

Awesome thesis



uOttawa

Bob Hette

Thesis submitted to the University of Ottawa
as a partial requirement for the degree of
Doctor of Philosophy in Biology

Department of Biology
Faculty of Science
University of Ottawa

©Bob Hette, Ottawa, Canada, 2024

Yo no soy, yo no soy, yo no soy

—David Wosniack—

Abstract

The abstract should outline the main approach and findings of the thesis and must not be more than 500 words.

Sommaire

The abstract but in french this time.

Declaration

Reproducibility statement

This thesis was written using Quarto (Allaire et al. 2022) and the R Statistical Software v4.4.0, Puppy Cup (R Core Team 2024), and the R packages listed in Table A.1. All materials (including the data sets and source files) required to reproduce this document can be found at the Github repository github.com/youraccount/thesis.

This work is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).

Author declaration

I hereby declare that this thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

The ideas, development and writing up of all the papers in the thesis were the principal responsibility of myself, the student, working under the supervision of Julien Martin. The inclusion of co-authors reflects the fact that the work came from active collaboration between researchers and acknowledges input into team-based research. This thesis was written in manuscript style and I have renumbered sections of submitted or published papers in order to generate a consistent presentation within the thesis.

Co-authorship statement

The following people and institutions contributed to the publications included in this thesis:

- Bob Hette (BH): University of Ottawa, Canada
- Igor Tex (IT): University of Textile, Softland
- Julien Martin (JGAM): University of Ottawa, Canada

My first manuscript.

Integrated as Chapter 2 in this thesis. Under review at time of submission.

Authors:

- BH: Conceptualization, Investigation, Data curation, Formal analysis, Writing -Original Draft.
- IT: Writing - Review & Editing.
- JGAM: Conceptualization, Resources, Supervision, Writing - Review & Editing.

My second manuscript.

Integrated as Chapter 3 in this thesis. Under review at time of submission.

Authors:

- BH: Conceptualization, Investigation, Data curation, Formal analysis, Writing -Original Draft.
- IT: Writing - Review & Editing.
- JGAM: Conceptualization, Resources, Supervision, Writing - Review & Editing.

Acknowledgements

I would like to thank my pet goldfish for ...

If you have engaged the services of a professional editor, you must provide their name and a brief description of the service rendered. If the professional editor's current or former area of academic specialisation is similar your own, this too should be stated as it may suggest to examiners that the editor's advice to the student has extended beyond guidance on English expression to affect the substance and structure of the thesis.

If you have used generative artificial intelligence (AI) technologies, you must include a written acknowledgment of the use and its extent. Your acknowledgement should at a minimum specify which technology was used, include explicit description on how the information was generated, and explain how the output was used in your work. Below is a suggested format:

"I acknowledge the use of [insert AI system(s) and link] to [specific use of generative artificial intelligence]. The output from these was used to [explain use]."

Free text section for you to record your acknowledgment and gratitude for the more general academic input and support such as financial support from grants and scholarships and the non-academic support you have received during the course of your enrolment.

You may also wish to acknowledge significant and substantial contribution made by others to the research, work and writing represented and/or reported in the thesis. These could include significant contributions to: the conception and design of the project; non-routine technical work; analysis and interpretation of research data; drafting significant parts of the work or critically revising it so as to contribute to the interpretation.

Indigenous affirmation

Ni manàdjiyànànig Màmìwininì Anishinàbeg, ogog kà nàgadawàbandadjig iyo akì eko weshkad. Ako nongom egawikàd kì mìgiwewàdj. Ni manàdjiyànànig kakina Anishinàbeg ondaje kaye ogog kakina eniyagizidjig enigokamigàg Kanadàng eji ondàpinangig endàwàdjìn Odàwàng. Ninisidawinawànànig kenawendamòdjig kije kikenindamàwin; weshkinìgidjig kaye kejeyàdizidjig. Nigijeweninmànànig ogog kà nìgànì sòngideyedjig; weshkad, nongom; kaye àyànikàdj.

We pay respect to the Algonquin people, who are the traditional guardians of this land. We acknowledge their longstanding relationship with this territory, which remains uncaded. We pay> respect to all Indigenous people in this region, from all nations across Canada, who call Ottawa home. We acknowledge the traditional knowledge keepers, both young and old. And we honour their courageous leaders: past, present, and future.

