Performance of Rookie Can Predict Price of Their Rookie Prizm Silver Cards*

My subtitle if needed

Harrison Huang

April 24, 2024

Collecting and investing in cards has been relevant for a while now. There are complex factors that contribute to the price fluxation of these cards. This analysis will use player statistics to create a model to try to grasp possible future price trends of the card. A linear model was used in this analysis. The results indicated that player statistics may still not be sufficient to predict future prices of the rookie card.

1 Introduction

Collectible cards such as Pokemon, Yu-Gi-Oh! cards, and Sports cards still exist and are relevant in our world. In the digitized world we live in today, these physical cards are often forgotten. We have also heard wild stories about specific Pokemon cards selling for millions of dollars, the same applies to other collectible cards. NBA basketball cards have gained significant popularity in recent years. Apart from being collector's items, they have also become a form of investment for some individuals.

Many factors go into the valuation of a basketball card. Some example factors include the rarity of the card, the performance and popularity of the player, which series it comes from, and the condition of the card. Each year, the cards are updated and RC labeled cards are labeled on the players that are rookies for that year. These RC-labeled cards are only printed in that specific year and are usually the most sought-after cards among collectors. The specific stats of each player such as points per game, rebounds, and turnover also dictate the valuation of their rookie cards. The complexity of these elements often makes it difficult to predict the future value of the card.

This analysis finds that there are a lot more than performance linking to the price of the rookie card. The performance statistics is only a some of the reasons fluctuating card prices. There are so much more than just the performance of the rookie when taking in consideration of price analysis. Future steps will needed in order to take a look at more factors that may affect the price of the rookie card of that specific player.

```
In Section 2 of the paper, the source and data sets are discussed. Strengths and weaknesses,
```

2 Data

The first place the data was collected from is ESPN, player statistics were obtained from scrapping the website and picking out the right tables. Please be respectful if you decide to use it for any other purpose. Each player had multiple tables and I downloaded the tables and merged players' 202202-2023 and 2023-2024 data. This allows all statistics to be viewed in one table. In addition, when considering which of the statistics to focus on, I asked an NBA reporter Lisa Kao for suggestions. She mentioned that average points, blocks, steals, and assists are the top 5 statistics focused on in the industry. Something to keep in mind is that these statistics presented are all positive statistics, which means that the higher the number the better the player has performed.

The second source of the data came from Sportscardpro website. They collect data from eBay's successful transactions of the card and gather them onto their website. Since there was no table to download the data, I had to manually create an Excel file with the data presented on the website and then import it into rStudio. The price focuses on the PSA 10 and Prizm Silver series of that specific player's rookie card.

The analysis of these three datasets will be carried out using the statistical programming language `R` (R Core Team 2020), using the `tidyverse`(Wickham et al. 2019), `here`(Müller 2020), and `readxl`(Wickham and Bryan 2022) packages. The figures and tables in the paper are generated using the, respectively, `ggplot2`(Wickham 2016) and `knitr`(Xie 2022) packages.

2.1 Player Statistics

Below is a brief explination of the tables including player statistics:

1. The `REB` column refers to the number of rebounds the player average per game in that month.
2. The `AST` column refers to the number of assists the player average per game in that month.
3. The `BLK` column refers to the number of blocks the player average per game in that month.

2

4. The `STL` column refers to the number of steals the player average per game in that month.
5. The `PTS` column refers to the number of points the player average per game in that month.

Table 1: The data set containing player statistics of Anthon Edward from 2022 to 2024

Months	REB	AST	BLK	STL	PTS
2022-10	6.1	4.4	0.3	0.9	23.0
2022-11	5.5	3.5	0.5	1.7	22.8
2022-12	6.8	5.2	0.7	2.3	25.3
2023-01	5.9	4.9	0.8	1.4	27.3
2023-02	4.9	4.4	1.1	1.5	23.5
2023-03	4.8	4.1	0.7	0.9	22.7
2023-04	7.0	4.0	1.5	2.0	29.8
2023-10	6.1	4.4	0.3	0.9	23.0
2023-11	5.5	3.5	0.5	1.7	22.8
2023-12	6.8	5.2	0.7	2.3	25.3
2024-01	5.9	4.9	0.8	1.4	27.3
2024-02	4.9	4.4	1.1	1.5	23.5
2024-03	4.8	4.1	0.7	0.9	22.7
2024-04	7.0	4.0	1.5	2.0	29.8

