My title*

My subtitle if needed

First author Another author

April 13, 2024

First sentence. Second sentence. Third sentence. Fourth sentence.

1 Introduction

You can and should cross-reference sections and sub-sections. We use R Core Team (2023) and Wickham et al. (2019).

The remainder of this paper is structured as follows. Section **??**….

2 Data

Table 1: Sample of Cleaned Elections Data

Ward ID	Eligible Voter Turnout (%)
1	24
2	30
3	33
4	38
5	28

*Code and data are available at: LINK.

Table 2: Sample of Cleaned Toronto Ward Profile Data

Ward ID	Uneducated Population (%)	Unemployment Rate (%)	Income
1	18.997568	16.5	95200
2	11.053754	12.8	146600
3	9.269583	11.8	127200
4	9.072244	12.9	127200
5	21.750594	16.4	88700

Table 3: Sample of Combined Ward Election, Income, Employment, and Education Data

Ward ID	Ward Name	Uneducated Population (%)	Unemployment Rate (%)	Income	Eligible Voter Turnout (%)
1	Etobicoke North	18.997568	16.5	95200	24
2	Etobicoke Centre	11.053754	12.8	146600	30
3	Etobicoke-Lakeshore	9.269583	11.8	127200	33
4	Parkdale-High Park	9.072244	12.9	127200	38
5	York South-Weston	21.750594	16.4	88700	28
6	York Centre	13.692888	14.1	107500	25
7	Humber River-Black Creek	23.080036	17.8	85700	22
8	Eglinton-Lawrence	10.490333	12.2	176400	32
9	Davenport	18.012986	13.1	107300	31
10	Spadina-Fort York	4.841211	9.8	118200	24

Table 4: Summary Statistics

Variable	Mean	Median	Standard. Deviation	Min	Max
Income	120096.00	107300.00	33980.64	85700.00	224800.00
Voter Turnout (%)	29.48	29.00	4.22	22.00	38.00
Uneducated Population (%)	12.43	11.95	4.93	4.84	23.08

Table 4: Summary Statistics

Variable	Mean	Median	Standard. Deviation	Min	Max
Unemployment Rate (%)	14.13	14.10	2.11	9.80	17.80