This Indigenous Affirmation was written the Office of Indigenous Affairs at the University of Ottawa, in partnership with the Indigenous Education Council, Indigenous student groups, and members of the local Indigenous community (<https://www.uottawa.ca/about-us/indigenous/indigenous-affirmation>). This statement acknowledges that the University of Ottawa, including the Kerr lab where I completed work for this thesis, was built on the traditional territory of the Algonquin Nation. I collected all the data for this thesis within the boundary of the City of Ottawa, which includes the traditional territory of the Algonquin Nation and the Mohawk Nation (<https://native-land.ca/>). I acknowledge my own settler history, as well as the colonial history of the University of Ottawa. I will continue to educate myself on Canada's colonial past and current Indigenous issues, and to leverage any power I have for (re)conciliation.

Table of contents

Abstract	i
Sommaire	ii
Declaration	iii
Co-authorship statement	iv
Acknowledgements	v
Indigenous affirmation	vi
List of Figures	viii
List of Tables	ix
1. Introduction	1
1.1. Structure of a thesis	1
1.2. Quarto	3
1.3. Data	3
1.4. Figures	4
1.5. Results from analyses	4
1.6. Tables	5
2. My first manuscript	8
2.1. Introduction	8
2.2. Methods	8
2.3. Results	8
2.4. Discussion	8

3. My second manuscript	9
3.1. Introduction	9
3.2. Methods	9
3.3. Results	9
3.4. Discussion	9
4. Conclusion	10
Bibliography	11
Appendices	13
A. R Packages	13
B. Additional stuff	14

List of Figures

1.1. Quarterly sales, advertising and GDP data.	5
---	---

List of Tables

1.1. Coefficients from the fitted model.	5
1.2. This is a wide table	7
A.1. Packages used to generate this thesis	13

Chapter 1

Introduction

1.1. Structure of a thesis

You start with the frontmatter, usually including abstract acknowledgements and declaration of co-authorship. Then, you have a general Introduction where you introduce the main ideas of your thesis, and an overview of the context and background. In a PhD, typically, Chapters 2–4 would contain your own contributions. Think of each of these as potential papers to be submitted to journals. Finally, Chapter 5 provides some concluding remarks, discussion, ideas for future research, and so on. Appendixes can contain additional material that don't fit into any chapters, but that you want to put on record. For example, additional tables, output, etc.

For a MSc thesis with only 1 manuscript, then the thesis will be composed of the frontmatter followed by the manuscript where each section of the manuscript (*e.g.* introduction, methods, ...) is a chapter, and finished by the bibliography and appendices.

1.1.1. Front Matter (index.qmd file)

It should include:

- an abstract (in both english and french)
- An author declaration
- Co-authorship statement listing the co-authors and detailling authors contributions for each chapter

- Acknowledgements
- Table of contents (automatically generated with Quarto)
- List of Tables (automatically generated with Quarto)
- List of Figures (automatically generated with Quarto)

1.1.2. General introduction

This is an overarching, unifying introduction to the dissertation as a whole. It must contain:

- a. Introduction
- b. Literature review
- c. Information enabling a trained researcher reading the chapter to develop sufficient understanding of the field to understand the theme and questions/hypotheses of the dissertation
- d. Dissertation theme and objectives or hypotheses to be tested

1.1.3. Manuscript Chapters

Each subsequent chapter, aside from the General Conclusion, comprises a single manuscript (published, submitted, or nearly submitted). Importantly, however, a single, consistent format must be used, and chapters must be presented in a logical progression.

- You may include an introductory “Context” section for each chapter, to establish the overall flow within the thesis and to build a tie to previous chapters. If you have not included a **Declaration of co-authorship** in the frontmatter, this section should include an authorship statement to explain your role in the research, as well as the roles of any co-authors on the corresponding publication. Normally, it is expected that a PhD student will be the first author on any papers arising from their research.
- Supporting information (SI) also referred to as Electronic Supplementary Material or Appendices, should be provided as Appendices to the thesis.
- If the paper was a Communication or Report, you may have key details in the Supporting Information (SI). Any important elements in the SI, such as experimental details, should be integrated into the main body of the chapter. Less critical elements should be included at the end of the thesis as appendices.

