

# A Template Quarto Repository

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## Abstract

The abstract is a crucial component of any scientific paper, as it provides a summary of the research and its main findings. This paper provides guidelines for writing an effective scientific abstract. The first step is to identify the key elements of the research, such as the research question, methods, results, and conclusions. Next, the abstract should be written in a clear and concise manner, using simple language and avoiding technical jargon. The abstract should also be structured, with a clear introduction, methods section, results section, and conclusion. Additionally, the abstract should accurately and succinctly convey the main findings of the research, highlighting the significance and implications of the work. By following these guidelines, researchers can ensure that their abstract effectively communicates the key aspects of their research and attracts the attention of potential readers. - Written by ChatGPT

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## Preface

This is a template repository that I and my students can use to start projects that will implement the workflow presented in my [lab documentation](#). It also serves as an instruction manual in this workflow, a template article, and a sandbox for me to practice and learn. I encourage students to use the [Quarto Guide](#) as their primary reference.

The document in this template renders to two<sup>1</sup> outputs:

- A website
- An Elsevier journal article

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<sup>1</sup>I hope to make it possible to render the article to a BYU Engineering thesis as well. Give me a bit of time.

To render this document, use the command `quarto render` in your terminal pointed at the working directory. This will create a website available locally in a `_book` folder and a PDF of the article stored in that folder.

To render your website *and* push its content to a live website, use the command `quarto publish gh-pages`. Details of this process are available on the [Quarto guide](#).

You can change the article to a different publisher by following the directions at the [Quarto Journal Templates GitHub](#) repository.

## 1. Introduction

The introduction of your report is not simply an “introduction”, but rather a **motivation** of why your project matters. What is the cost of not solving this problem? What have been previous attempts to solve this problem? The *why* is more important than the *what*. Why is this article worthy of archiving?

The introduction to an article is usually three or so paragraphs long. First, state the overall context of the problem, with citations to basic statistics and previous major findings. Then, Discuss the specific context of your research; why have previous methods or research not addressed your specific issue? You also need to have citations here.

In the third paragraph, you can introduce the purpose of your research and the new method or data you bring to the issue. This paragraph often begins with a statement similar to “In this paper, we present...”

An outline of the article is then usually a good idea, even though the outline might change little from article to article. A Literature Review details prior research in this area, and discusses its strengths and limitations. A Methodology section identifies the data, models, and other elements you use, while a Results section presents the outcomes of your methodology with tables and figures and a comprehensive discussion of their meanings. Discussions, and Conclusions sections may present your interpretations of your findings for future research, policy, etc.

## 2. Literature Review

The literature review is not simply a “review” or a list of what has been done in the past. This needs to a thoughtful synthesis that accomplishes two things:

- Shows that you understand the previous efforts that other people have made on this problem.
- Identifies the limitation or the gap in those previous efforts.

You will have already mentioned this gap in the introduction, but here you need to build a solid case for why what you are doing is a meaningful contribution.

Literature reviews do not have a specific guidelines for length or number of citations. It's more about making a rhetorical argument; if it's a new problem then the review can be shorter. But you'll need to refer to previous attempts at the problem, the methods you are trying, and other things.

### *2.1. Citations and Bibliographies*

Quarto has a robust method for generating citations. If you follow the [setup instructions](#), then you can easily search your database from inside Rstudio after typing the `@` command. Keep your Zotero database up-to-date and correct (and share it with your coauthors!) to minimize the pain you will feel in writing articles.

Note that there are two ways to make citations. Doing `@key` will give you a text citation, allowing you to refer to the author mid-sentence.

[Ben-Akiva and Lerman \(1985\)](#) is the canonical reference in choice modeling for transportation.

But if you put the citation in brackets like `[@citationkey]` you can make parenthetical citations. You can also give page numbers for quotes or specific findings this way.

The difference in the choice model logsum can be used as a measure of consumer surplus, and therefore accessibility improvement ([Ben-Akiva and Lerman, 1985](#), p. 301).

## **3. Methodology**

In this chapter, you describe the approach you have taken on the problem. This usually involves a discussion about both the data you used and the models you applied.

### *3.1. Data*

Discuss where you got your data, how you cleaned it, and any assumptions you made. In this example, we get the `Car` dataset from the `mlogit` ([Croissant, 2020](#)) package<sup>2</sup> and massage it to be in the format needed for `mlogit`.

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<sup>2</sup>You can often get a well-formatted citation for an R package by typing `citation(package = "packagename")` in the console.

