Prizm Silver Rookie Cards*

An Analysis Using Statistic Serformance of an Individual Player and Their Rookie Card Price

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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 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

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

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, methods of collection, and terminologies will be explored. Section 3 of the paper will incorporate a model aiming to use player statistics to predict the price trend of the card. Section 4 will then look at the results from the model. Lastly, section 5 will be a reflection about possible steps and the discussion of the strengths and weaknesses of this analysis.

2 Data

The first place the data was collected from is "ESPN" (n.d.), 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 data sets will be carried out using the statistical programming language `R` (R Core Team 2023), using the `here`(Müller 2020a), and `readxl`(**citexl?**) packages. Various packages were used throughout the writing of this paper including `tidyverse` (Wickham et al. 2019), `arrow` (Richardson et al. 2023), `here` (Müller 2020b), `ggmap` (Kahle and Wickham 2013), `knitr` (Xie 2023), `dplyr` (Wickham et al. 2023), `janitor` (Firke 2023), `lintr` (Hester et al. 2024), and `rstanarm` (Goodrich et al. 2023).

2.1 Player Statistics

Below is a brief explanation 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

Months	REB	AST	BLK	STL	PTS
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

Date	LaMelo	Anthony Edward	Tyrese Maxey	Tyrese Haliburton	Zion Willaimson
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
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 2023) using the `rstanarm` package of Goodrich et al. (2023). 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

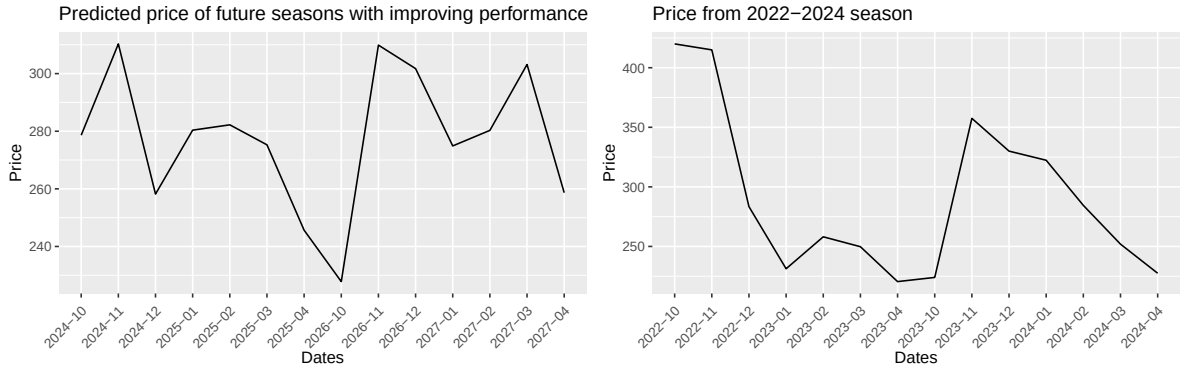
3.2.3 Anthony Edward prediction

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 Preduction

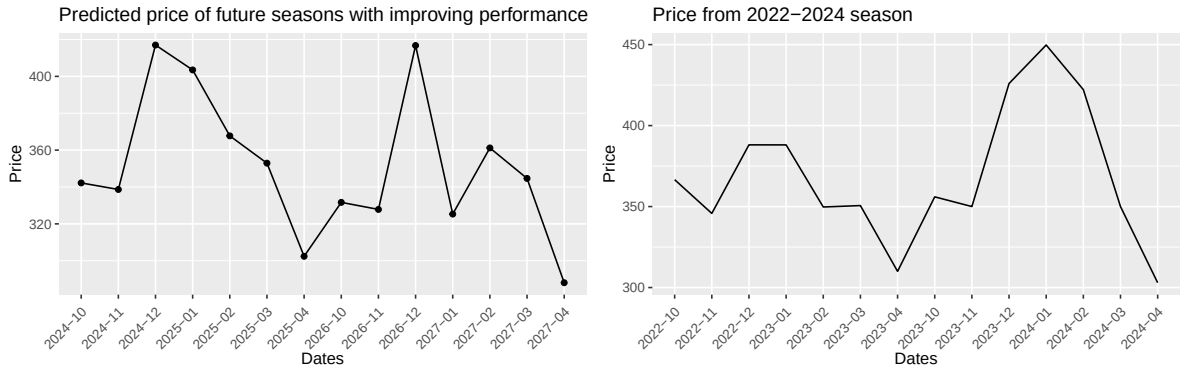


(a) Model Predicted Price

(b) Price from 2022-2024 season

Figure 1: The comparision between past season versus predicted improving season of Tyrese Maxey