Table 2: The data set containing player statistics of Tyrese Maxey from 2022 to 2024

Months	REB	AST	BLK	STL	PTS
2022-10	3.6	3.4	0.1	1.1	23.3
2022-11	3.3	5.6	0.4	0.9	22.4
2022-12	1.0	1.0	0.0	0.0	9.0
2023-01	2.4	3.5	0.0	0.7	18.9
2023-02	2.4	2.6	0.1	0.7	16.5
2023-03	3.2	3.8	0.1	0.9	22.7
2023-04	4.0	1.5	0.5	0.5	17.0
2023-10	6.7	6.3	0.3	0.7	30.3
2023-11	4.2	6.7	0.7	0.9	26.3
2023-12	2.6	6.2	0.4	0.7	24.8
2024-01	3.1	6.8	0.5	1.7	24.5
2024-02	4.3	5.5	0.3	1.0	26.9
2024-03	3.3	5.6	0.4	0.9	24.3
2024-04	4.0	5.8	0.4	0.8	30.0

Table 3: The data set containing player statistics of Tyrese Haliburton from 2022 to 2024

Months	REB	AST	BLK	STL	PTS
2022-10	5.3	12.3	0.7	1.0	20.0
2022-11	3.2	11.7	0.7	1.1	28.6
2022-12	4.5	14.0	0.5	0.9	21.4
2023-01	4.6	11.6	0.7	1.4	17.9
2023-02	2.7	8.9	0.8	1.3	16.1
2023-03	4.6	9.1	0.7	1.3	16.7
2023-04	3.7	10.0	1.0	1.4	18.9
2023-10	5.3	12.3	0.7	1.0	20.0
2023-11	3.2	11.7	0.7	1.1	28.6
2023-12	4.5	14.0	0.5	0.9	21.4
2024-01	4.6	11.6	0.7	1.4	17.9
2024-02	2.7	8.9	0.8	1.3	16.1
2024-03	4.6	9.1	0.7	1.3	16.7
2024-04	3.7	10.0	1.0	1.4	18.9

In Table 1, Table 2, and Table 3 are the three player statistics data that will be used in the model.

2.2 Card Price statistics

Table 4: This table is the Prizm Silver RC card price monthly from 2022 season to the end of 2023 season.

Date	LaMelo	Anthony Edward	Tyrese Maxey	Tyrese Haliburton	Zion Willaimson
2022-10	1236.75	926.17	420.00	366.60	1676.00
2022-11	892.57	716.66	415.00	345.77	1030.00
2022-12	1001.67	640.50	283.41	388.10	1007.50
2023-01	800.50	569.95	231.27	388.08	959.25
2023-02	740.03	611.64	258.09	349.73	810.00
2023-03	510.00	590.00	249.78	350.60	687.72
2023-04	535.58	591.83	220.50	309.99	590.55
2023-10	495.56	625.00	224.00	356.00	637.50
2023-11	485.00	595.00	357.50	350.00	487.50
2023-12	378.14	580.00	330.00	425.97	460.00
2024-01	351.95	530.52	322.34	449.74	355.00
2024-02	320.13	576.48	284.45	422.20	350.00

Date	LaMelo	Anthony Edward	Tyrese Maxey	Tyrese Haliburton	Zion Willaimson
2024-03	307.00	612.45	251.94	350.00	380.00
2024-04	285.89	628.63	227.51	302.98	382.50

The table above Table 4 includes the card price. The player card price is from a website called Sportscardpro, they collect data from eBay's successful transactions of the card and gather them onto their website. Since there was no table to download the data, I had to manually create an Excel file with the data presented on the website and then import it into rStudio. The price focuses on the PSA 10 and Prizm Silver series of that specific player's rookie card. Initially, I was going to include data for Zion and LaMelo, however, due to injuries that occurred throughout their career, the player statistics were inconsistent and had a lot of missing months. For those reasons, I will only be following forward with Tyrese Maxey, Tyrese Haliburton, and Anthony Edward.

3 Model

The goal of this paper's modelling strategy is to investigate the effect that average player statistics has on their price of the PSA 10 Prizm Silver rookie card. I will then use the model to make potential prediction of the upcoming price of the player card based on their current statistics and price data.