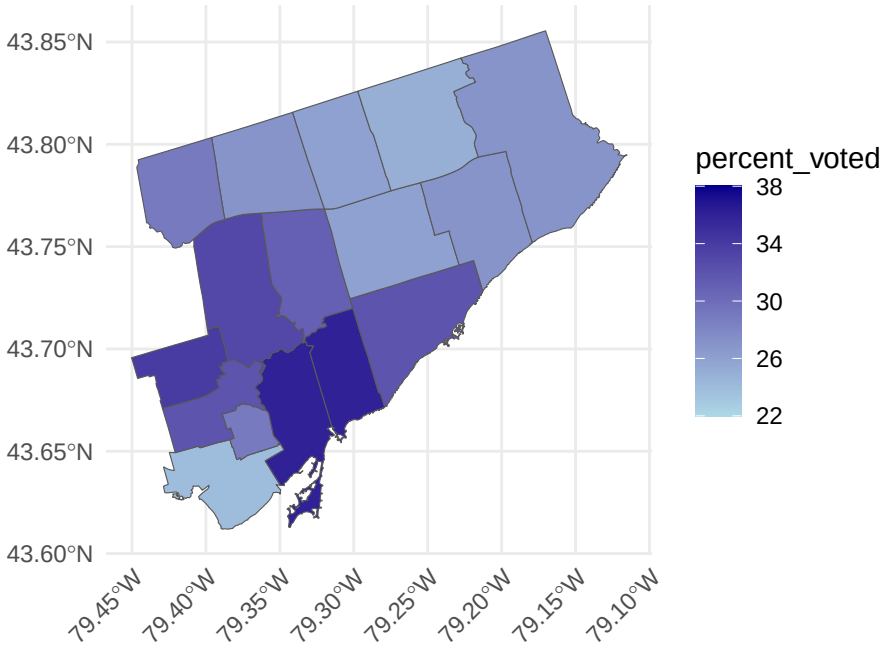


Figure 2: Map of Toronto highlighting the voter turnout across wards

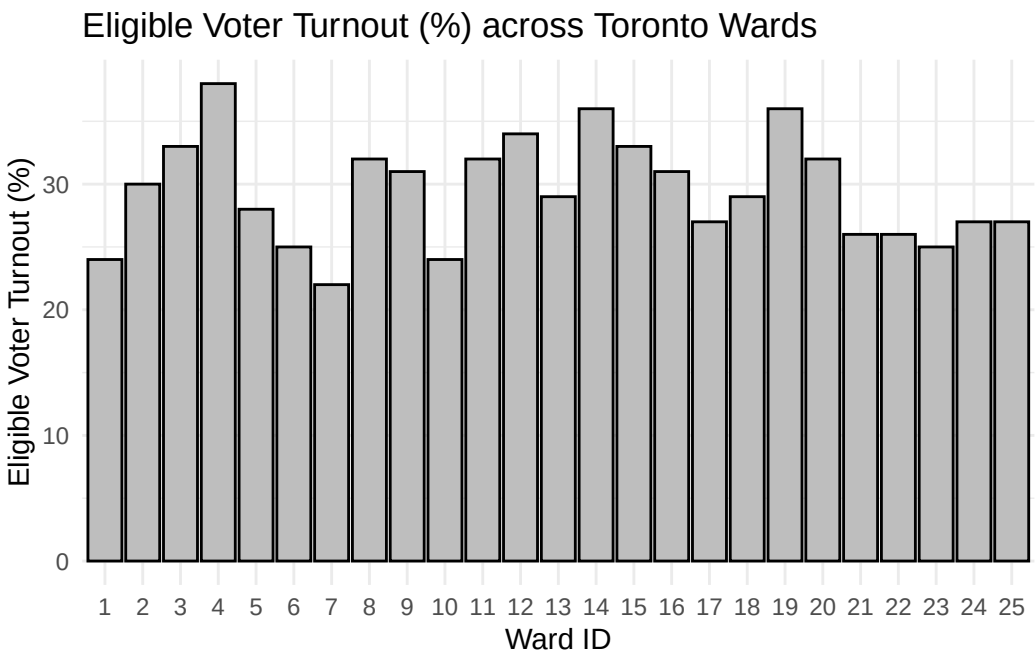


Figure 1: Voter Turnout (%) across Toronto Wards