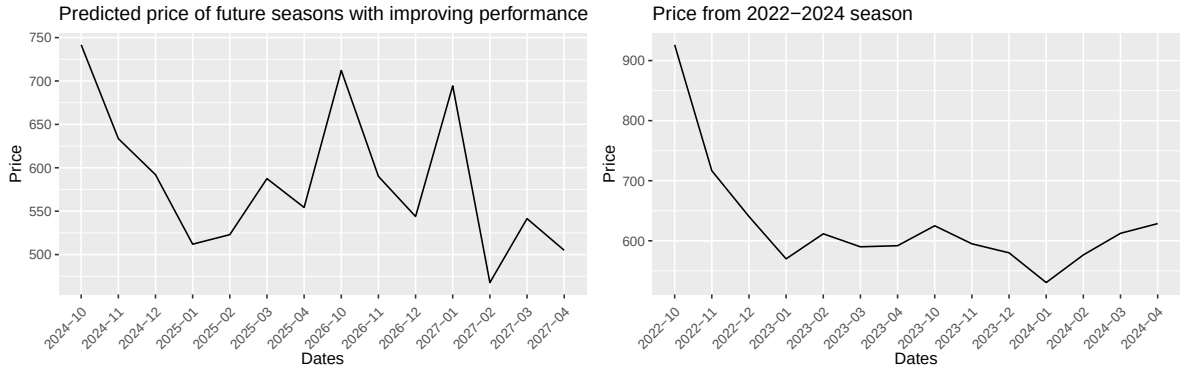
4.2 Tyrese Haliburton Prediction



(a) Model Predicted Price (b) Price from 2022-2024 season

Figure 2: The comparision between past season versus predicted improving season of Tyrese Haliburton

4.3 Anthony Edward Prediction



(a) Model Predicted Price (b) Price from 2022-2024 season

Figure 3: The comparision between past season versus predicted improving season of Anthony Edward

In Figure 1, Figure 2, and Figure 3 the results are all very similar. The over all price has a downward trend initially without the use of the model. However, in the start of the 2023 season, all three players card price saw an upward trend with then later died down again falling into another downward trend. This could be because if people coming back to the sport also bringing more attention to playing cards ultimately leading to increase in the price. When the month jumps from April to October, a price increase can be observed, which indicates an

end of a season to the start of the next season. The predicted price interestingly displayed an increase at the beginning of each season and decreasing of price after around December of each 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 play styles. 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 mock data had in increase of 2% each month of each players statistics, which should lead to overall increase of the price if the statistics were all positively related to the price. The weight of an varibale might be overlooked or underlooked which could be casuing this issue.

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 live stream 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 Time and Price

The time frame also plays a crucial role in prices of many items in our every day life. For example, the rent price in Toronto starting May is lower compared to September from my past experience. This is due to the mass fluctuation of students leaving Toronto in May and coming back to Toronto in September. Timing and price in this case also plays a role in the change or card prices.

After taking a closer look at trends from both predicted and past data, an interesting point came up mind. When observing turning points of the price, they all seems to be the start and end of a season. Price increasing trends tends to happen at the start of each season, and then become more and more unpredictable throughout the season. This brings attention to the timing of the season and the price may be quite related and even more than the player statistics. Because despite implementing an increasing performance for each of the player statistics to run the model on, there are no clear signs of increasing price overall. The thing that stood out the most is the price increase at the start of every season in October. This could suggest that the initial hype of a new season could be contrbuting to the increase of the card price.

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 data set from "SPORTSCARDPRO" (n.d.).

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. Upon taking a look at **?@fig-4**, **?@fig-5**, and **?@fig-6**, the fit of the data are not very good. 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. I think also using an average of all the player's statistics and price data and compare them to individual model would also be something beneficial, exploring the overall relationship rather than one at a time. Overall, this analysis gives insgitht to how complex the relationship is and that a lot more work would be required to be done.