3.1 Model set-up

Define y_i as the price of the PSA10 Prizm Silver rookie card. Then β_1 is the average rebounds a player gets per game, γ_1 is the average assists a player gets per game, θ_1 is the average blocks a player gets per game, ϕ_1 is the average steals a player gets per game, and lastly, κ_1 is the average points a player gets per game. This is the same for all the player, since each players' statistics and card price likely independent, I will use the same model on the three players, Tyrese Haliburton, Tyrese Maxey, and Anthony Edward.

$$y_i|\mu_i, \sigma \sim \text{Normal}(\mu_i, \sigma) \tag{1}$$
$$\mu_i = \alpha + \theta_i + \phi_i + \kappa_i + \beta_i * \gamma_i \tag{2}$$
$$\alpha \sim \text{Normal}(0, 2.5) \tag{3}$$
$$\beta \sim \text{Normal}(0, 2.5) \tag{4}$$
$$\gamma \sim \text{Normal}(0, 2.5) \tag{5}$$
$$\theta \sim \text{Normal}(0, 2.5) \tag{6}$$
$$\phi \sim \text{Normal}(0, 2.5) \tag{7}$$
$$\kappa \sim \text{Normal}(0, 2.5) \tag{8}$$
$$\sigma \sim \text{Exponential}(1) \tag{9}$$

We run the model in R (R Core Team 2020) using the `rstanarm` package of (**rstanarm?**). We use the default priors from `rstanarm`.

3.1.1 Model justification

We expect a positive relationship between the statistics of the player and price of their rookie trading card. Usually, if a player plays better, the price of their Rookie Card should increase, therefore we will use a linear regression model.

3.2 Model prediction

I will create a test data set for 2024-2025 and 2026-2027 season and use the model with this test data set to predict the price of these players using their own model. In Table 5, Table 6, and Table 7 are the predicted data based by improving the players statistics slightly.

3.2.1 Tyrese Maxey prediction

Table 5: This table is the prediction price of Tyrese Maxey RC Prizm Silver card using the model

Predicted Price	Month
651.3696	2024-10
610.3010	2024-11
624.4785	2024-12
471.1016	2025-01
544.1576	2025-02

Predicted Price	Month
759.3135	2025-03
932.3165	2025-04
587.0424	2026-10
847.6312	2026-11
633.5597	2026-12
567.4162	2027-01
804.7464	2027-02
714.6124	2027-03
749.5004	2027-04

3.2.2 Tyrese Haliburton prediction

Table 6: This table is the prediction price of Tyrese Haliburton RC Prizm Silver card using the model

Predicted Price	Month
-304.37264	2024-10
-303.47269	2024-11
-686.02220	2024-12
-165.39884	2025-01
-330.90748	2025-02
-55.69843	2025-03
-159.89055	2025-04
-383.97714	2026-10
423.92007	2026-11
-222.96825	2026-12
-356.54236	2027-01
-365.41311	2027-02
-914.71809	2027-03
-559.01818	2027-04

3.2.3 Anthony Edward prediction

Table 7: This table is the prediction price of Anthony Edward RC Prizm Silver card using the model

Predicted Price	Month
466.795267	2024-10
309.305331	2024-11
1071.036873	2024-12
125.342707	2025-01
314.599869	2025-02
662.374324	2025-03
377.054079	2025-04
10.209074	2026-10
363.063180	2026-11
608.401588	2026-12
4.914536	2027-01
326.322583	2027-02
328.590768	2027-03
587.923689	2027-04