- In some cases, subsequent developments in the field may change the conclusions of one of your published chapters. This may be mentioned in a final “Subsequent Advances” section following the conclusion of the chapter. This should be discussed with your supervisor.
- Not every paper you’ve published has to be included. If your contribution to a paper was minor (and you are not the first author), omit it. Talk to your supervisor about what you will include.

1.1.4. General Conclusion

This is a significant part of a manuscript-based dissertation. It is NOT simply a summary of the manuscript chapters. It must include:

- a. A full analysis of the findings in the various chapters in light of current research in the field
- b. Discussion of the overall significance and contribution of the research to the field of study
- c. Discussion and conclusions relating the chapters to each other and the overall field
- d. Comments on strengths and weaknesses of the dissertation research
- e. Evaluation of current knowledge and proposals for new ideas related to the field of study
- f. Presentation of the status of relevant working hypotheses
- g. Discussion of any potential applications of the research findings

1.2. Quarto

In this template, the rest of the chapter shows how to use quarto. The big advantage of using quarto is that it allows you to include your R or Python code directly into your thesis, to ensure there are no errors in copying and pasting, and that everything is reproducible. It also helps you stay better organized.

For details on using Quarto, see <http://quarto.org>.

1.3. Data

Included in this template is a file called `sales.csv`. This contains quarterly data on Sales and Advertising budget for a small company over the period 1981–2005. It also contains the GDP (gross

domestic product) over the same period. All series have been adjusted for inflation. We can load in this data set using the following code:

```
sales <- readr::read_csv("data/sales.csv") |>
  rename(Quarter = `...1`) |>
  mutate(
    Quarter = as.Date(paste0("01-", Quarter), "%d-%b-%y"),
    Quarter = yearquarter(Quarter)
  ) |>
  as_tsibble(index = Quarter)
```

Any data you use in your thesis can go into the `data` directory. The data should be in exactly the format you obtained it. Do no editing or manipulation of the data prior to including it in the `data` directory. Any data munging should be scripted and form part of your thesis files (possibly hidden in the output).

1.4. Figures

Figure 1.1 shows time plots of the data we just loaded. Notice how figure captions and references work. Chunk names can be used as figure labels with `fig-` prefixed. Never manually type figure numbers, as they can change when you add or delete figures. This way, the figure numbering is always correct.

1.5. Results from analyses

We can fit a regression model to the sales data.

If y_t denotes the sales in quarter t , x_t denotes the corresponding advertising budget and z_t denotes the GDP, then the resulting model is:

$$y_t = \beta x_t + \gamma z_t + \varepsilon_t \tag{1.1}$$

where $\hat{\beta} = 1.85$, and $\hat{\gamma} = 1.04$. We can reference this equation using Equation 1.1.

