

# ECON 470 HW4

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## 1 Instructions

In this assignment, you'll again work with the Medicare Advantage data. These data are described in detail in the [Medicare Advantage GitHub Repo](#). We worked with a subset of these data back in assignment 1; however, this assignment requires that you work with a more complete version of the Medicare Advantage data, but for fewer years. Once you have data downloaded and code running, answer following questions:

## 2 Summarize the data

**2.0.1 Question 1. Remove all SNPs, 800-series plans, and prescription drug only plans (i.e., plans that do not offer Part C benefits). Provide a box and whisker plot showing the distribution of plan counts by county over time. Do you think that the number of plans is sufficient, too few, or too many?**

Figure 1 displays the distribution of plan counts by county over time from 2007 to 2015. The box and whisker plot shows that there are many extreme values on the upside of the distribution. The distribution has been shifting downwards from 2008 to 2011, and has stayed at a relatively low level from 2011 to 2015.

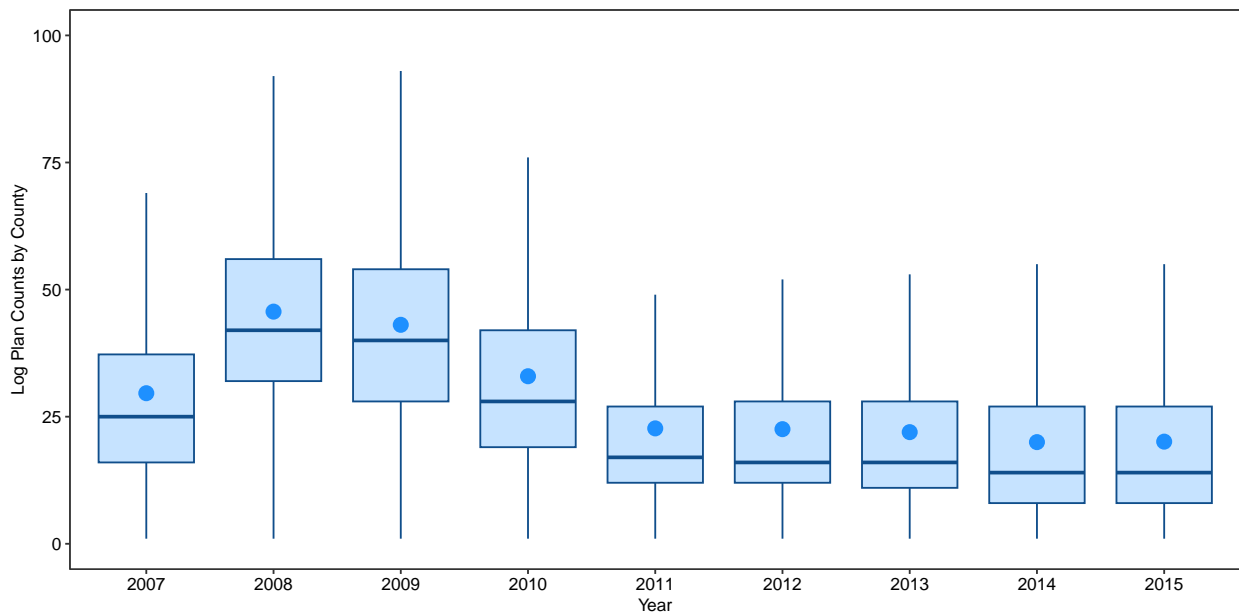


Figure 1: Distribution of Plan Counts by County from 2007 to 2015

Table 1 displays the summary statistics of plan counts by county over time from 2007 to 2015. The number of plans by county on average has been falling overtime with the sharpest decrease happening in 2011. Overall, the number of plans is too few, as 75% of counties have no more than 10 plans in any year between 2011 and 2015, while only a few counties have a relatively large number of plans.

Table 1: Summary Statistic of Plan Counts by County from 2007 to 2015

factor(year)	Mean	Max	Q2	Median	Q3	Min
2007	41.40	800	17	26	43.0	1
2008	72.66	1,343	33	46	70.5	1
2009	69.63	1,307	30	43	69.0	1
2010	48.66	906	20	29	48.0	1
2011	30.21	513	12	18	30.0	1
2012	29.96	522	12	17	31.0	1
2013	29.23	554	11	17	32.0	1
2014	26.57	509	8	15	28.0	1
2015	27.31	492	8	15	29.0	1

## 2.0.2 Question 2. Provide bar graphs showing the distribution of star ratings in 2009, 2012, and 2015. How has this distribution changed over time?

