The Earlier the Cheaper? Houston Rockets Ticket Price Analysis

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Author Note

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A pair of fundamental concepts of the economy is supply and demand: if supply goes up and demand goes down, the price will drop, and vice versa. This is obviously true in sports, where ticketing is a main source of revenue for professional sports teams: they aim to sell out every game and maximize the revenue. Therefore, there has been a substantial increase in the adoption of the dynamic pricing system among teams in order to adjust to the change in supply and demand (Xu, Fader & Veeraraghavan, 2015). There are a number of factors that the system takes into account, including seat location, opponent, match time (day vs night, holidays etc.), peer events and so on (Deksnyte & Lydeka, 2012). Aside from these intuitive ones, one variable raises people's interests: the time when people buy tickets. While other factors are more explicit – seats closer to the court or matches with better opponents will cost more, for instance – the relation between time to event and price is unclear: it is not definitive whether prices will rise or drop when the event nears. With total supply relatively stable (a limited number of seats available depending on the capacity of the arena), the price will increase as time goes on if customers have a high demand for the tickets. On the contrary, if the event is not popular, teams might drop the price significantly before the event in order to sell more tickets. Nevertheless, it is valuable to take a look at the general trend of the price change in correspondence to time to the event, as it reflects the change in supply and demand over time. In particular, this study focuses on the Houston Rockets, a team in the National Basketball Association (NBA), to evaluate the relationship between time to event and ticket price on both primary market (sold by the Rockets directly) and secondary market (where ticketholders sell tickets). Moreover, we split the data into training and testing sets to create a model to predict the price given the time to event.

Background

The home arena of the Rockets is Toyota Center with a seating capacity of 18,023 for basketball events according to Harris County Houston Sports Authority. Figure 1 shows the seating map of the Toyota Center. The Rockets divides these sections into six areas: upper sideline, upper endzone, premium, club, lower corner and the lower endzone. Table 1 details the classification of different areas. In general, tickets for sideline sections are more expensive than endzone on the same level because of the better view, and premium tickets are the most expensive.

Hypothesis

This paper believes that as a time to event decreases, the ticket price will increase because the Rockets is the only professional basketball team in Houston and one of the top teams in the NBA, therefore it makes sense that the demand for tickets is high. Fans are more likely to buy tickets earlier, fearing that tickets from the primary market would sell out quickly, and prices on the secondary market would rise gradually.

Methods

Data

This study collected 4,997,198 records from three seasons (2016-17, 2017-18 & 2018-19) of ticket transaction history, consisting of both primary market and secondary market (in this case Flash Seats, the official partner of the Rockets) records. Since only completed transactions will be measured, we dropped records that listed price but never actually sold. We got 2,635,494 records remaining after cleaning up the dataset, including 86,1437 from 2016-17, 98,2230 from 2017-18 and 79,1827 from 2018-19 season.

We used Jupyter Notebook to analyze the data, including numpy, matplotlib, sklearn and pandas packages to parse and build the model.

Analysis

We first plot the relationship between time to event (in days) and price by season, and Figures 2 – 4 show the result. 2016-17 season. We see that there are 5-figure priced tickets in both 2017-18 and 2018-19 season, specifically 2017-18 where tickets above $20,000 were sold. The increase in price reflected the strong performance by the Rockets: they held the best record in the regular season and played seven games against the reigning champion Golden State Warriors. Another interesting phenomenon is that most high-priced ticket transactions (above $5,000) occurred within 100 days to the event, and a significant portion of them was on gameday. The reason might be that the supply on gameday is low, so buyers have to pay well above the usual market price for tickets, which illustrated the hypothesis that prices would increase as the event nears.

