My title*

My subtitle if needed

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

1 Introduction

2 Data

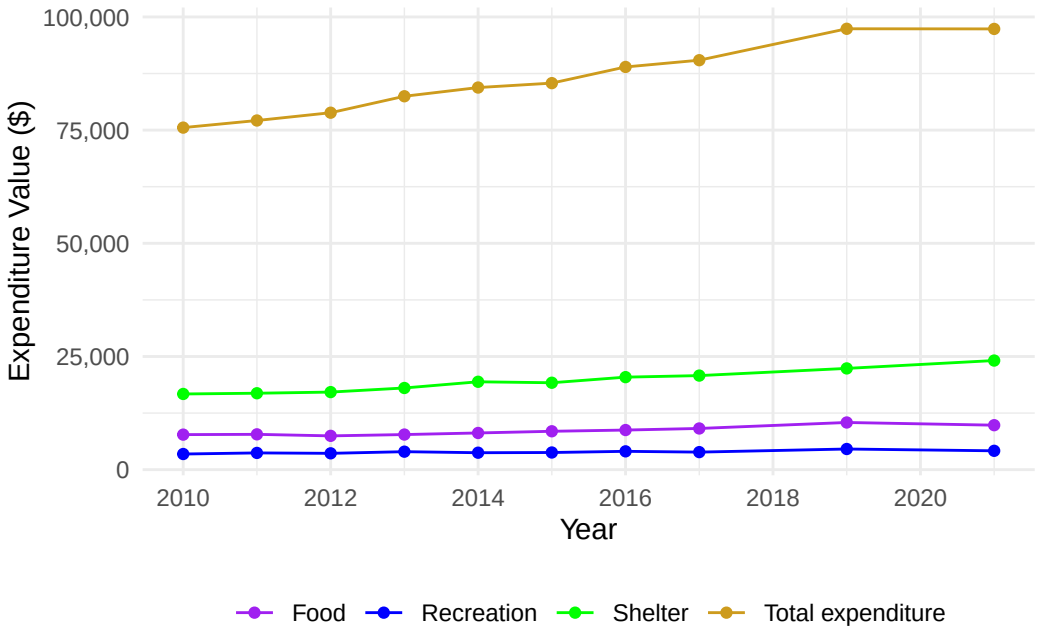

Figure 1: Household spending per year

*Code and data are available at: https://github.com/rahmabinth/consumer-behaviour

From the spending dataset, we chose to select the values for all food expenditures, all shelter expenditures, recreation expenditures, and total expenditures. This choice was made because these are principal expenditures for everyone. Recreation was added to this mix, to identify how consumers behave when inflation is high.