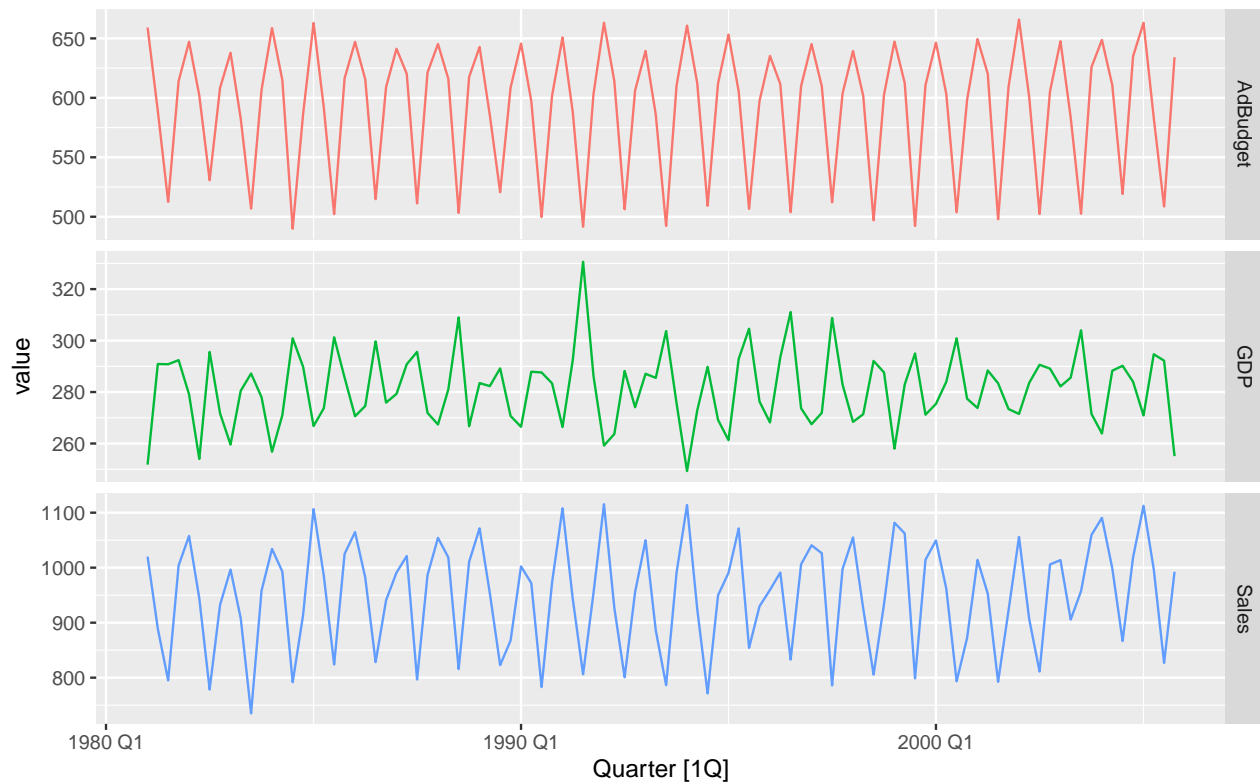


Figure 1.1.: Quarterly sales, advertising and GDP data.

1.6. Tables

We can also make a nice summary table of the coefficients, as shown in Table 1.1

Again, when looking at the `.qmd` file notice the use of labels and references to automatically generate table numbers.

Table 1.1.: Coefficients from the fitted model.

Coefficient	Estimate	P value
(Intercept)	-438.977	0.019
GDP	1.037	0.021
AdBudget	1.852	0.000

1.6.1. Wide table (landscape page)

Here is how you can get a table on page with landscape orientation (Table 1.2). You need to put the table in a pandoc div (delimited by :::) indicating the side way rotation

here is an example for a table but it also works for figures just use **sidewaysfigure** instead of **sidewaystable**

Table 1.2.: This is a wide table

	num	char	fctr	date	time	datetime	currency
grp_a							
row_1	0, 11	apricot	one	jeu. 15/01/2015	13:35	Monday, January 1, 2018	49, 95
row_2	2, 22	banana	two	dim. 15/02/2015	14:40	Friday, February 2, 2018	17, 95
row_3	33, 33	coconut	three	dim. 15/03/2015	15:45	Saturday, March 3, 2018	1, 39
row_4	444, 40	durian	four	mer. 15/04/2015	16:50	Wednesday, April 4, 2018	65 100, 00
grp_b							
row_5	5 550, 00	NA	five	ven. 15/05/2015	17:55	Saturday, May 5, 2018	1 325, 81
row_6	NA	fig	six	lun. 15/06/2015	NA	Wednesday, June 6, 2018	13, 26
row_7	777 000, 00	grapefruit	seven	NA	19:10	Saturday, July 7, 2018	NA
row_8	8 880 000, 00	honeydew	eight	sam. 15/08/2015	20:20	NA	0, 44

Chapter 2

My first manuscript

Hette Bob, Tex Igor & Martin Julien

Submitted to Journal of No-nonsense

Abstract

2.1. Introduction

2.2. Methods

2.3. Results

2.4. Discussion

Acknowledgements

specific to the study as per your manuscript

Chapter 3

My second manuscript

Hette Bob, Tex Igor & Martin Julien

Submitted to Journal of No-nonsense

Abstract

3.1. Introduction

3.2. Methods

3.3. Results

3.4. Discussion

Acknowledgements

specific to the study as per your manuscript

Chapter 4

Conclusion

It cannot be a good day without Lasagna

– My stomach, 2023 –

here you should provide some concluding remarks, discussion, ideas for future research, and so on.