4 Results

4.1 Average player statistics

4.2 Price trend ratio to player average

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
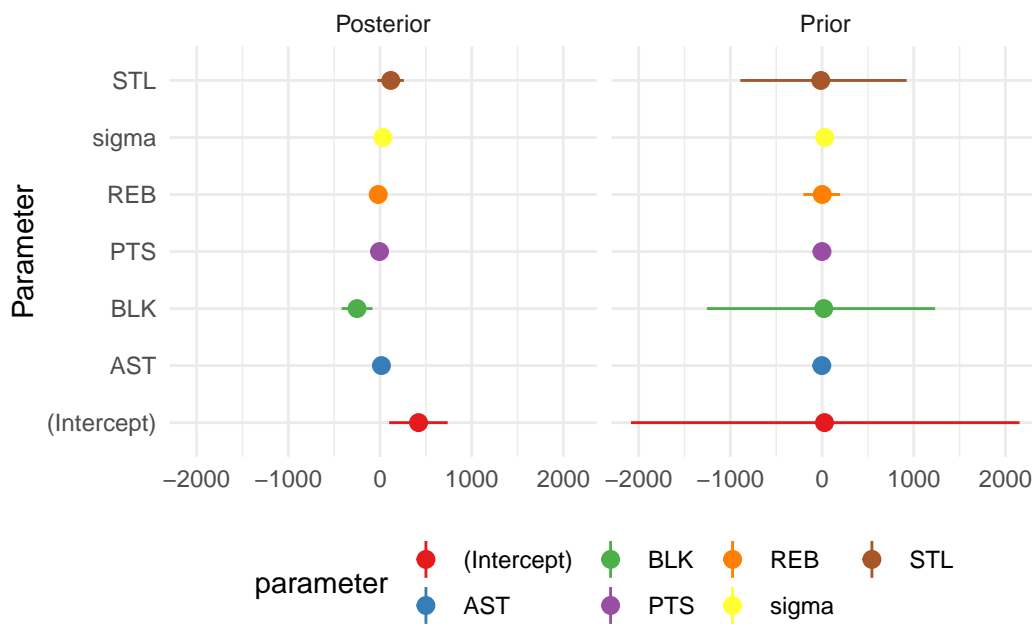