

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

My subtitle if needed

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Collecting and investing in cards has been relevant for a while now. There are complex factors that contribute to the price fluctuation 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.

*Code and data are available at: <https://github.com/lemonface88/NBA>

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' 2022-2023 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.

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 Williamson
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 Williamson
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.

$$y_i | \mu_i, \sigma \sim \text{Normal}(\mu_i, \sigma) \quad (1)$$

$$\mu_i = \alpha + \theta_i + \phi_i + \kappa_i + \beta_i * \gamma_i \quad (2)$$

$$\alpha \sim \text{Normal}(0, 2.5) \quad (3)$$

$$\beta \sim \text{Normal}(0, 2.5) \quad (4)$$

$$\gamma \sim \text{Normal}(0, 2.5) \quad (5)$$

$$\theta \sim \text{Normal}(0, 2.5) \quad (6)$$

$$\phi \sim \text{Normal}(0, 2.5) \quad (7)$$

$$\kappa \sim \text{Normal}(0, 2.5) \quad (8)$$

$$\sigma \sim \text{Exponential}(1) \quad (9)$$

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. The mock data wick use the original data from 2022 to 2024 with an increase of 2% each month to see if increasing performance statistics have an impact on the card price.

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
278.6230	2024-10
310.3122	2024-11
258.1895	2024-12

Predicted Price	Month
280.3690	2025-01
282.2224	2025-02
275.2840	2025-03
245.6480	2025-04
227.8084	2026-10
309.8934	2026-11
301.7378	2026-12
274.8990	2027-01
280.2999	2027-02
303.1682	2027-03
258.6640	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
342.2097	2024-10
338.6551	2024-11
417.0009	2024-12
403.4867	2025-01
367.7228	2025-02
352.9182	2025-03
302.4046	2025-04
331.6631	2026-10
327.8328	2026-11
416.7303	2026-12
325.3050	2027-01
361.1903	2027-02
344.6518	2027-03
288.0798	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
741.6483	2024-10
633.5811	2024-11
592.0385	2024-12
511.9724	2025-01
522.9536	2025-02
587.5276	2025-03
554.3090	2025-04
712.1658	2026-10
590.1181	2026-11
543.9087	2026-12
694.3920	2027-01
467.7814	2027-02
541.4124	2027-03
504.9232	2027-04

4 Results

4.1 Tyrese Maxey Predution

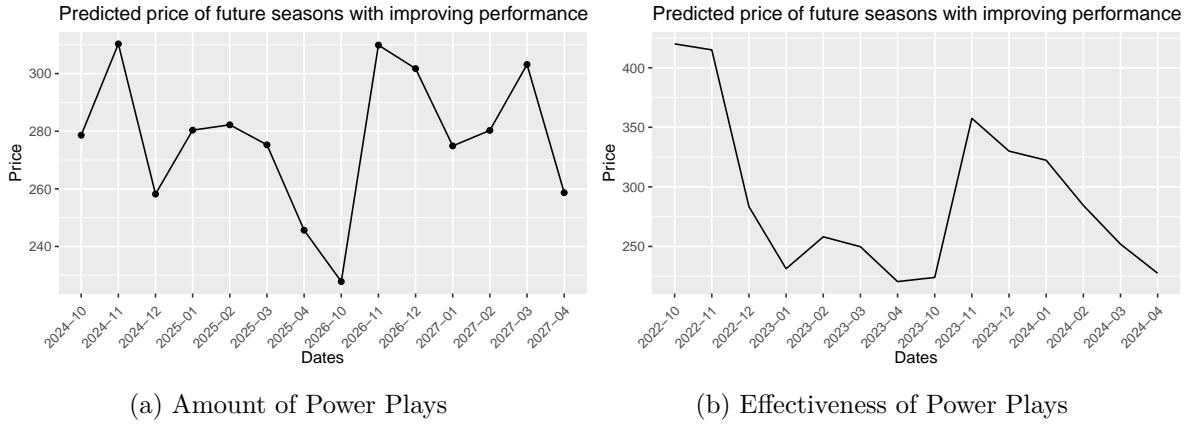
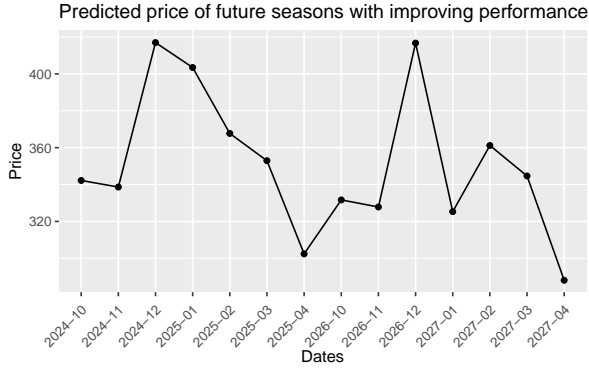
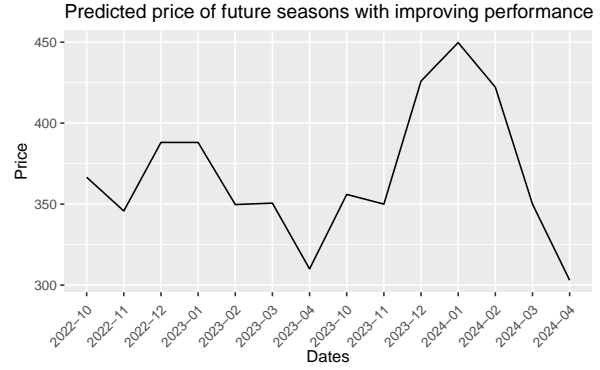