Then we take a look at how time to the event affects pricing in different areas. We create a nested mapping that maps section to another (days to the event, price) mapping. The controlled variable is section, and the independent variable is days to the event, while the dependent variable is the price. For simplicity, we compute the price as the average price of tickets in the same section bought on the same day. After that, we plot the relationship between the time to event and price as well as a regression line. Figures 4 to 10 are the results, and Table 2 shows the regression equation. The coefficient is not large overall, but there are still some notable discoveries: Premium section is the only section with a positive coefficient, meaning that as days to event decrease, the price would slightly decrease. The reasoning behind that might be that the supply for premium sections are not as high as others, so the price is relatively inelastic. In addition, people who can afford these tickets are less likely to track the change in price over time, so they might not buy tickets well in advance. For other sections, we see that the time to the

event has the most significant impact on lower endzone, followed by the upper sideline, lower corner, upper endzone and club. There is a significant gap between lower, upper bowl area and high-end seating areas like club and premium. Most coefficients are negative, meaning that prices will increase as the event approaches.

Next we build the model by splitting the data into 80% of the training set and 20% of the testing set. Figures 11 to 16 show the predicted and actual outcome for each section, and Table 3 reports the prediction score for models built for each section. Again, the score is not notably high, although the tier is clear: the score for upper sideline is the highest, well beyond others. This means that prices for upper sideline tickets follow a more similar pattern in relation to time to the event compared with other sections. The scores for premium, club and upper endzone are negative, meaning the models do not these sections as a result of more dissected patterns.

Conclusion

Taking two results into account, we see that the relationship between the time to the event and price is not significantly high, meaning that this is not the decisive factor in determining the price. Yet, there are still some useful findings when it comes to different areas: The prices for upper sideline area have the tightest relation with time to the event by ranking first in both, and most areas show a negative coefficient, so the result supports our hypothesis that prices would generally increase if customers buy tickets later.

In the future, some other useful research would be to take other factors, such as opponent and section, into account to build a more accurate model. However, an obstacle for this would be assigning scores to them: although sections have its own number, it does not mean much as section 101 is not necessarily better than section 102. Therefore, to quantify the seat quality is not a straightforward task. A similar idea could be applied to rank opponents, as there are

numerous factors needed to take into account, and modeling that could take a significant amount of time. Another interesting study would be that on what day do prices change the most. In the end, the ideal outcome would be to create a system that given the time to the events, the opponent and section, the output would be a reference price. This could be a helpful and handy supplement for teams to amend the dynamic pricing system and monitor the trends on the secondary market.

References

Deksnyte, I., & Lydeka, Z. (2012). Dynamic Pricing and Its Forming Factors. *International Journal of Business and Social Science,3*(23).

Harris County Houston Sports Authority. https://www.houstonsports.org/toyota-center/

Xu, J., Fader, P., & Veeraraghavan, S. (2015). Evaluating the Effectiveness of Dynamic Pricing Strategies on MLB Single-Game Ticket Revenue [Abstract].

Tables

Table 1

Toyota Center Seating Section Classification

Area	Sections
Upper Sideline	405 – 414, 422 – 431
Upper Endzone	401 – 404, 415 – 421, 432 – 434
Premium	Ledge Dining, Courtside, VIP
Club	105 –109, 118 –122
Lower Corner	103, 104, 110, 111, 116, 117, 123, 124
Lower Endzone	101, 102, 112 – 115, 125, 126

Table 2

Regression on Price for Each Area

Area	Regression
Upper Sideline	y = -0.054x + 53.82
Upper Endzone	y = -0.046x + 38.68
Premium	y = 0.021x+ 731.4
Club	y = -0.039x + 262.4
Lower Corner	y = -0.047x + 119.15
Lower Endzone	y = -0.058x + 96.7

Table 3

Prediction Score for Model on Each Area

Area	Prediction Score
Upper Sideline	0.172
Upper Endzone	-0.521
Premium	-0.002
Club	-0.003
Lower Corner	0.028
Lower Endzone	0.067