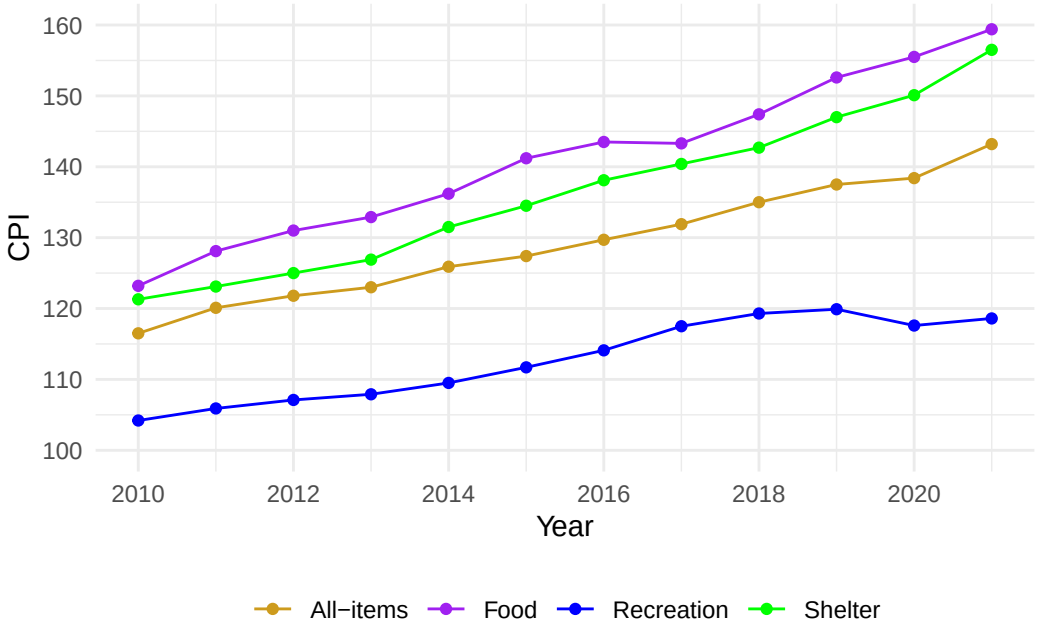

Figure 2: Consumer Price Index (CPI) per Year

From the CPI dataset, we chose to look at the annual average to keep it consistent with the annual average of expenditures. The variables

From the income dataset, we chose to isolate the values for the category "all persons with income". This indicate all tax fillers and dependants that earn income from all sources. This was done to keep our analysis consistent.

3 Model

The goal of our model is to forecasting the total expenditure in a household in a year, based solely on a the Consumer Price Index, and the number of people in Ontario earning an income. 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`.