Figure 1: The comparision between past season versus predicted improving season



(a) Amount of Power Plays

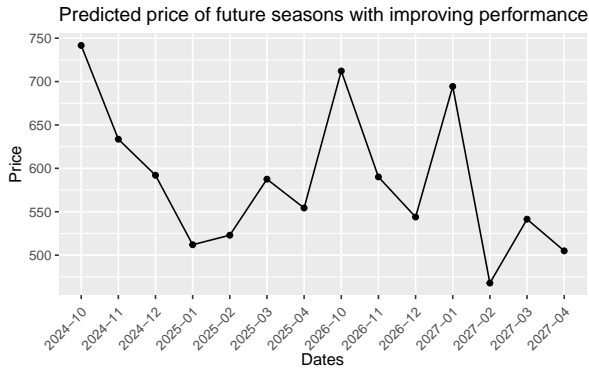


(b) Effectiveness of Power Plays

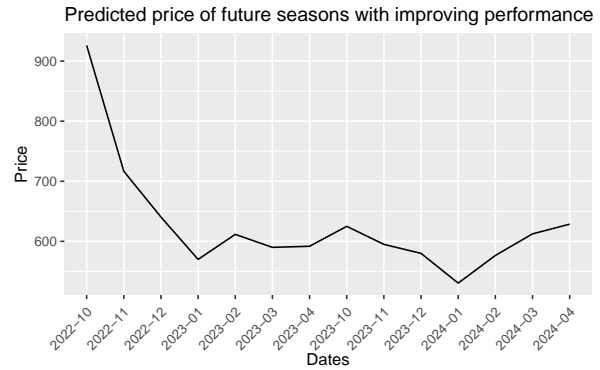
Figure 2: The comparison between past season versus predicted improving season

4.2 Tyrese Haliburton Predution

4.3 Anthony Edward Prediction



(a) Amount of Power Plays



(b) Effectiveness of Power Plays

Figure 3: The comparison between past season versus predicted improving season

5 Discussion

5.1 Overall price trend

The player's performance does not have too much of a prediction factor in the price of their card. Overall, almost every player has a downward trend in price regardless of how they are performing in the league. I think this has to do with the initial overvaluation of the card. The

quantity that is released into the market also plays a critical role in the price. As we know, the more supply, and if the demand can't keep up with the supply, then the price will go down. With more packs of cards being opened every day, the number of cards being released into the market also increases.

5.2 Confounding variables

The linear model may be too simple due to each player's positions and playstyles. Because we are assuming that the higher the statistics are the better a player is performing. However, basketball is not only about statistics. If a player is known and in charge of defensive plays, their blocks and rebounds may be more important compared to attack-oriented players. The behavior of a player outside the league is also very crucial in terms of this. Even though Ja Morant played well in the league, he had multiple occasions where he displayed illegal objects during his livestream on Instagram. This devastated his reputation overall and he also received game restrictions as punishment. His card price also plummeted from around 2000 to now at around 400 dollars.