Table 1: Descriptive Statistics of Dataset

		regcar (N=10930)		sportuv (N=1048)		sportcar (N=880)		stwagon (N=4446)		truck (N=5628)		van (N=4992)	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
price		4.2	1.9	4.7	1.9	4.8	2.2	4.1	1.9	4.2	2.0	4.2	1.9
range		237.2	94.5	241.6	94.7	233.6	96.7	238.7	94.3	238.2	93.1	236.8	94.7
size		2.4	0.8	2.1	1.0	1.4	1.0	2.3	0.8	2.4	0.8	2.5	0.7
fuel		N	Pct.	N	Pct.	N	Pct.	N	Pct.	N	Pct.	N	Pct.
	gasoline	2704	24.7	280	26.7	218	24.8	1096	24.7	1413	25.1	1247	25.0
	methanol	2729	25.0	246	23.5	225	25.6	1091	24.5	1445	25.7	1216	24.4
	cng	2767	25.3	260	24.8	238	27.0	1109	24.9	1360	24.2	1282	25.7
	electric	2730	25.0	262	25.0	199	22.6	1150	25.9	1410	25.1	1247	25.0

Often there will be a table describing summary statistics of your dataset. Table 1 shows a nice table using the `datasummary` functions in the `modelsummary` package (Arel-Bundock, 2022).

### 3.2. Models

If your work is mostly a new model, you probably will have introduced some details in the literature review. But this is where you describe the mathematical construction of your model, the variables it uses, and other things. Some methods are so common (linear regression) that it is unnecessary to explore them in detail. But others will need to be described, often with mathematics. For example, the probability of an alternative  $i$  in the a multinomial logit model is

$$P_i(X_{in}) = \frac{e^{X_{in}\beta_i}}{\sum_{j \in J} e^{X_{jn}\beta_j}} \quad (1)$$

Use [LaTeX mathematics](#). You’ll want to number display equations so that you can refer to them later in the manuscript. Other simpler math can be described inline, like saying that  $i, j \in J$ . Details on using equations in Quarto are available [here](#).

You can also refer back to numbered equations, like the probability of an MNL presented in Equation 1.

## 4. Applications

This section might be called “Results” instead of “Applications,” depending on what it is that you are working on. But you’ll probably say something like “The initial model estimation results are given in Table 2” That table is created with the `modelsummary()` package and function.

Sometimes, it is nice to put the models or your other results into a figure instead of a table. Have a look at Figure 1. Note that your figures might look better in pdf if you use the `tikz` rendering device.

Table 2: Model Summary Results

	Model 1	Model 2
typesportuv	0.833 (5.945) (0.140)	0.815 (5.805) (0.140)
typesportcar	0.614 (4.192) (0.146)	0.628 (4.259) (0.147)
typestwagon	-1.415 (-22.979) (0.062)	-1.428 (-23.119) (0.062)
typetruck	-1.002 (-20.600) (0.049)	-1.010 (-20.673) (0.049)
typevan	-0.812 (-17.431) (0.047)	-0.806 (-17.183) (0.047)
price	-0.221 (-8.475) (0.026)	-0.191 (-7.130) (0.027)
range		0.003 (18.923) (0.0002)
Num.Obs.	27 924	27 924
RMSE	0.80	0.78

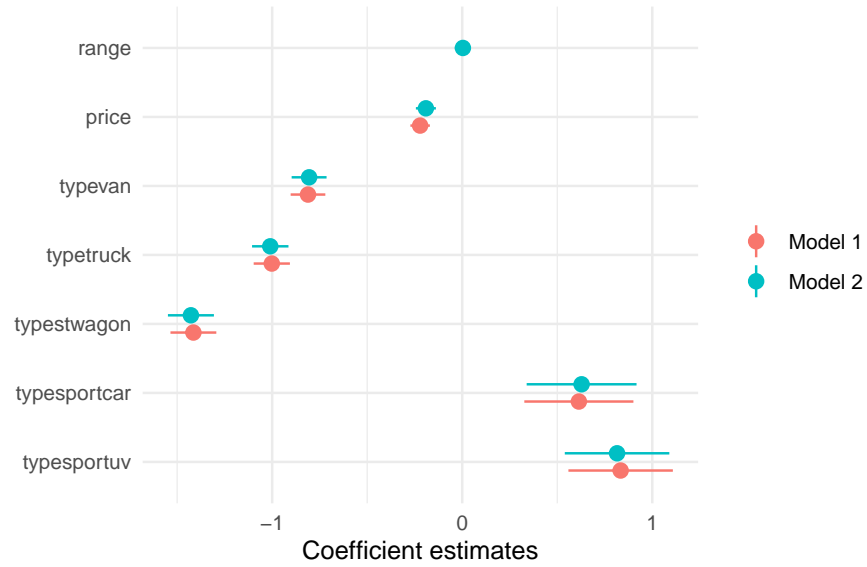


Figure 1: Estimated model coefficients and confidence intervals.

With those results presented, you can go into a discussion of what they mean. first, discuss the actual results that are shown in the table, and then any interesting or unintuitive observations.

#### *4.1. Additional Analysis*

Usually, it is good to use your model for something.

- Hypothetical policy analysis
- Statistical validation effort
- Equity or impact analysis

If the analysis is substantial, it might become its own top-level section.

## **5. Conclusions**

This section need not be overly long. You should address any limitations of your results, such as dependence on underlying assumptions or geographic scope. You should also provide a map for future research.

Finally, you should underline the contributions of this work and any practical relevance.

## **References**

### **References**

- Arel-Bundock, V., 2022. modelsummary: Data and model summaries in R. Journal of Statistical Software 103, 1–23. doi:[10.18637/jss.v103.i01](https://doi.org/10.18637/jss.v103.i01).
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