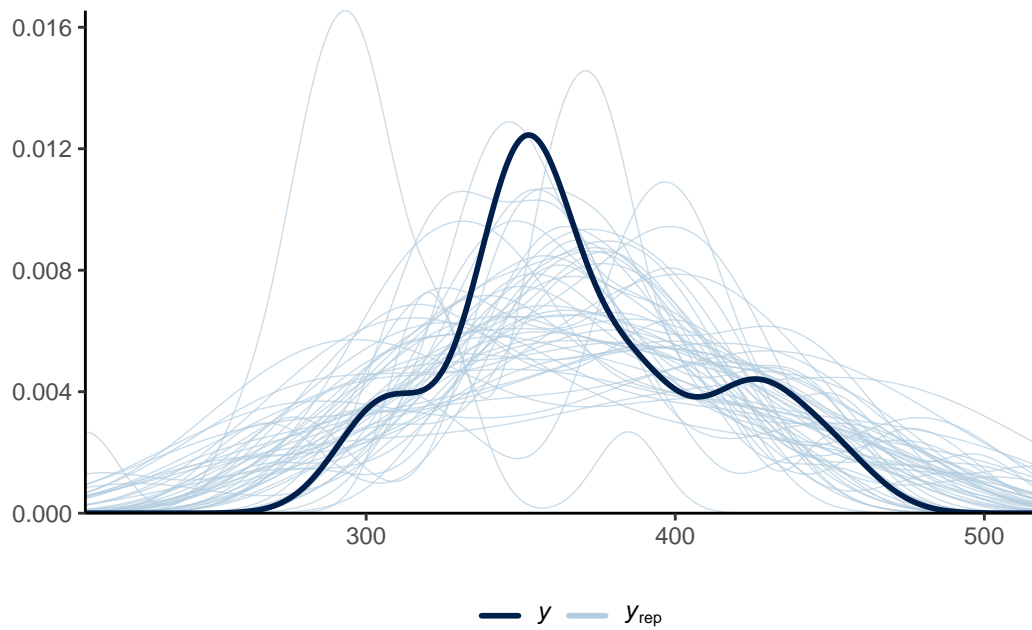
5.3 Third discussion point
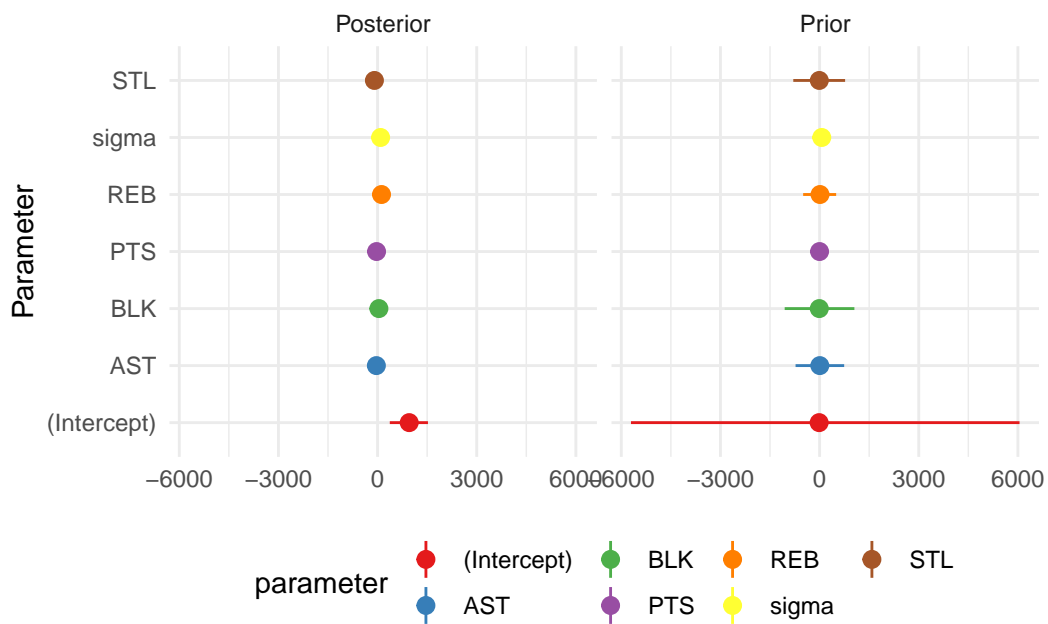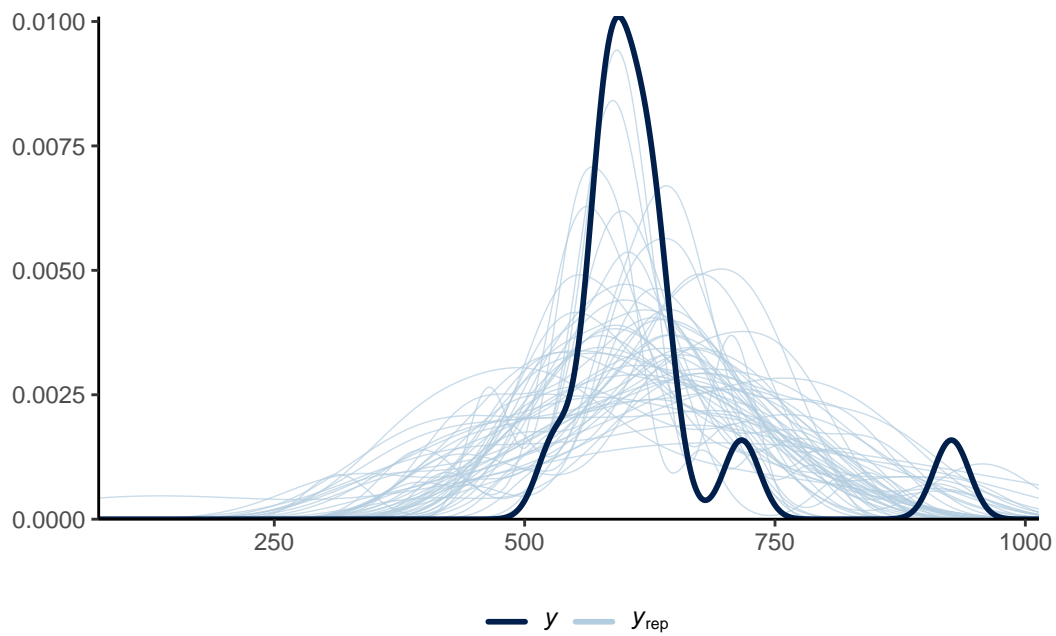
5.4 Weaknesses and next steps