5.3 Third discussion point

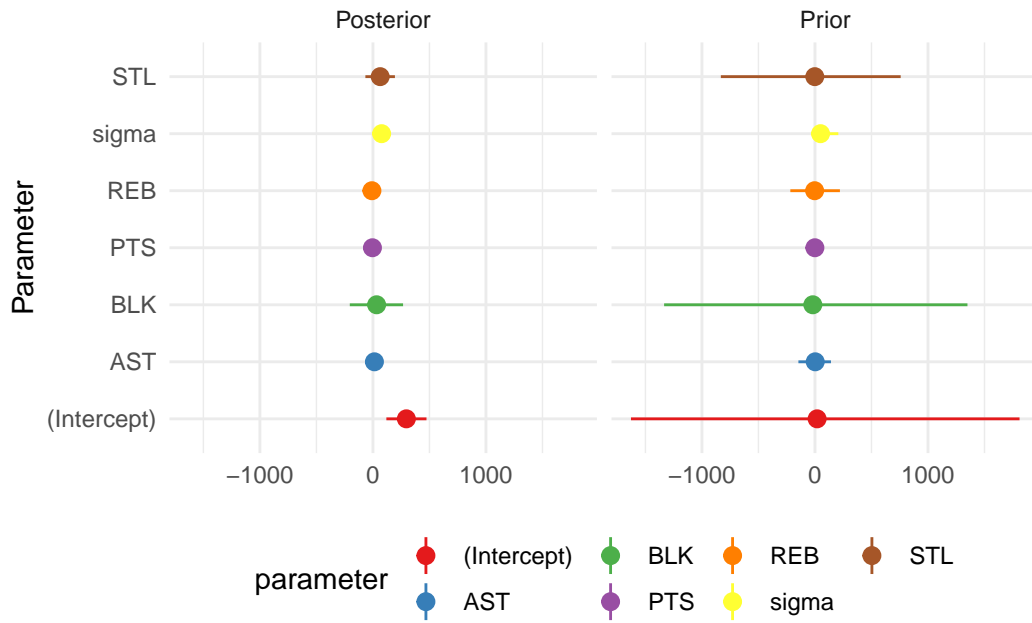
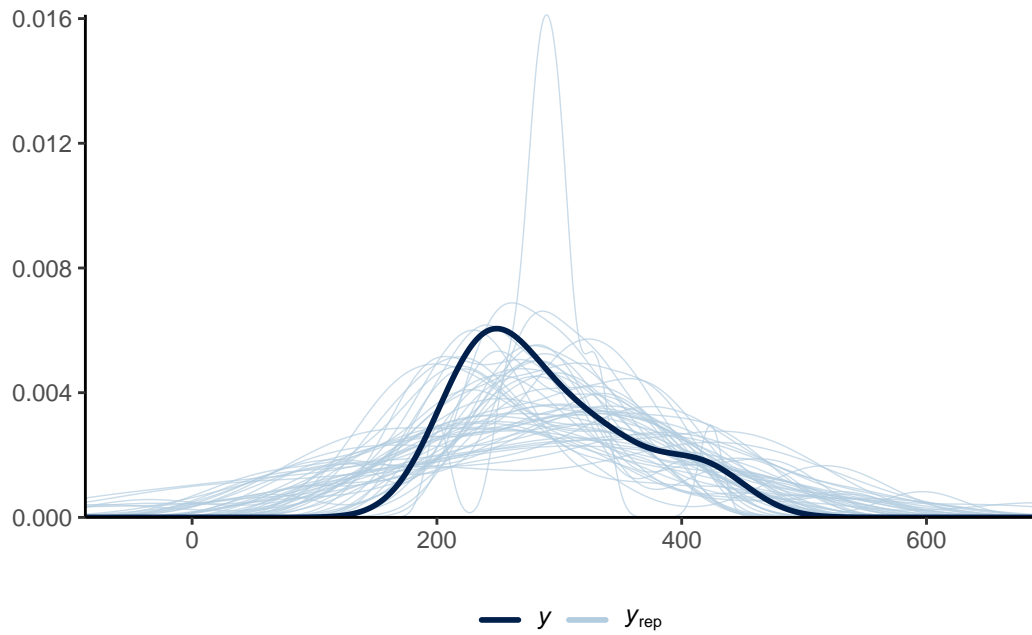
5.4 Weaknesses and next steps