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

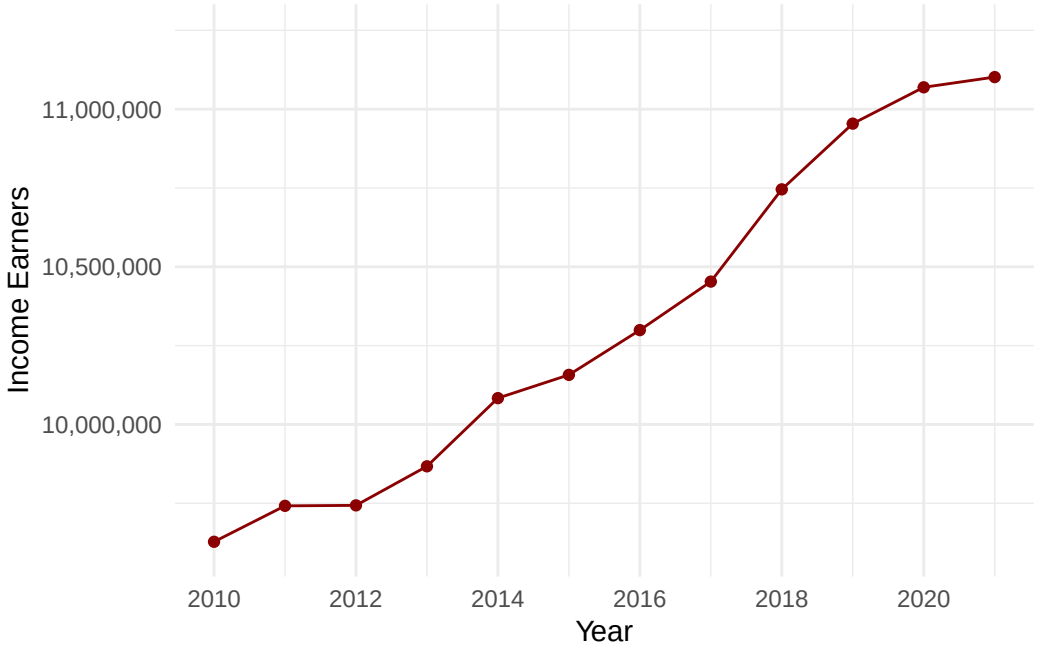

Figure 3: Number of Income Earners

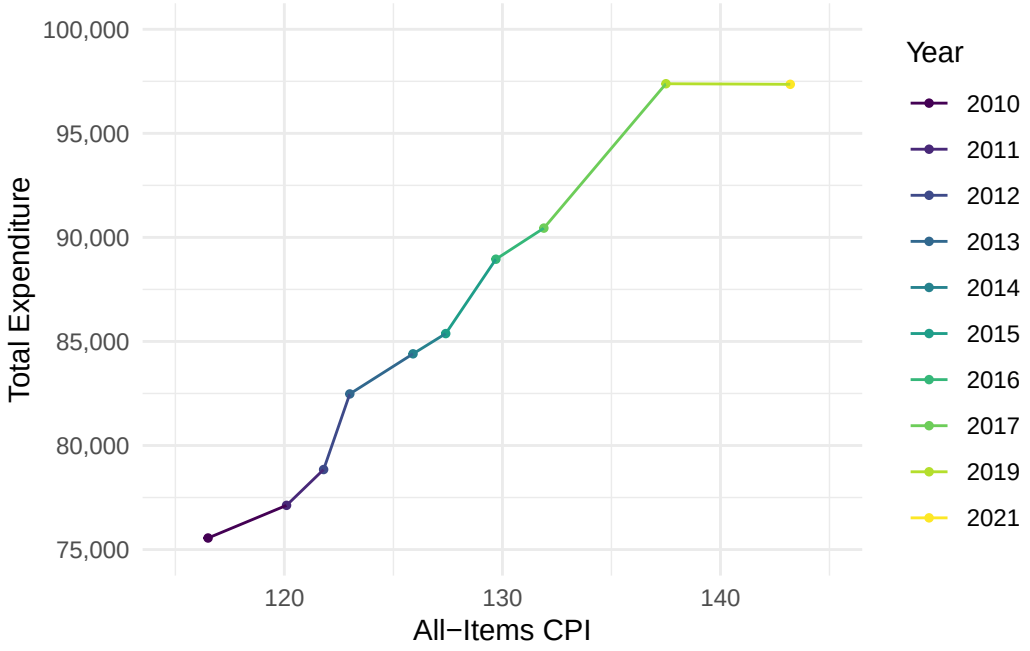

Figure 4: CPI and total expenditure over the year

3.1 Model set-up

3.1.1 Simple linear regression

The model we employ is:

$$
\begin{aligned}
y_i|\mu_i, \sigma &\sim \text{Normal}(\mu_i, \sigma) && (1)\\
\mu_i &= \beta_0 + \beta_1 \times \text{cpi}_i + \epsilon && (2)\\
\beta_0 &\sim \text{Normal}(0, 2.5) && (3)\\
\beta_1 &\sim \text{Normal}(0, 2.5) && (4)\\
\sigma &\sim \text{Exponential}(1) && (5)
\end{aligned}
$$

Where:

- y_i as the total expenditure in Canadian dollars in year i.
- cpi_i is the annual Consumer Price Index (CPI) for year i

3.1.2 Multiple linear regression

The model we employ is:

$$
\begin{aligned}
y_i|\mu_i, \sigma &\sim \text{Normal}(\mu_i, \sigma) && (6)\\
\mu_i &= \beta_0 + \beta_1 \times \text{cpi}_i + \beta_2 \text{income}_i + \epsilon && (7)\\
\beta_0 &\sim \text{Normal}(0, 2.5) && (8)\\
\beta_1 &\sim \text{Normal}(0, 2.5) && (9)\\
\beta_2 &\sim \text{Normal}(0, 2.5) && (10)\\
\sigma &\sim \text{Exponential}(1) && (11)
\end{aligned}
$$

Where: * y_i as the total expenditure in Canadian dollars in year i. * cpi_i is the annual Consumer Price Index (CPI) for year i * $income_i$ is the number of people in Ontario earning an income

3.1.3 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.