Figures

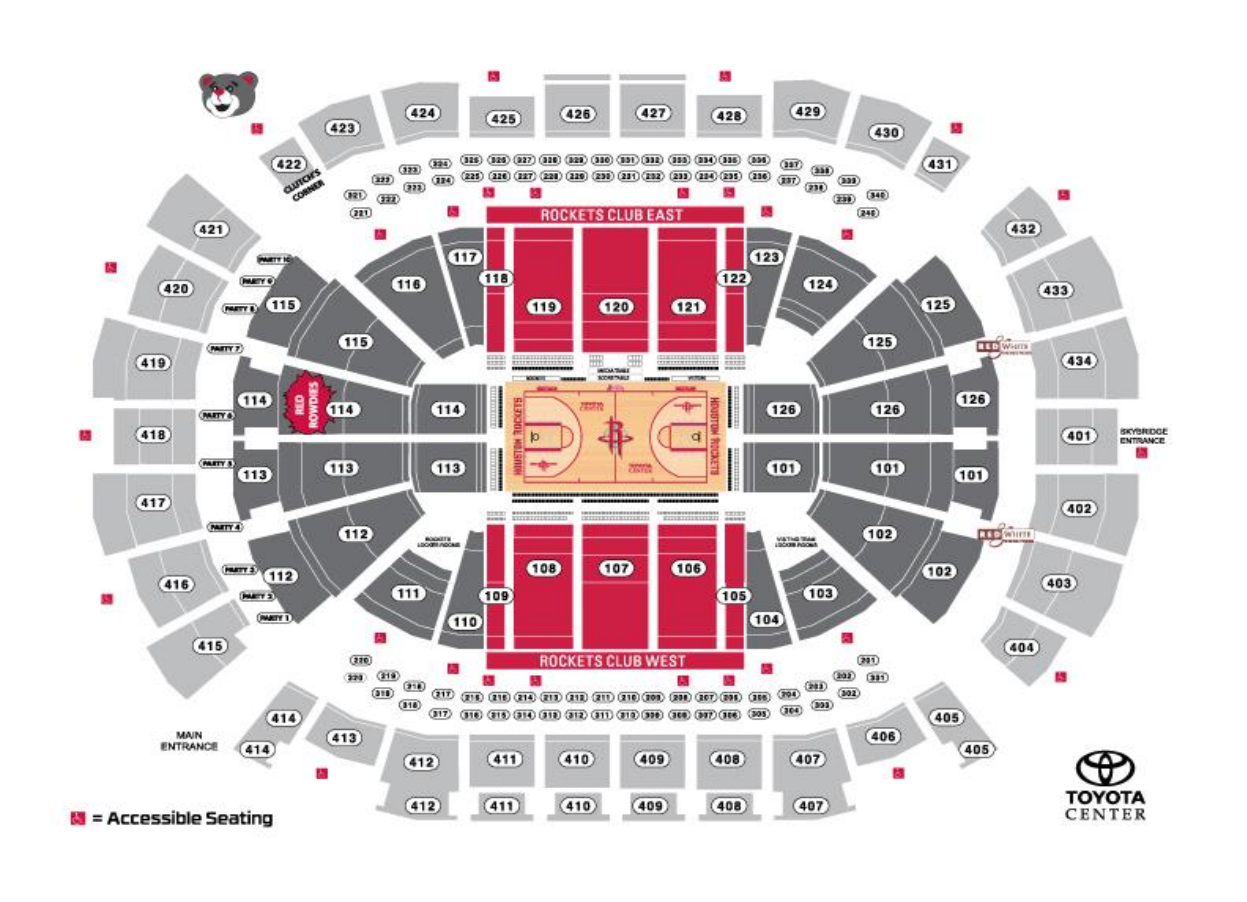

Figure 1. Toyota Center Seating Map, from https://www.toyotacenter.com/events/seating-charts