Weaknesses and next steps should also be included. More player should be added into this analysis and

A Appendix

A.1 Model Check
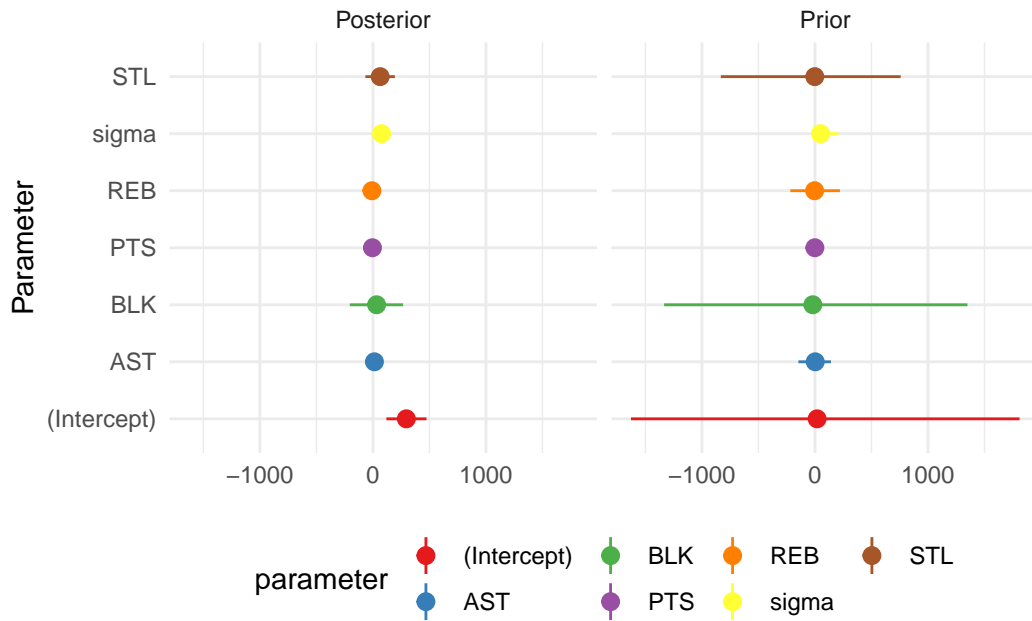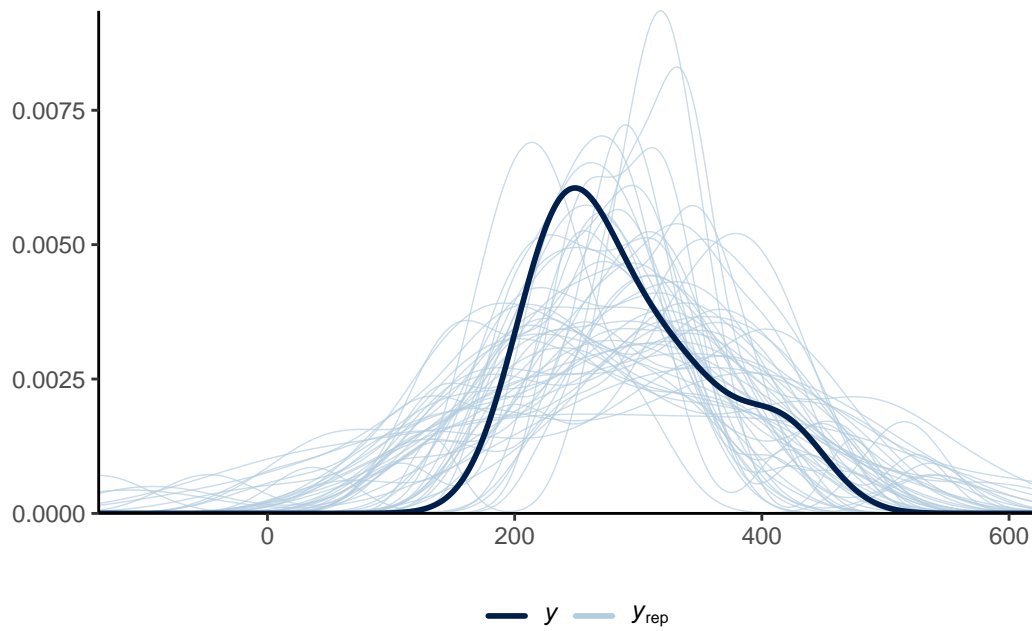
References

Müller, Kirill. 2020. *Here: A Simpler Way to Find Your Files.* https://CRAN.R-project.org/package=here.

R Core Team. 2020. *R: A Language and Environment for Statistical Computing.* Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Wickham, Hadley. 2016. *Ggplot2: Elegant Graphics for Data Analysis.* Springer-Verlag New York. https://ggplot2.tidyverse.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.

Wickham, Hadley, and Jennifer Bryan. 2022. *Readxl: Read Excel Files.* https://CRAN.R-project.org/package=readxl.

Xie, Yihui. 2022. *Knitr: A General-Purpose Package for Dynamic Report Generation in r.* https://yihui.org/knitr/.