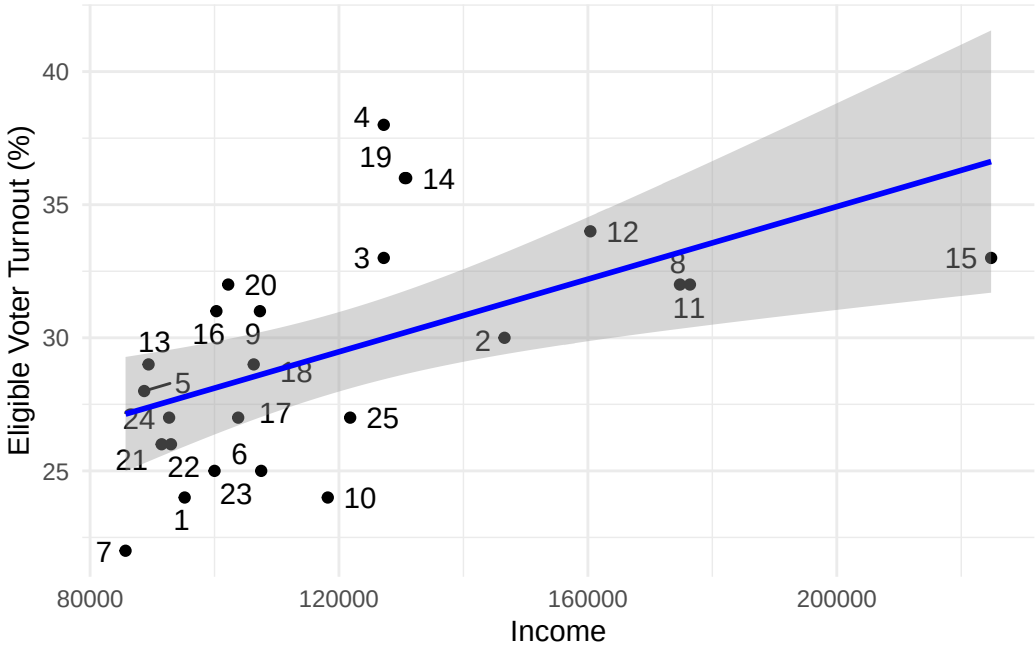


Figure 3: Correlation between Eligibile Voter Turnout and Ward's Income

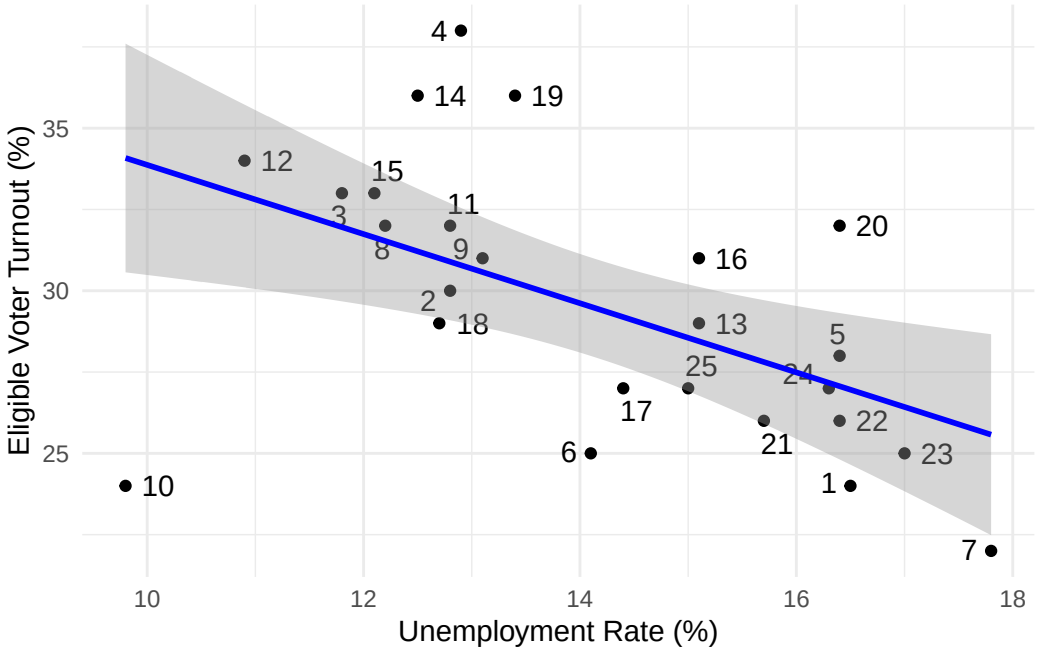


Figure 4: Correlation between Eligibile Voter Turnout and Ward's Unemployment Rate