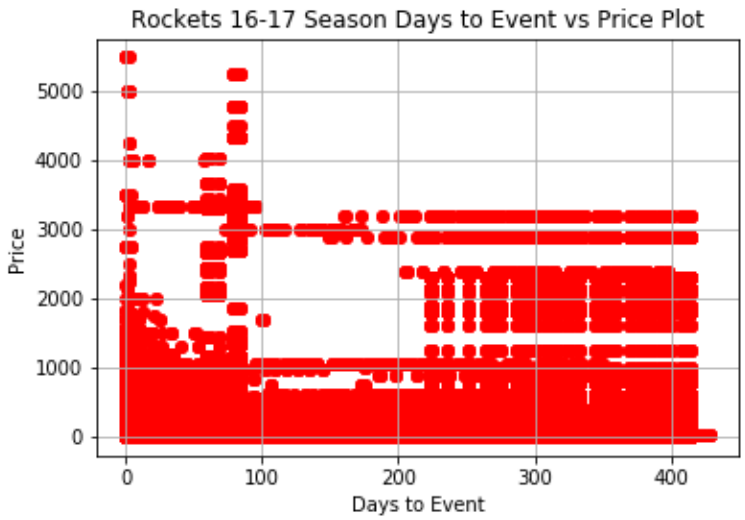

Figure 2. 2016-17 Season Rockets Days to Event vs Price Plot

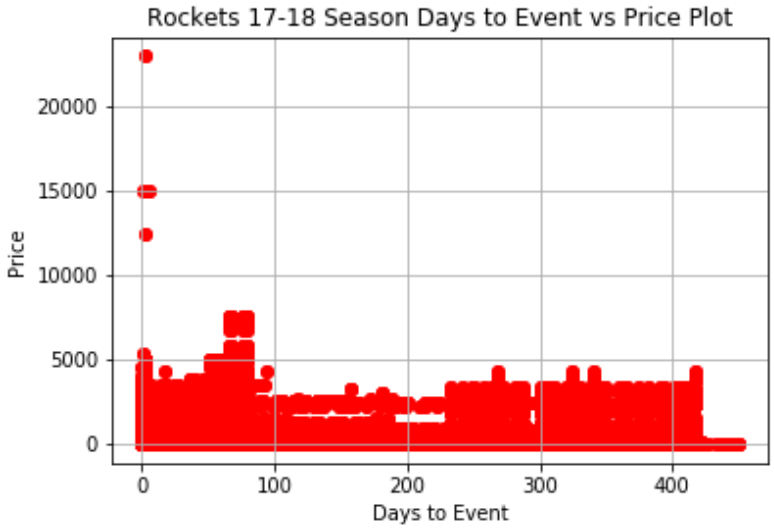

Figure 3. 2017-18 Season Rockets Days to Event vs Price Plot

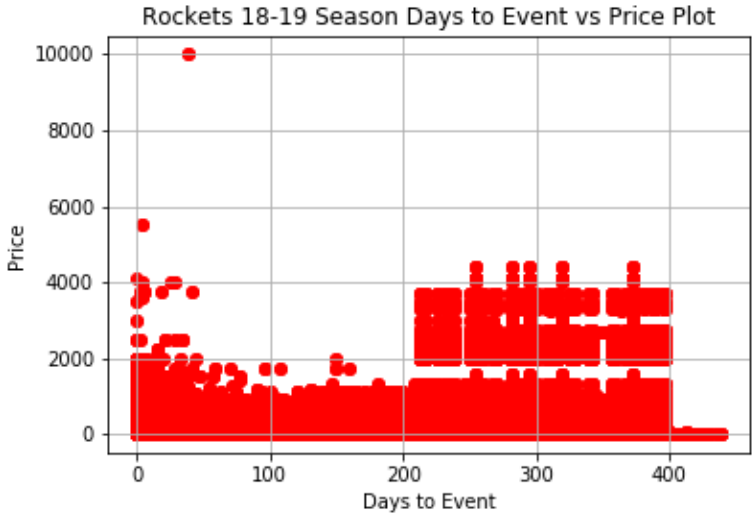

Figure 4. 2018-19 Season Rockets Days to Event vs Price Plot

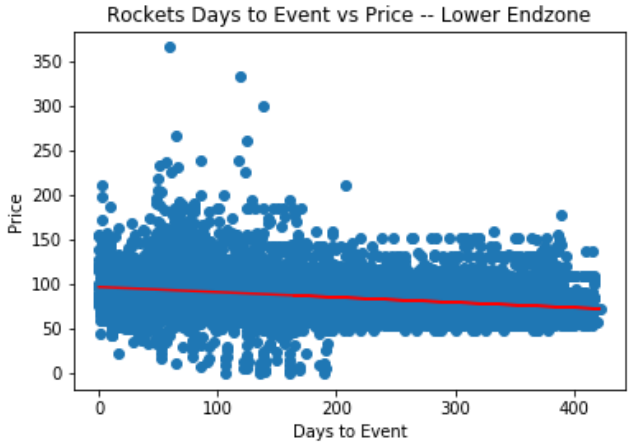

