
govtdebt <- ifelse(NZ2017data$rgovtdebt == 9, 3, NZ2017data$rgovtdebt)

#dependent variables
votelabour <- ifelse(NZ2017data$rpartyvote == 1, 1, 0)
votenational <- ifelse(NZ2017data$rpartyvote == 2, 1, 0)
votegreen <- ifelse(NZ2017data$rpartyvote == 3, 1, 0)
votenzfirst <- ifelse(NZ2017data$rpartyvote == 4, 1, 0)


NZ2017data2 <- data.frame(votelabour, votenational, votegreen, votenzfirst, partyvote,
                          immigrants,
                          govincdiffs,
                          spendeduc,
                          climatepolicy,
                          abortion,
                          treaty,
                          govtdebt)

#recoding NAs
NZ2017data2$immigrants[is.na(NZ2017data2$immigrants) == T] = 3
NZ2017data2$govincdiffs[is.na(NZ2017data2$govincdiffs) == T] = 3
NZ2017data2$govtdebt[is.na(NZ2017data2$govtdebt) == T] = 3
NZ2017data2$spendeduc[is.na(NZ2017data2$spendeduc) == T] = 3
NZ2017data2$climatepolicy[is.na(NZ2017data2$climatepolicy) == T] = 3
```

```
NZ2017data2$abortion[is.na(NZ2017data2$abortion) == T] = 3
NZ2017data2$treaty[is.na(NZ2017data2$treaty) == T] = 3


#Logistic 1

m1log <- glm(votelabour ~ treaty + govtdebt + govincdiffs + climatepolicy, data = NZ2017data2,
family = binomial)
m2log <- glm(votenational ~ treaty + govtdebt + govincdiffs + climatepolicy, data =
NZ2017data2, family = binomial)
m3log <- glm(votegreen ~ treaty + govtdebt + govincdiffs + climatepolicy, data = NZ2017data2,
family = binomial)
m4log <- glm(votenzfirst ~ treaty + govtdebt + govincdiffs + climatepolicy, data = NZ2017data2,
family = binomial)

stargazer(list(m1log, m2log, m3log, m4log),
        omit.stat = c("f", "rsq", "ser"),
        dep.var.caption = "Voter choice",
        column.labels = c("Labour", "National", "Green", "New Zealand First"),
        covariate.labels = c("Treaty of Waitangi", "Government Debt", "Income Inequality",
"Climate Change"),
        type = "text",
        digits = 3,
        no.space = T,
        intercept.bottom = TRUE,
        out = "pjct_combined_model.html",
        star.cutoffs = c(0.05, 0.01, 0.001))

#odds ratios
exp(coef(m1log))
exp(coef(m2log))
exp(coef(m3log))
exp(coef(m4log))

#probability prediction
data_predict <- NZ2017data2

fit_prob_1 <- predict(m1log, newdata=data_predict, type="response")
fit_prob_2 <- predict(m2log, newdata=data_predict, type="response")
fit_prob_3 <- predict(m3log, newdata=data_predict, type="response")
fit_prob_4 <- predict(m4log, newdata=data_predict, type="response")

fit_mod_s <- data.frame(partyvote,
                    fit_prob_1 = as.matrix(fit_prob_1),
```

```
                    fit_prob_2 = as.matrix(fit_prob_2),
                    fit_prob_3 = as.matrix(fit_prob_3),
                    fit_prob_4 = as.matrix(fit_prob_4))

#party prediction
fit_mod_s$predict_party <-    ifelse(fit_prob_1 > fit_prob_2,
                              ifelse(fit_prob_1 > fit_prob_3,
                                   ifelse(fit_prob_1 > fit_prob_4,
                                        1,
                                        4),
                                   ifelse(fit_prob_3 > fit_prob_4,3,4)),
                              ifelse(fit_prob_2 > fit_prob_3,
                                   ifelse(fit_prob_2 > fit_prob_4,
                                        2,
                                        4),
                                   ifelse(fit_prob_3 > fit_prob_4,3,4)))
table(fit_mod_s$predict_party)
fit_mod_s$correct_prediction <- ifelse(fit_mod_s$predict_party == fit_mod_s$partyvote,1,0)
table(fit_mod_s$correct_prediction)

#party prediction v2
fit_mod_s$predict_party_2 <- ifelse(fit_prob_3 > 0.3, ifelse(fit_prob_3 > fit_prob_4, 3, 4),
ifelse(fit_prob_4 > 0.3, 4,
                               ifelse(fit_prob_1 > fit_prob_2,
                                   ifelse(fit_prob_1 > fit_prob_3,
                                        ifelse(fit_prob_1 > fit_prob_4,
                                             1,
                                             4),
                                        ifelse(fit_prob_3 > fit_prob_4,3,4)),
                                   ifelse(fit_prob_2 > fit_prob_3,
                                        ifelse(fit_prob_2 > fit_prob_4,
                                             2,
                                             4),
                                        ifelse(fit_prob_3 > fit_prob_4,3,4)))))

fit_mod_s$correct_prediction_2 <- ifelse(fit_mod_s$predict_party_2 ==
fit_mod_s$partyvote,1,0)
table(fit_mod_s$correct_prediction_2)
table(fit_mod_s$predict_party_2)