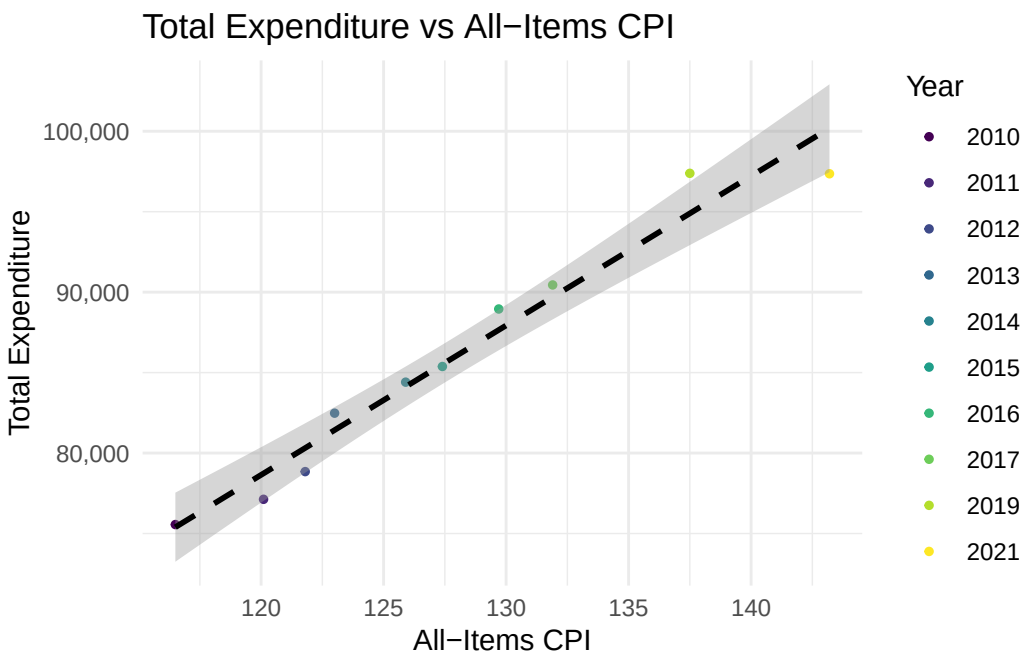

Figure 5: Linear model

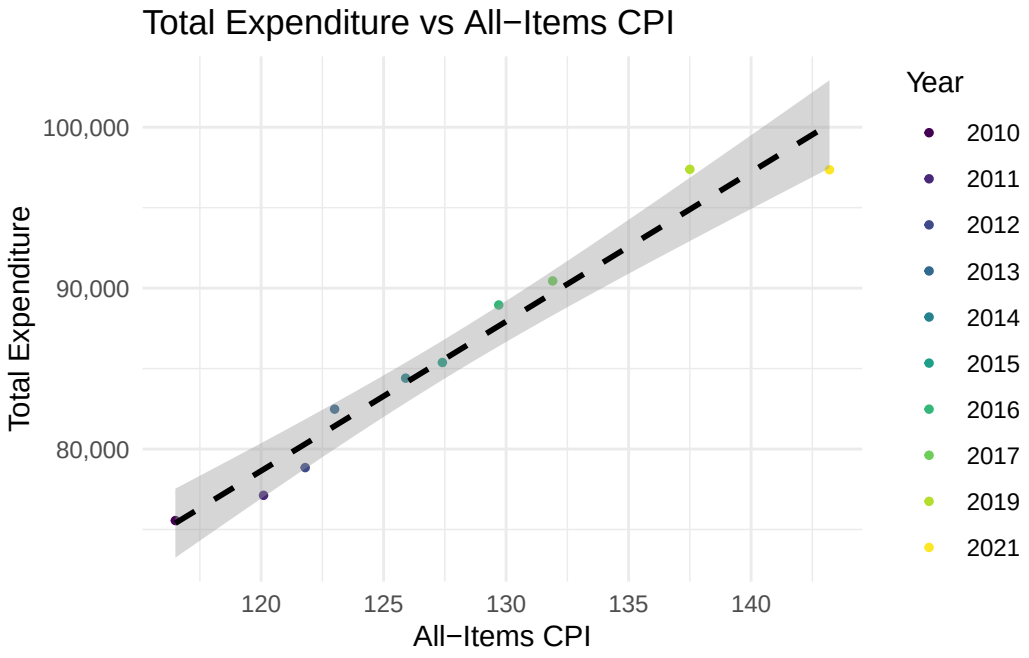

Figure 6: Linear model

Table 1: Explanatory models of

	First model	Second model
(Intercept)	−32 899.89	−59 979.55
	(9842.07)	(18 660.19)
cpi	928.77	225.52
	(76.80)	(437.28)
income		0.01
		(0.01)
Num.Obs.	10	10
R2	0.944	0.955
R2 Adj.	0.920	0.932
Log.Lik.	−88.550	−87.273
ELPD	−92.0	−91.1
ELPD s.e.	3.1	2.3
LOOIC	184.1	182.1
LOOIC s.e.	6.1	4.6
WAIC	182.4	180.5
RMSE	1501.29	1326.89

4 Results

Our results are summarized in Table 1.

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

Posterior predictive check

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/.