Figure 5. Rockets Days to Event vs Price – Lower Endzone

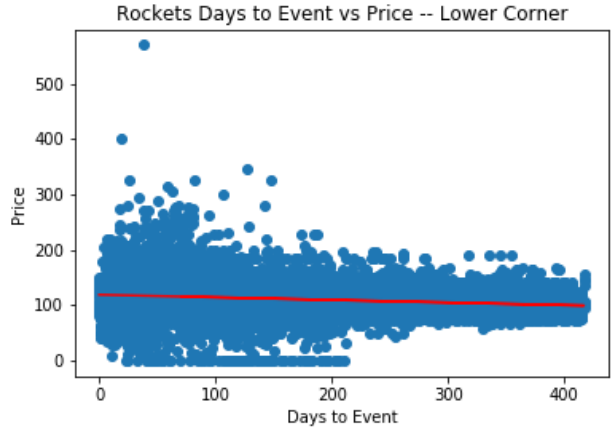

Figure 6. Rockets Days to Event vs Price – Lower Corner

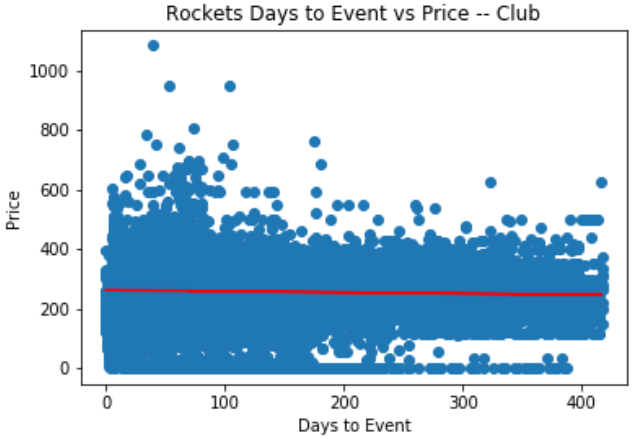

Figure 7. Rockets Days to Event vs Price – Club

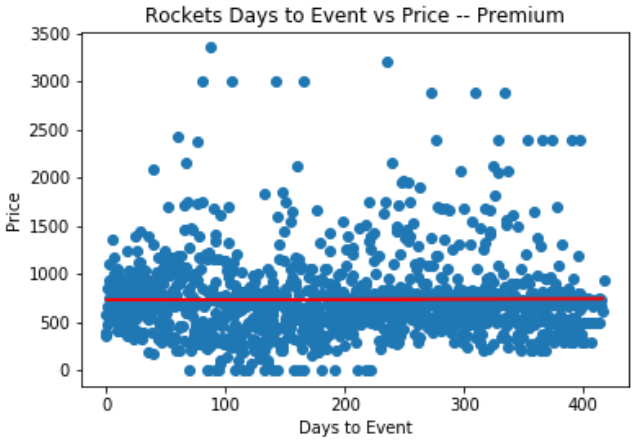

Figure 8. Rockets Days to Event vs Price – Premium

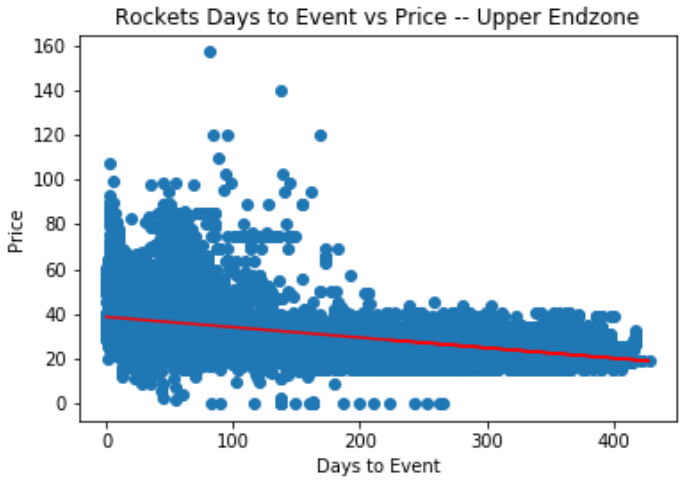