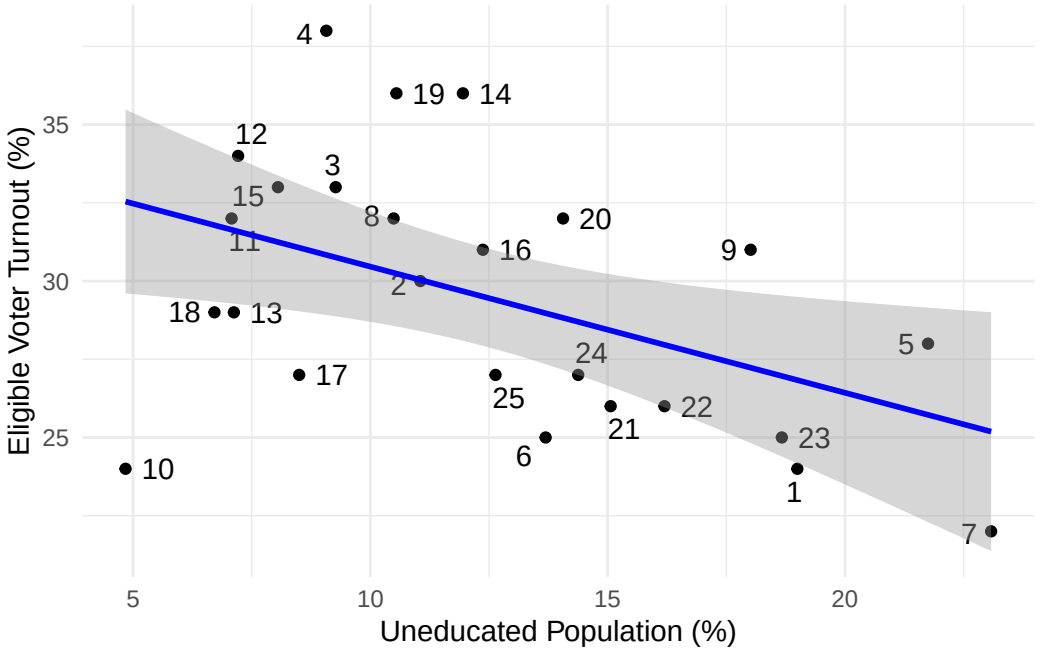


Figure 5: Correlation between Eligibile Voter Turnout and Ward's Level of Education

3 Model

The goal of our modelling strategy is twofold. Firstly,…

Here we briefly describe the Bayesian analysis model used to investigate… Background details and diagnostics are included in Appendix **??**.

3.1 Model set-up

Define y_i as the number of seconds that the plane remained aloft. Then β_i is the wing width and γ_i is the wing length, both measured in millimeters.

$$y_i|\mu_i, \sigma \sim \text{Normal}(\mu_i, \sigma) \tag{1}$$
$$\mu_i = \alpha + \beta_i + \gamma_i \tag{2}$$
$$\alpha \sim \text{Normal}(0, 2.5) \tag{3}$$
$$\beta \sim \text{Normal}(0, 2.5) \tag{4}$$
$$\gamma \sim \text{Normal}(0, 2.5) \tag{5}$$
$$\sigma \sim \text{Exponential}(1) \tag{6}$$

We run the model in R (R Core Team 2023) using the `rstanarm` package of Goodrich et al. (2022). We use the default priors from `rstanarm`.

3.1.1 Model justification

We expect a positive relationship between the size of the wings and time spent aloft. In particular…

We can use maths by including latex between dollar signs, for instance θ.

4 Results

Our results are summarized in Table **??**.

Table 5: Explanatory models of flight time based on wing width and wing length

	First model
(Intercept)	3.46
	(0.49)
percent_uneducated	0.00
	(0.01)
income	0.00
	(0.00)
unemployment_rate	−0.01
	(0.03)
Num.Obs.	25
Log.Lik.	−70.304
ELPD	−73.4
ELPD s.e.	2.1
LOOIC	146.9
LOOIC s.e.	4.1
WAIC	146.5
RMSE	3.37

5 Discussion

5.1 First discussion point

If my paper were 10 pages, then should be be at least 2.5 pages. The discussion is a chance to show off what you know and what you learnt from all this.