Figure 2 and Figure 3 display the distribution of star ratings in 2009, 2012, and 2015. The distribution changed from right skewed to left skewed, as the majority of plans moved from the lower end of star ratings to the upper end of star ratings. The mode of the distribution shifted upwards, as most plans are rated 2.5 stars, 3 stars, and 4 stars in 2009, 2012, and 2015 respectively. This means that the quality of the plans as measured by star ratings has improved overtime.

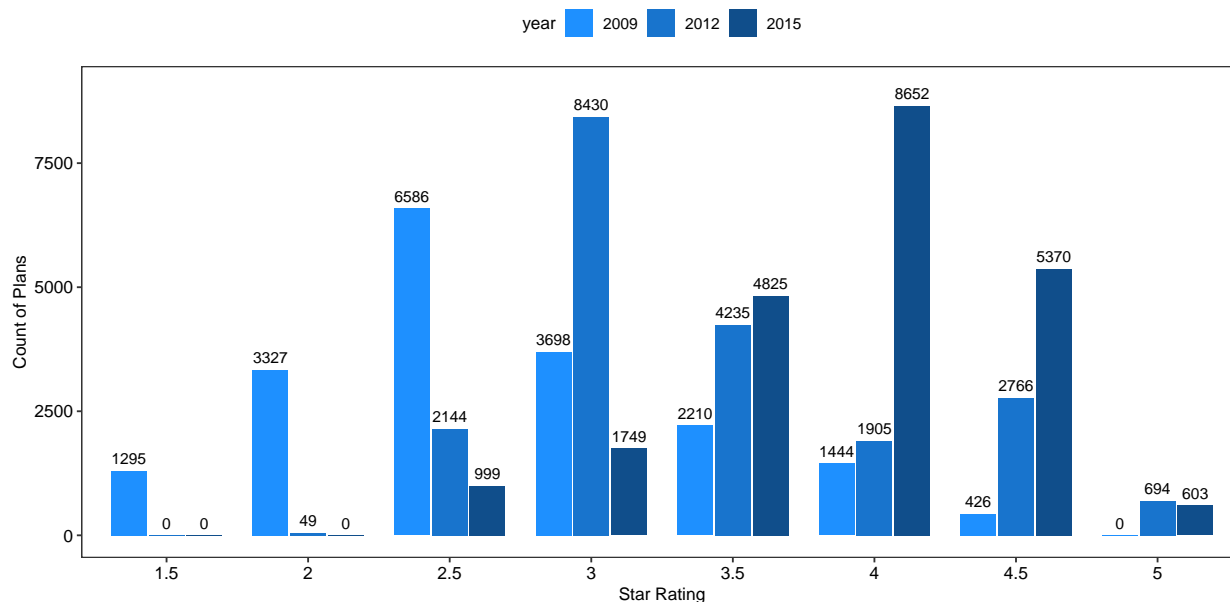


Figure 2: Frequency Distribution of Star Ratings in 2009, 2012, and 2015 (One Plot)