This is a significant part of a manuscript-based dissertation. It is NOT simply a summary of the manuscript chapters. It must include:

- a. A full analysis of the findings in the various chapters in light of current research in the field
- b. Discussion of the overall significance and contribution of the research to the field of study
- c. Discussion and conclusions relating the chapters to each other and the overall field
- d. Comments on strengths and weaknesses of the dissertation research
- e. Evaluation of current knowledge and proposals for new ideas related to the field of study
- f. Presentation of the status of relevant working hypotheses
- g. Discussion of any potential applications of the research findings

Bibliography

- Allaire, J. J., Teague, C., Scheidegger, C., Xie, Y., and Dervieux, C. (2022), “Quarto.” <https://doi.org/10.5281/zenodo.5960048>.
- Allaire, J., Xie, Y., Dervieux, C., McPherson, J., Luraschi, J., Ushey, K., Atkins, A., Wickham, H., Cheng, J., Chang, W., and Iannone, R. (2024), *rmarkdown: Dynamic documents for r*.
- Francisco Rodriguez-Sanchez, and Connor P. Jackson (2023), *grateful: Facilitate citation of r packages*.
- Iannone, R., Cheng, J., Schloerke, B., Hughes, E., Lauer, A., and Seo, J. (2024), *gt: Easily create presentation-ready display tables*.
- O’Hara-Wild, M., Hyndman, R., and Wang, E. (2024a), *fable: Forecasting models for tidy time series*.
- O’Hara-Wild, M., Hyndman, R., and Wang, E. (2024b), *feasts: Feature extraction and statistics for time series*.
- R Core Team (2024), *R: A language and environment for statistical computing*, Vienna, Austria: R Foundation for Statistical Computing.
- Wang, E., Cook, D., and Hyndman, R. J. (2020), “A new tidy data structure to support exploration and modeling of temporal data,” *Journal of Computational and Graphical Statistics*, Taylor & Francis, 29, 466–478. <https://doi.org/10.1080/10618600.2019.1695624>.
- Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L. D., François, R., Golemund, G., Hayes, A., Henry, L., Hester, J., Kuhn, M., Pedersen, T. L., Miller, E., Bache, S. M., Müller, K., Ooms, J., Robinson, D., Seidel, D. P., Spinu, V., Takahashi, K., Vaughan, D., Wilke, C., Woo, K., and Yutani, H. (2019), “Welcome to the tidyverse,” *Journal of Open Source Software*, 4, 1686. <https://doi.org/10.21105/joss.01686>.
- Xie, Y. (2014), “knitr: A comprehensive tool for reproducible research in R,” in *Implementing reproducible computational research*, eds. V. Stodden, F. Leisch, and R. D. Peng, Chapman; Hall/CRC.

- Xie, Y. (2015), *Dynamic documents with R and knitr*, Boca Raton, Florida: Chapman; Hall/CRC.
- Xie, Y. (2024), *knitr: A general-purpose package for dynamic report generation in r*.
- Xie, Y., Allaire, J. J., and Golemund, G. (2018), *R markdown: The definitive guide*, Boca Raton, Florida: Chapman; Hall/CRC.
- Xie, Y., Dervieux, C., and Riederer, E. (2020), *R markdown cookbook*, Boca Raton, Florida: Chapman; Hall/CRC.

Appendix A

R Packages

Table A.1.: Packages used to generate this thesis

Package	Version	Citation
base	4.4.0	R Core Team (2024)
fable	0.3.4	O’Hara-Wild et al. (2024a)
feasts	0.3.2	O’Hara-Wild et al. (2024b)
grateful	0.2.4	Francisco Rodriguez-Sanchez and Connor P. Jackson (2023)
gt	0.10.1	Iannone et al. (2024)
knitr	1.46	Xie (2014); Xie (2015); Xie (2024)
rmarkdown	2.26	Xie et al. (2018); Xie et al. (2020); Allaire et al. (2024)
tidyverse	2.0.0	Wickham et al. (2019)
tsibble	1.1.4	Wang et al. (2020)

Appendix B

Additional stuff

You might put some computer output here, or maybe additional tables. It is possible to have multiple appendices. Just list them in the appropriate place within `_quarto.yml`.