Figure 9. Rockets Days to Event vs Price – Upper Endzone

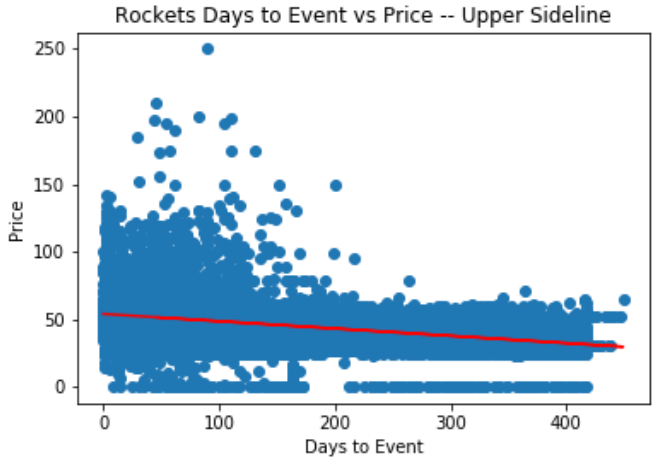

Figure 10. Rockets Days to Event vs Price – Upper Sideline

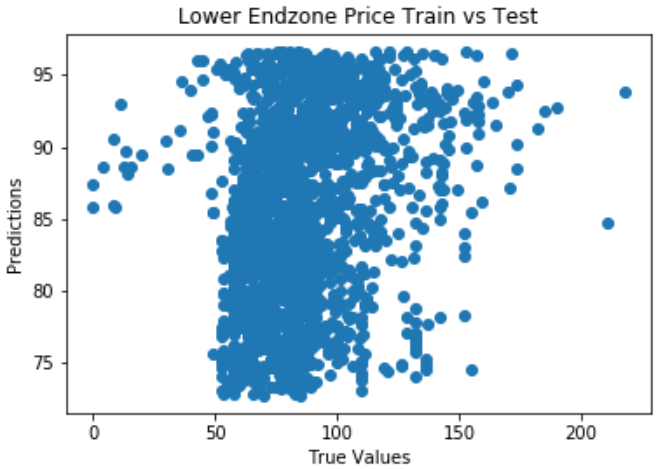

Figure 11. Lower Endzone Price Predicted and Actual Output

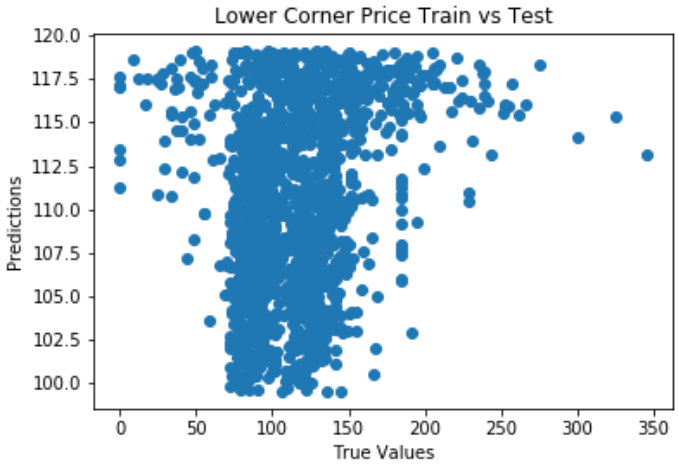

Figure 12. Lower Corner Price Predicted and Actual Output