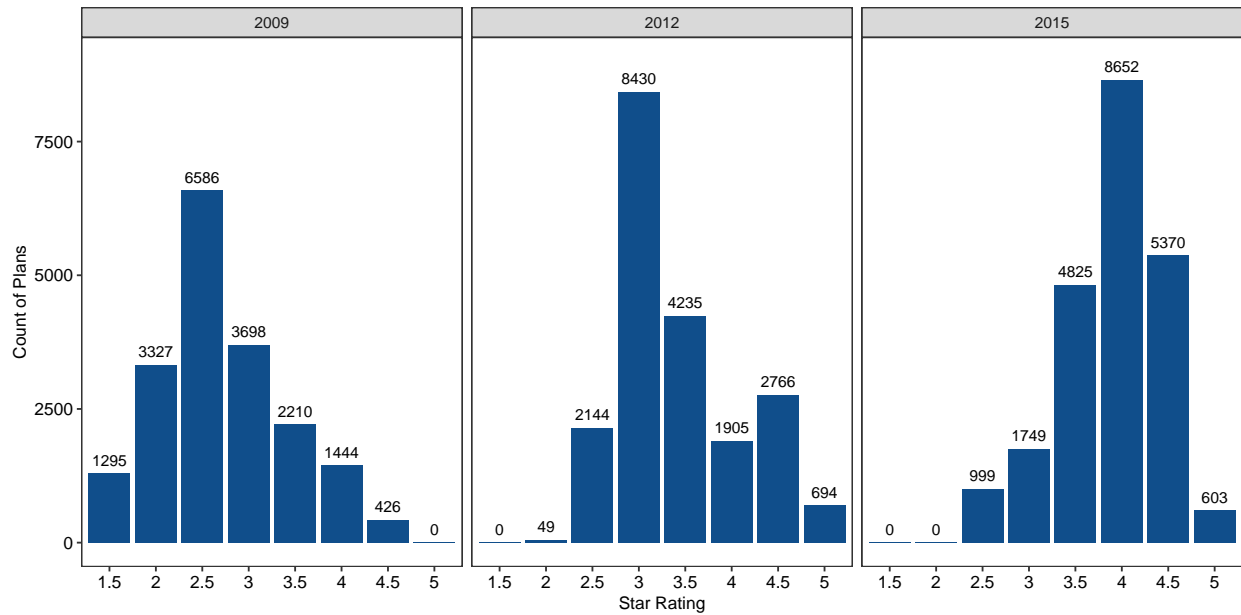


Figure 3: Frequency Distribution of Star Ratings in 2009, 2012, and 2015 (Separate Plots)

**2.0.3 Question 3. Plot the average benchmark payment over time from 2009 through 2015. How much has the average benchmark payment risen over the years?**

Figure 4 displays the average benchmark payment of Part C over time from 2009 to 2015. The average benchmark payment has been slowly increasing from 2009 to 2014 and fell in 2015. From 2009 to 2015, the average benchmark payment decreased by 20.27 from 804.72 to 784.44.

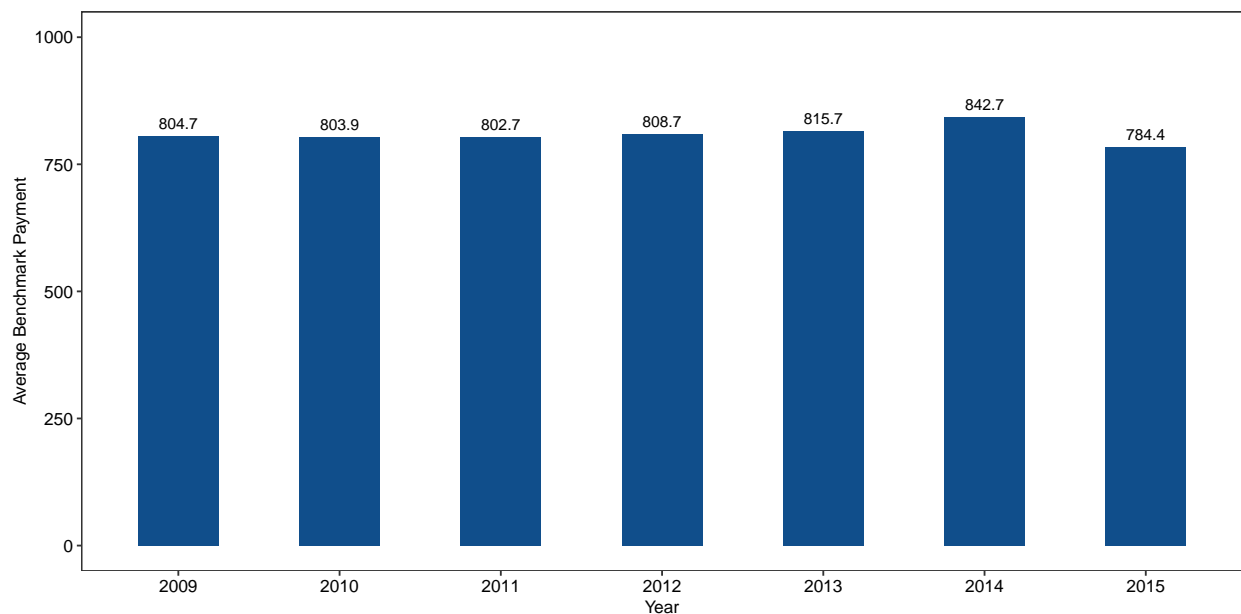


Figure 4: Average Benchmark Payment from 2009 to 2015

**2.0.4 Question 4. Plot the average share of Medicare Advantage (relative to all Medicare eligibles) over time from 2009 through 2015. Has Medicare Advantage increased or decreased in popularity? How does this share correlate with benchmark payments?**

