

Price Elasticity and Customer Spend Modeling for a Coffee Chain

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Overview

This report estimates price sensitivity for Starbucks' lattes among its customers. However, due to limitations in data collection, we only observe spending behavior for customers who voluntarily enrolled in the rewards program (with an average enrollment rate of 36.4%). Because enrollment is self-selected, there is a risk of selection bias; responsiveness to a change in price may differ between customers who choose to enroll and those who opt out of the program. To address this, the study presents separate models that adjust for self-selection bias, and provide a more accurate estimate of price sensitivity for the overall customer base. The analysis also offers actionable business recommendations based on these findings.

Simple Elasticity Regression

The results of a log-log regression shows that for every 1% increase in price of a drink, there will be approximately a 1.775% decrease in monthly spend. The model also shows an expected increase of about 716.4% in monthly spend for female customers relative to a male customer, since $\exp(1.969) = 7.164$. We can also see that for every year of age, the monthly spend increases about 1.1%, since $\exp(0.011) = 1.011$.

Table 1: Log-Log Regression Model Results

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	4.380	0.214	20.513	0
log(avgPrice)	-1.775	0.114	-15.516	0
female1	1.969	0.042	46.421	0
age	0.011	0.002	5.538	0

Heckman Two-step estimator

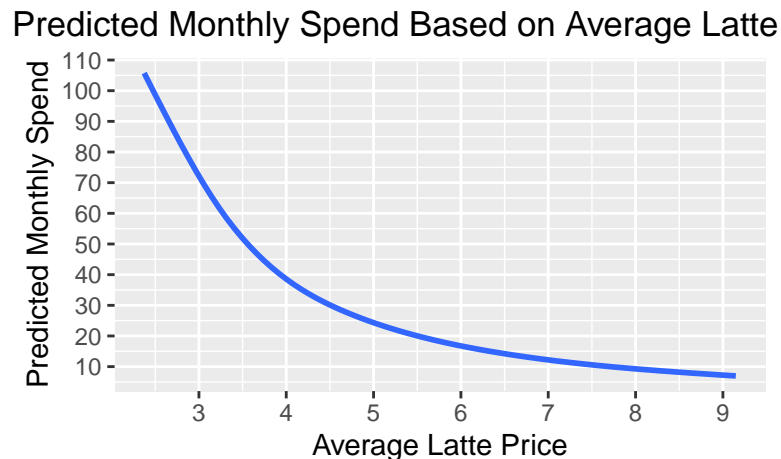
Running a Heckman two-step estimator using survey data to predict the probability of enrolling (using the Enrollment Promotional value as the variable that influences probability of joining the rewards program) shows some underlying bias in the original model. With the coefficients adjusted for self-selection bias in the data, we can interpret the coefficients as follows (holding all other variables constant): For every 1% increase in the price of a drink, there will be approximately a 2.065% decrease in monthly spend, There is also an expected 725.7% increase in monthly spend for female customers relative to a male customer ($\exp(1.982) = 7.257$), and an expected monthly spend increase of 1.4% ($\exp(0.014) = 1.014$).

Table 2: Heckman Two-step Regression Model Results

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	3.909	0.192	20.370	0
age	0.014	0.002	7.607	0
female1	1.982	0.038	52.362	0
log(avgPrice)	-2.065	0.103	-20.051	0
imr	1.470	0.069	21.206	0

Selection Bias in the Data

Comparing the previous two models we can see signs of selection bias in our data set. The overall price elasticity has increased by about 0.29% showing that the actual price elasticity is actually greater than we originally thought. Holding the age, and enroll Promotion at a set value, we can visualize this price elasticity in the graph below.



We can see a large drop in the predicted spend for prices of \$2.5 to around \$5 with a less steep decrease from \$5 to \$9. If we could reduce the average price of a latte, we can see a jump in demand. The current average latte price is about \$6 on average, we can see in the graph that the predicted monthly spend for that price point is about \$17. Decreasing this average price closer to \$5 leads to a predicted monthly spend of approximately \$25. This decrease of \$1 would lead to approximately an \$8 increase in customer monthly spend. Assuming that Starbucks will see around 400 million customers a month (between our 38,000 global stores), an average of \$8 increase in monthly spend per customer would equal around \$3.2 Billion in sales globally per month.

We can drill this down even further by looking at the predicted monthly spend by price and gender. This shows that female customers are most likely to spend more on a monthly basis than male customers. We could also determine this by looking at the model coefficients; however, by graphing this against the Average latte price, we can see that at the lowest average price of \$2, female customers are predicted to spend approximately 7.2x more than male customers. Based on these predictions there is a lot more value to be found from marketing to our female customer demographic when compared to the male demographic.

