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ECON 490
Final Project Report

SUMMARY

The purpose of this project is to estimate a structural model of a poor household demand for dietary staples. To do this, we used household consumption data from Jensen and Miller's 2008 paper entitled *Giffen Behavior and Subsistence Consumption*.

ESTIMATION

We proposed that a poor household's demand for dietary staples follows this Data-Generating Process (DGP):

$$b = \frac{i[\beta p_m - p_b] + p_m p_b(1-\beta)\bar{c}}{p_b(p_m - p_b)} + e$$

where
b is the quantity demanded for the staple measured in calories
p_b is the price of a calorie from the staple
p_m is the price index of a calorie from all the other sources of food
i is the income of the household
$\bar{c}$ is the quantity of caloric intake that makes the feeling of hunger become unbearable
β is the importance of satiating hunger in the preferences of the household
and e is a random variable with E(e) = 0

We tuned the model to three moments:

1. The average consumption of b before the experimental policy was introduced

$$\frac{5144(.64+.36p_m)[\beta p_m - 1] + p_m(1-\beta)\bar{c}}{(p_m - 1)} = 2.85(1805).64$$

2. The average consumption of b after its price has increased by 1%

$$\frac{5144.25(.64+.36p_m)[\beta p_m - 1.01] + p_m 1.01(1-\beta)\bar{c}}{1.01(p_m - 1.01)} = 2.85(1805).64(1 + .00235)$$

3. The average consumption of b after its price has decreased by 1%

$$\frac{5144.25(.64+.36p_m)[\beta p_m - .99] + p_m .99(1-\beta)\bar{c}}{.99(p_m - .99)} = 2.85(1805).64(1 - .00235)$$

We normalized the price of the staple (p_b) as 1, and then used the ATE that Jensen and Miller retrieved from their experiment to set up the right sides of the system of equations. With the three equations, we set up to estimate three parameters:

β - which we originally set to .5, as it ranges between 0 and 1
$\bar{c}$ - which is set to 5144, as it is the average caloric intake per household in the data
p_m - which is set to 2, because the price index should start higher than the price

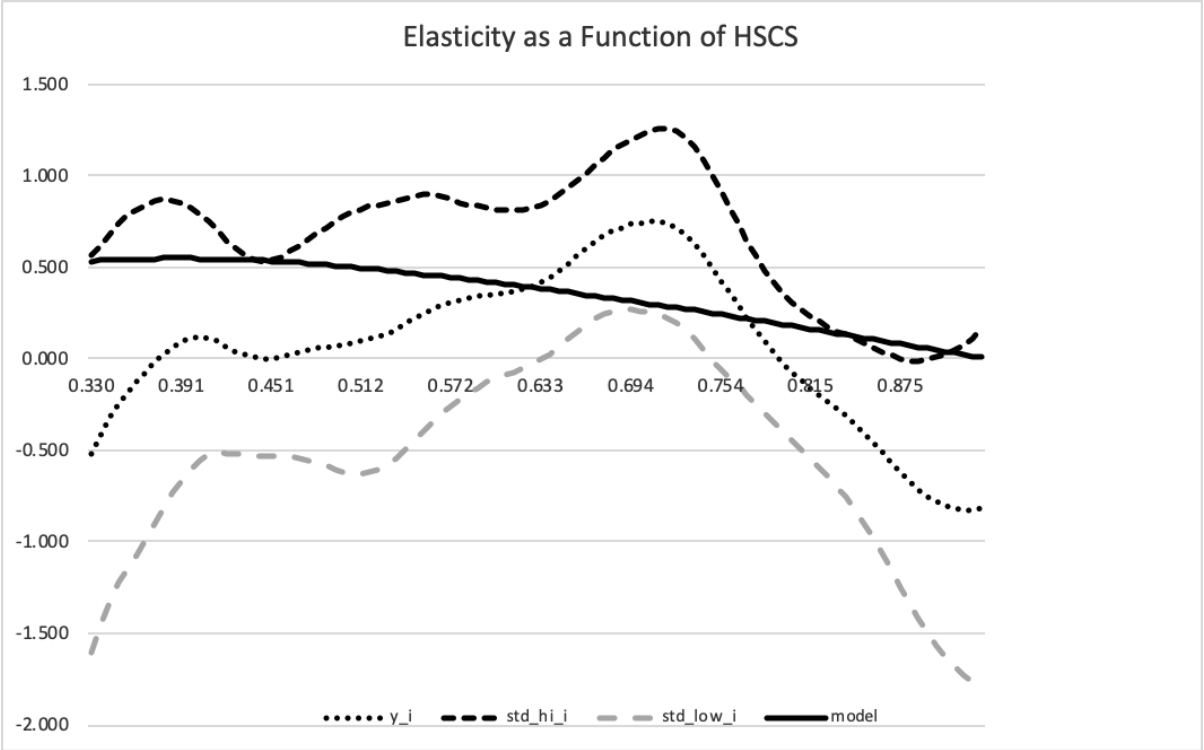
To solve the system of equations, we first subtract the right side from the left in each equation (the residual; $(b - \widehat{b})$), then square the residual from each equation, and sum them all up to get the Sum of Squares of Residuals. This is the quantity that we're going to minimize in order to estimate the parameters. Using Excel's Generalized Reduced Gradient (GRG) Nonlinear solving method, my estimation results are:

$\widehat{\beta} = .021581$
$\bar{c} = 5024.36$
$p_m = 4$

with a starting Residual Sum of Squares of 10292978.4, minimizing it down to 526.2287.

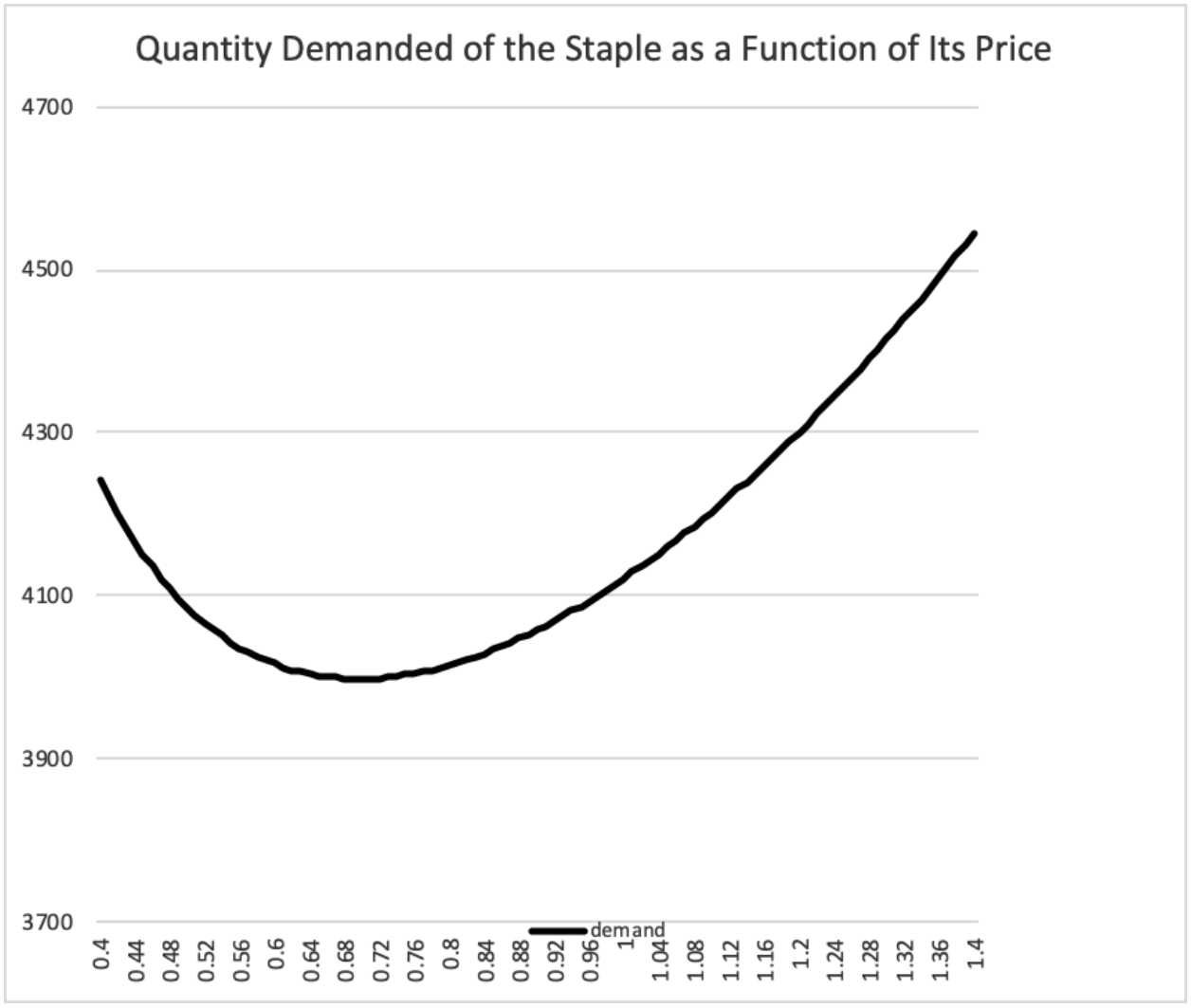
EXTRAPOLATIONS

We use our model to try and match the estimations done by Jensen and Miller's data, and from the graph below, we can see that our model remains in the 95% confidence interval for a majority of the data:



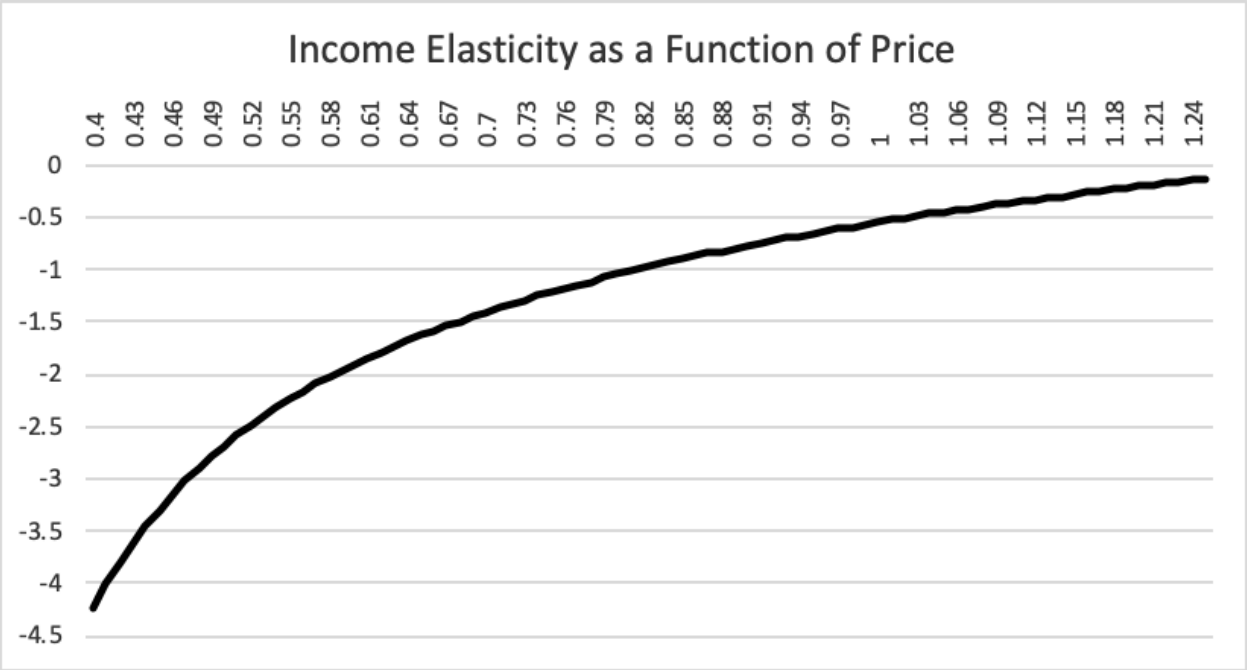
Our model predicts that household demand elasticity for staples will decrease as their household caloric share grows, meaning that a household will be less sensitive to the price of the staple when it is a higher proportion of their total diet.

In the next graph, we use our model to graph the demand for the staple as its price grows. We get the demand for the staple (b) by plugging in different values for the price of the staple (p_b) into our model, increasing by .01 going from a range of .4 to 1.4.



This graph tells us that past the price of around .7, the staple turns into a Giffen good, meaning that it is so necessary households will demand more of it even when the price increases.This graph proves what Miller & Jensen were after when they were looking at how subsistence living changes the normal assumptions of economics when some goods are so necessary for survival.

The final graph is an extrapolation of Income Elasticity as a Function of price. We want to see how sensitive a household's income is as a function of a changing staple price. To find the income elasticity, we calculate the arc elasticity of income by fixing the price, and increasing the income by 1%, then using the arc-elasticity formula.



As we can expect from a Giffen good, the household's income becomes more inelastic as the price of the staple increases. This is because when in a subsistence living situation, households are willing to spend their entire income on a higher priced dietary staple in order to survive.

CONCLUSION

From this project, I learned how to set up a method of moments estimation using a system of equations that we created based upon rational, economic theory. We tried to tune our model as close as possible to the true Data-Generating Process as presented in the Jensen & Miller paper. To do this, we minimize the residual sum of squares between our model and the data to find the best parameter estimates that match the moments presented in the system of equations.