Figure 5 displays the average share of Medicare Advantage (relative to all Medicare eligibles) over time from 2009 through 2015. Medicare Advantage has increased in popularity as the market share has been consistently rising over time from 2009 to 2015, with a faster rate from 2011 to 2015. The market share of Medicare Advantage increased by 0.07 from 0.15 to 0.23.

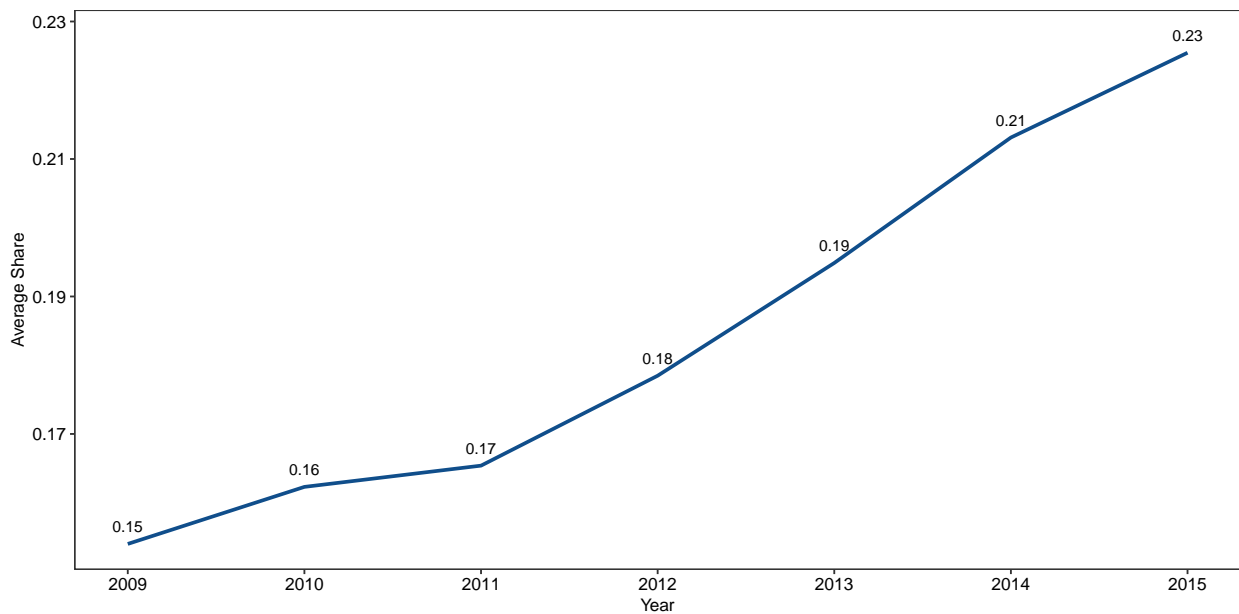


Figure 5: Average Share of Medicare Advantage (Relative to All Medicare Eligibles) from 2009 to 2015

### 3 Estimate ATEs

For the rest of the assignment, we'll use a regression discontinuity design to estimate the average treatment effect from receiving a marginally higher rating. We'll focus only on 2009, as this is the year in which the star rating running variable is easiest to replicate.

**3.0.1 Question 5. Calculate the running variable underlying the star rating. Provide a table showing the number of plans that are rounded up into a 3-star, 3.5-star, 4-star, 4.5-star, and 5-star rating.**

Table 2 displays the number of plans that are rounded up into each category of star ratings: 1.5-star, 2-star, 2.5-star, 3-star, 3.5-star, 4-star, 4.5-star, and 5-star rating.

Table 2: Number of Plans Rounded Up into Each Star Ratings in 2009

Star Ratings	Count
1.5	1,295
2	3,327
2.5	6,586
3	3,698
3.5	2,210
4	1,444
4.5	426

**3.0.2 Question 6. Using the RD estimator with a bandwidth of 0.125, provide an estimate of the effect of receiving a 3-star versus a 2.5 star rating on enrollments. Repeat the exercise to estimate the effects at 3.5 stars, 4 stars, and 4.5 stars. Summarize your results in a table.**

Table 3 displays the RD estimates, with a bandwidth of 0.125, of the effects of star rating on enrollments at 3 stars, 3.5 stars, and 4 stars. The estimate of the effect at 4.5 stars cannot be evaluated because the data on the right side of the threshold is insufficient.