5.2 Second discussion point

5.3 Third discussion point

5.4 Weaknesses and next steps

Weaknesses and next steps should also be included.

Appendix

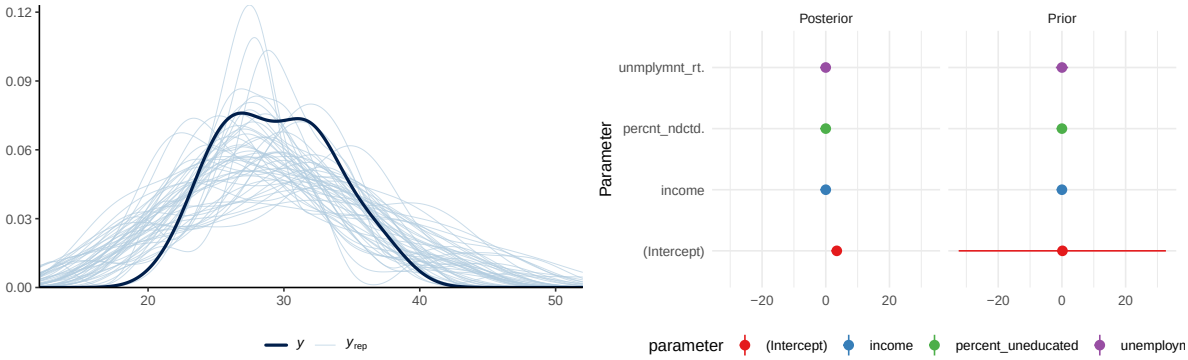
A Additional data details

B Model details

B.1 Posterior predictive check

In Figure **??** we implement a posterior predictive check. This shows...

In Figure **??** we compare the posterior with the prior. This shows...



(a) Posterior prediction check

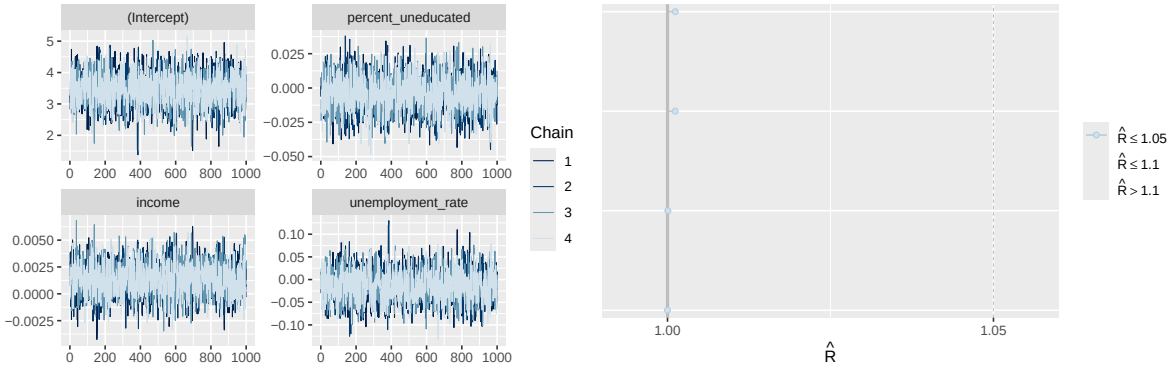
(b) Comparing the posterior with the prior

Figure 6: Examining how the model fits, and is affected by, the data

B.2 Diagnostics

Figure **??** is a trace plot. It shows... This suggests...

Figure **??** is a Rhat plot. It shows... This suggests...



(a) Trace plot (b) Rhat plot

Figure 7: Checking the convergence of the MCMC algorithm

References

Goodrich, Ben, Jonah Gabry, Imad Ali, and Sam Brilleman. 2022. "Rstanarm: Bayesian Applied Regression Modeling via Stan." https://mc-stan.org/rstanarm/.

R Core Team. 2023. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Grolemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. https://doi.org/10.21105/joss.01686.