#Logistic 2

m1log2 <- glm(votelabour ~ treaty + govtdebt + govincdiffs + climatepolicy + immigrants +
spendeduc + abortion, data = NZ2017data2, family = binomial)
```

```
m2log2 <- glm(votenational ~ treaty + govtdebt + govincdiffs + climatepolicy + immigrants +
spendeduc + abortion, data = NZ2017data2, family = binomial)
m3log2 <- glm(votegreen ~ treaty + govtdebt + govincdiffs + climatepolicy + immigrants +
spendeduc + abortion, data = NZ2017data2, family = binomial)
m4log2 <- glm(votenzfirst ~ treaty + govtdebt + govincdiffs + climatepolicy + immigrants +
spendeduc + abortion, data = NZ2017data2, family = binomial)

summary(m1log2)

stargazer(list(m1log2, m2log2, m3log2, m4log2),
        omit.stat = c("f", "rsq", "ser"),
        dep.var.caption = "Voter choice",
        column.labels = c("Labour", "National", "Green", "New Zealand First"),
        covariate.labels = c("Treaty of Waitangi", "Government Debt", "Income Inequality",
"Climate Change", "Immigration", "Education Spending", "Abortion" ),
        type = "text",
        digits = 3,
        no.space = T,
        intercept.bottom = TRUE,
        out = "pjct_combined_model_2.html",
        star.cutoffs = c(0.05, 0.01, 0.001))

#odds ratios
exp(coef(m1log2))
exp(coef(m2log2))
exp(coef(m3log2))
exp(coef(m4log2))

#probaility prediction
data_predict <- NZ2017data2

fit_prob_1_2 <- predict(m1log2, newdata=data_predict, type="response")
fit_prob_2_2 <- predict(m2log2, newdata=data_predict, type="response")
fit_prob_3_2 <- predict(m3log2, newdata=data_predict, type="response")
fit_prob_4_2 <- predict(m4log2, newdata=data_predict, type="response")

fit_mod_s_2 <- data.frame(partyvote,
                    fit_prob_1_2 = as.matrix(fit_prob_1_2),
                    fit_prob_2_2 = as.matrix(fit_prob_2_2),
                    fit_prob_3_2 = as.matrix(fit_prob_3_2),
                    fit_prob_4_2 = as.matrix(fit_prob_4_2))

#party prediction
fit_mod_s_2$predict_party <-    ifelse(fit_prob_1_2 > fit_prob_2_2,
```

```
                        ifelse(fit_prob_1_2 > fit_prob_3_2,
                               ifelse(fit_prob_1_2 > fit_prob_4_2,
                                      1,
                                      4),
                               ifelse(fit_prob_3_2 > fit_prob_4_2,3,4)),
                        ifelse(fit_prob_2_2 > fit_prob_3_2,
                               ifelse(fit_prob_2_2 > fit_prob_4_2,
                                      2,
                                      4),
                               ifelse(fit_prob_3_2 > fit_prob_4_2,3,4)))
table(fit_mod_s_2$predict_party)
fit_mod_s_2$correct_prediction <- ifelse(fit_mod_s_2$predict_party ==
fit_mod_s_2$partyvote,1,0)
table(fit_mod_s_2$correct_prediction)

#party prediction v2
fit_mod_s_2$predict_party_2 <- ifelse(fit_prob_3_2 > 0.3, ifelse(fit_prob_3_2 > fit_prob_4, 3, 4),
ifelse(fit_prob_4_2 > 0.3, 4,
                                  ifelse(fit_prob_1_2 > fit_prob_2_2,
                                         ifelse(fit_prob_1_2 > fit_prob_3_2,
                                                ifelse(fit_prob_1_2 > fit_prob_4_2,
                                                       1,
                                                       4),
                                                ifelse(fit_prob_3_2 > fit_prob_4_2,3,4)),
                                         ifelse(fit_prob_2_2 > fit_prob_3_2,
                                                ifelse(fit_prob_2_2 > fit_prob_4_2,
                                                       2,
                                                       4),
                                                ifelse(fit_prob_3_2 > fit_prob_4_2,3,4)))))

table(fit_mod_s_2$predict_party_2)
fit_mod_s_2$correct_prediction_2 <- ifelse(fit_mod_s_2$predict_party_2 ==
fit_mod_s_2$partyvote,1,0)
table(fit_mod_s_2$correct_prediction_2)

#model comparison
anova(m1log,m1log2, test = "Chi")
anova(m2log,m2log2, test = "Chi")
anova(m3log,m3log2, test = "Chi")
anova(m4log,m4log2, test = "Chi")

#Multicollinearity test
library(car)
vif(m1log2)
```