Table 3: RD Estimate of the Effect of Receiving Stars at 3.5 Stars, 4 Stars, and 4.5 Stars

	3-Star	3.5-Star	4-Star
Conventional	1,062.2258	1,143.1853	328.5270
Bias-Corrected	-148.4846	476.4857	-101.2723
Robust	-148.4846	476.4857	-101.2723

**3.0.3 Question 7. Repeat your results for bandwidths of 0.1, 0.12, 0.13, 0.14, and 0.15. Show all of the results in a graph. How sensitive are your findings to the choice of bandwidth?**

Table 4 displays the RD estimates, with different bandwidths, of the effects of star rating on enrollments at 3 stars, 3.5 stars, and 4 stars. The estimate of the effect at 4.5 stars cannot be evaluated because the data on the right side of the threshold is insufficient.

Table 4: RD Estimate of the Effect of Receiving Stars at 3.5 Stars, 4 Stars, and 4.5 Stars

	Bandwidth 0.1			Bandwidth 0.12			Bandwidth 0.13			Bandwidth 0.14			Bandwidth 0.15		
	3-Star	3.5-Star	4-Star	3-Star	3.5-Star	4-Star	3-Star	3.5-Star	4-Star	3-Star	3.5-Star	4-Star	3-Star	3.5-Star	4-Star
Conventional	-420.6281	790.7856	-56.11152	1,401.876	1,143.1853	328.5270	1,062.2258	1,131.8503	328.5270	-1,923.422	970.7665	282.95495	-1,841.966	974.5791	282.95495
Bias-Corrected	5,030.7653	661.8690	89.85829	-2,607.247	476.4857	-101.2723	-148.4846	517.8342	-101.2723	4,880.047	1,020.1727	-74.06225	4,616.880	1,021.0761	-74.06225
Robust	5,030.7653	661.8690	89.85829	-2,607.247	476.4857	-101.2723	-148.4846	517.8342	-101.2723	4,880.047	1,020.1727	-74.06225	4,616.880	1,021.0761	-74.06225

**3.0.4 Question 8. Examine (graphically) whether contracts appear to manipulate the running variable. In other words, look at the distribution of the running variable before and after the relevent threshold values. What do you find?**