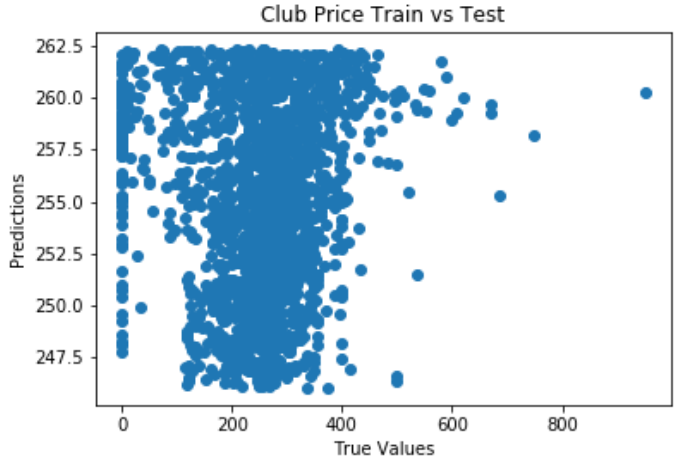

Figure 13. Club Price Predicted and Actual Output

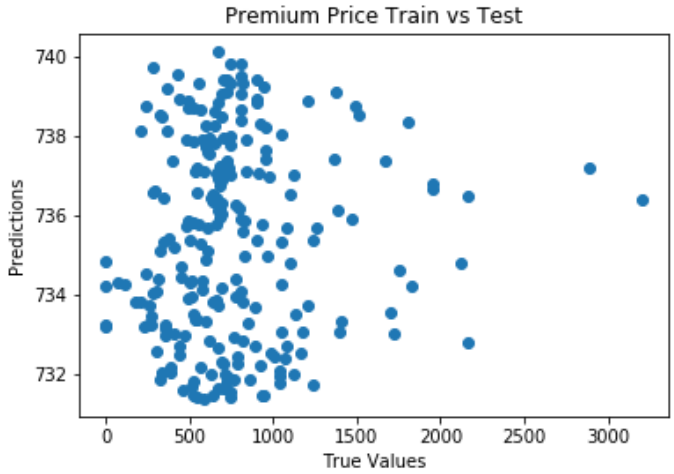

Figure 14. Premium Price Predicted and Actual Output

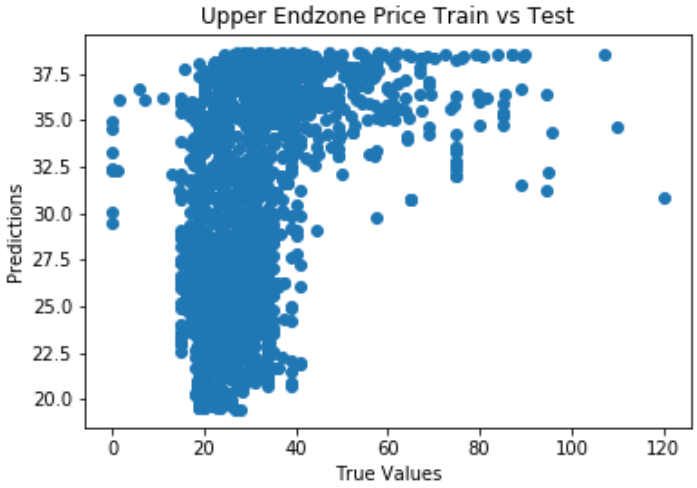

Figure 15. Upper Endzone Price Predicted and Actual Output

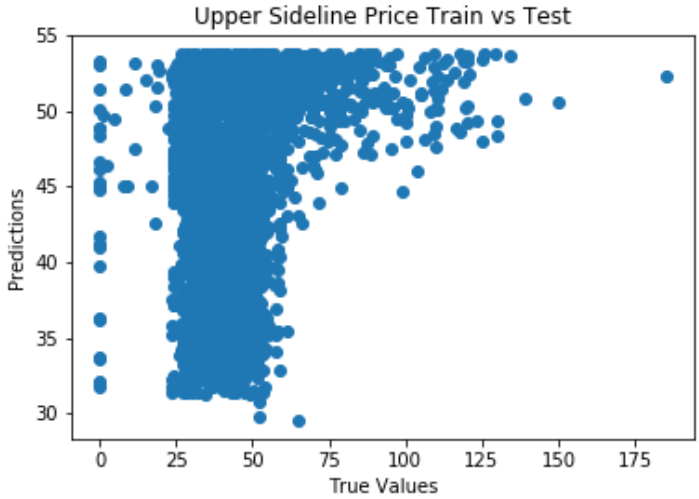

Figure 16. Upper Sideline Price Predicted and Actual Output