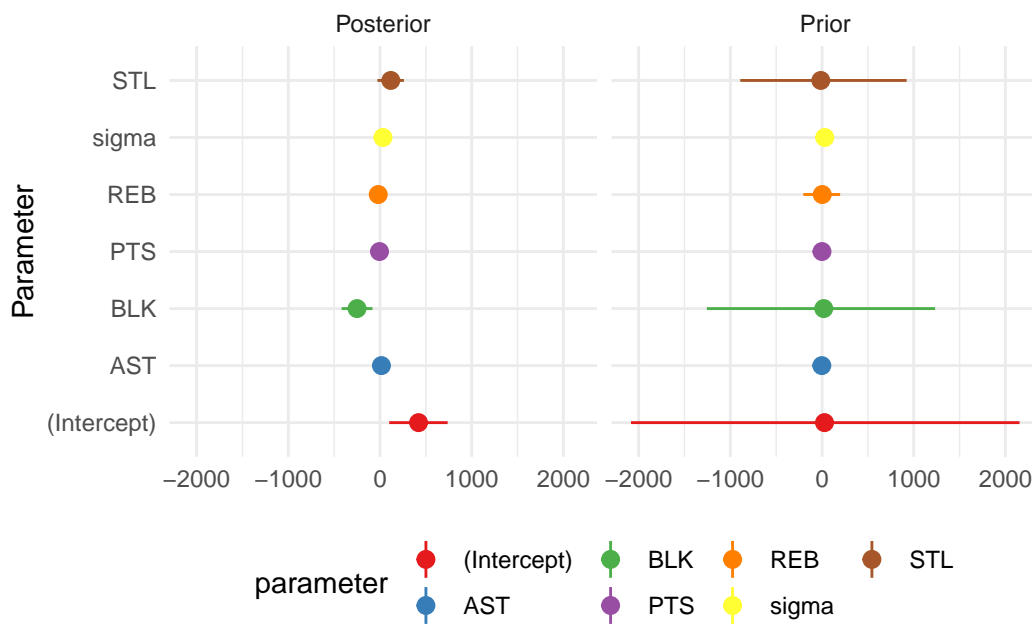
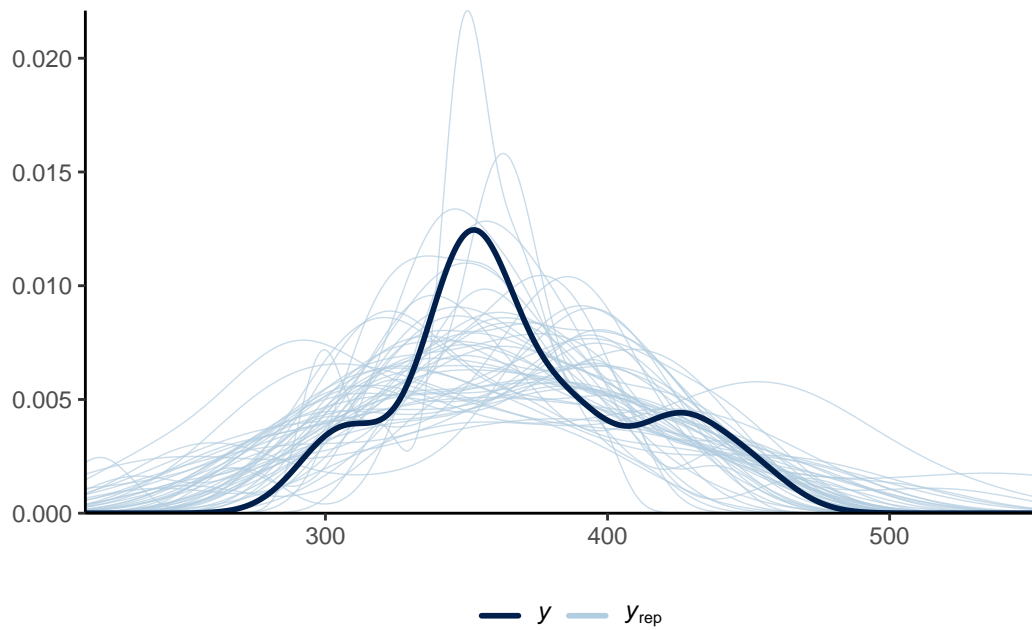
Since there isn't a major platform that provides the tracking of every transaction of a card, it is very difficult to obtain the true price of the card. Sportscardpro only gathers its data from completed transactions of that card on eBay, which is only a portion of the sales that happen on the internet. Transactions of the card that often happen offline in stores are also not tracked, if I sold a card to my friend for a cheaper price, it is not reflected in the dataset from Sportscardpro.