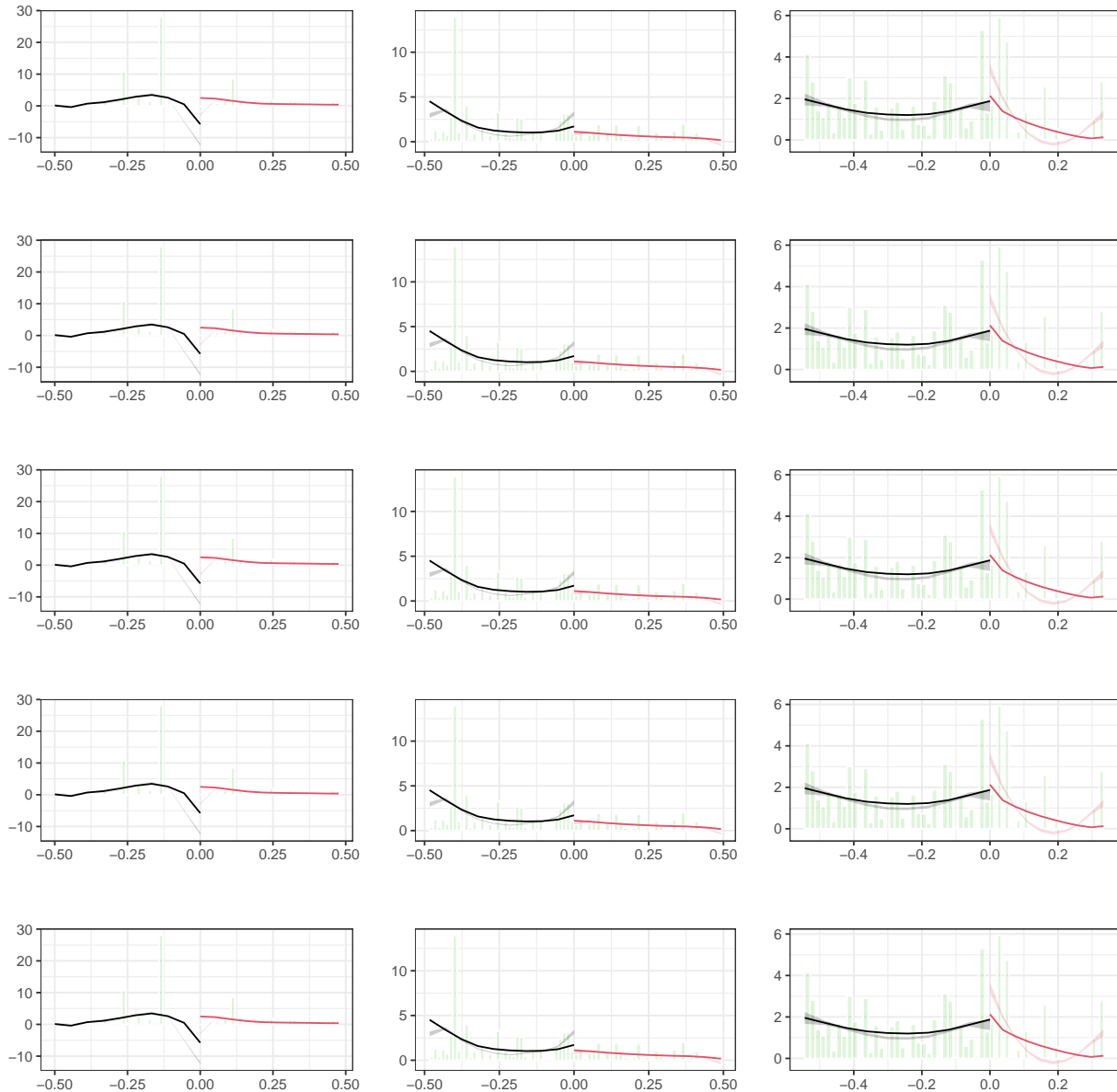


Figure 6: Distribution of the Running Variable Before and After the Relevent Threshold Values

**3.0.5 Question 9. Similar to question 8, examine whether plans just above the threshold values have different characteristics than contracts just below the threshold values. Use HMO and Part D status as your plan characteristics.**

##  
## Call:

```
## lm(formula = avg_enrollment ~ factor(Star_Rating) + factor(partd) +
##     factor(plan_type), data = ma.data.clean)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1327    -254    -108      41   68792
##
## Coefficients:
##                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   151.761      78.865   1.924  0.0543 .
## factor(Star_Rating)2          -88.963      49.048  -1.814  0.0697 .
## factor(Star_Rating)2.5           9.604      50.121   0.192  0.8480
## factor(Star_Rating)3           85.272      52.491   1.625  0.1043
## factor(Star_Rating)3.5          -61.805      61.734  -1.001  0.3168
## factor(Star_Rating)4           68.774      67.922   1.013  0.3113
## factor(Star_Rating)4.5         -426.521      88.928  -4.796 1.63e-06 ***
## factor(partd)Yes              178.874      27.660   6.467 1.02e-10 ***
## factor(plan_type)HMO/HMOPOS     537.885      60.704   8.861 < 2e-16 ***
## factor(plan_type)Local PPO      -79.702      67.590  -1.179  0.2383
## factor(plan_type)PFFS          -147.288      67.605  -2.179  0.0294 *
## factor(plan_type)PSO (State License) 927.288     497.000   1.866  0.0621 .
## factor(plan_type)Regional PPO   -210.115      74.138  -2.834  0.0046 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1478 on 18973 degrees of freedom
## Multiple R-squared:  0.04747,    Adjusted R-squared:  0.04686
## F-statistic: 78.79 on 12 and 18973 DF,  p-value: < 2.2e-16
```

### 3.0.6 Question 10. Summarize your findings from 1-5. What is the effect of increasing a star rating on enrollments? Briefly explain your results.

Having a higher star rating leads to higher enrollments. Having a higher star rating signifies that the plan has a better quality which makes it more attractive to people. The plans with higher star ratings are entirely different from the plans with lower star ratings in terms of coverage and benefits.