A Appendix

A.1 Model Check

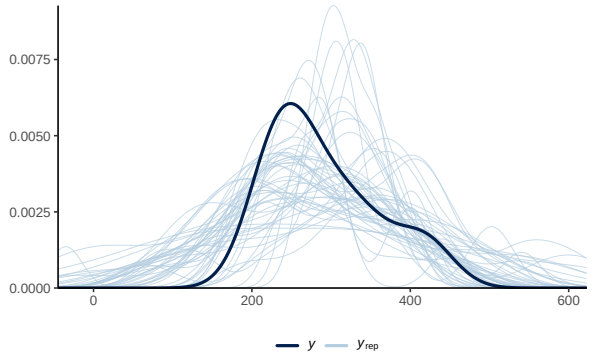


Figure 4: Model fit of Tyrese Maxey

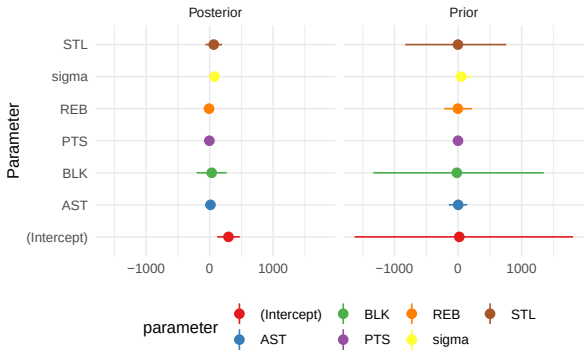


Figure 5: Model fit of Tyrese Maxey

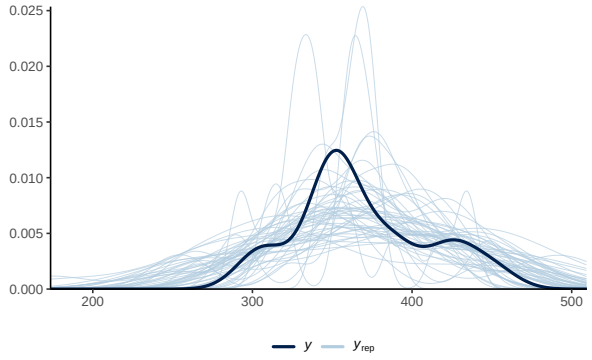


Figure 6: Model fit of Tyrese Haliburton

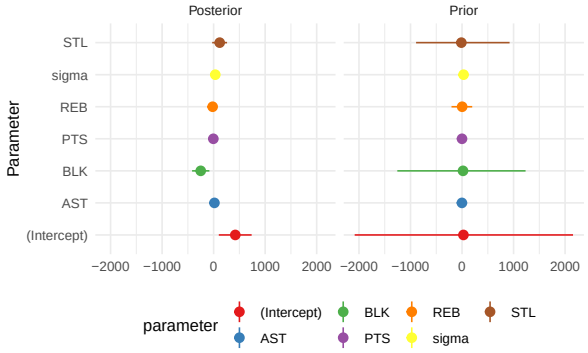


Figure 7: Model fit of Tyrese Haliburton

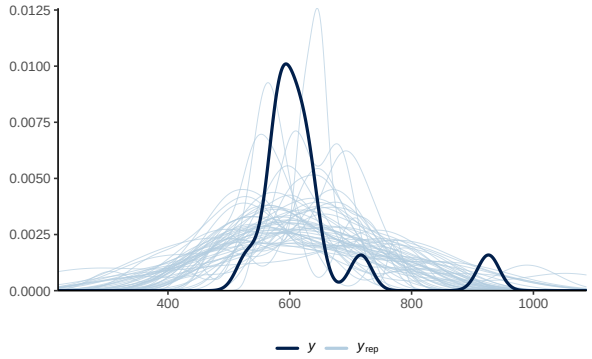


Figure 8: Model fit of Anthony Edward

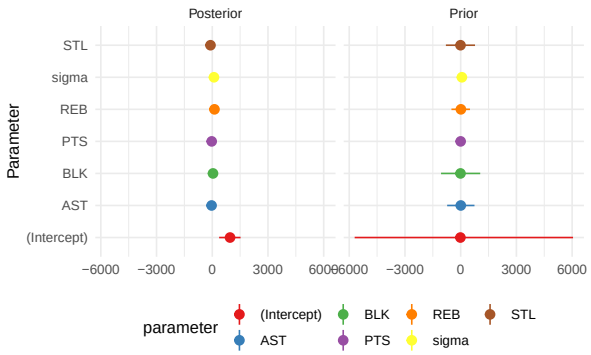


Figure 9: Model fit of Anthony Edward

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