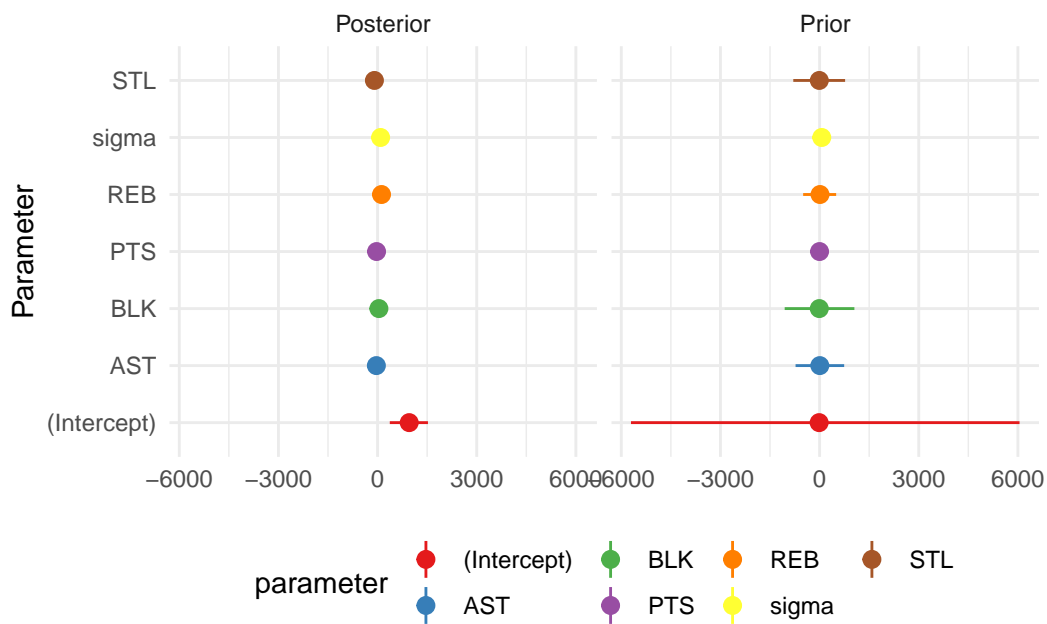
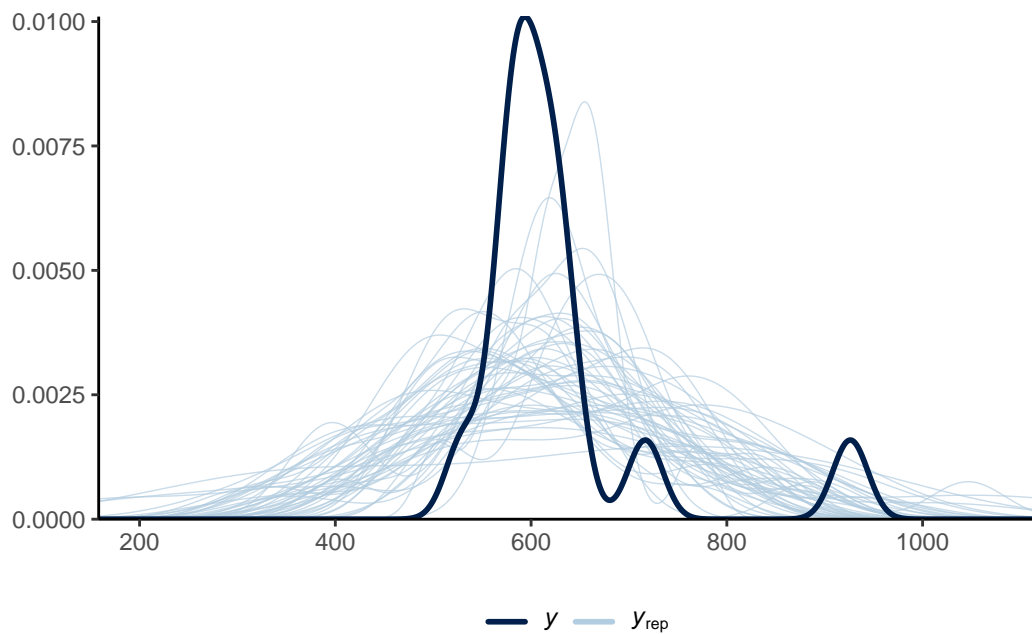
Future steps would include categorizing each player based on their positions and giving weight to the statistics that would have a better indication of their performance. For example, giving more weight to the average number of blocks per game for defensive players. Another step would be the incorporation of other models to find better fits, because of the complex relationship between the price and the player statistics, a more sophisticated model may be needed.

A Appendix

A.1 Model Check







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