EconS 410
Problem Set 2 – Supply Estimation: due May 10, 2019

Instructions:

Submit your completed problem set on D2L. Show all work. All answers (tables and write-up) must be in one file. All tables in your write-up should be labeled with full titles and names of the variables.

For the analyses where you are asked to use a statistical software (R), please also attach your code and dataset. To be eligible for full credit, your code must run successfully from start to finish, (without errors), must be clearly annotated, and produce results reported in your homework.

Introduction

You are an economist for the Economic Research Service at the USDA whose job is to figure out certain characteristics of the supply of ice-cream in the U.S. Not only must you correctly perform the statistical analysis, but your presentation of the results is vitally important. You need to be able to effectively communicate your findings with those who are not as well versed as you in economic theory and econometrics. Make it look sharp!

Data: A spreadsheet on D2L, HW2_data, has all the information you need. The data contain:

- quantity supplied (q_icecream),
- nominal price of ice-cream (p_icecream),
- nominal price of milk (p_milk),
- nominal price of butter (p_butter),
- population (pop),
- CPI (food_cpi).

Data Transformations

- Convert all price indexes into 2011 dollars using the CPI. CPI in December 2011 is 229.982.
- Create a per capita supply variable that is “q_icecream” divided by “pop” (population).
- Sort your data by year and month; create a time trend “t”

Data Analysis

1. Estimate the following supply model:

   $$Per\ Capita\ Q\ Supplied_{ice-cream,t} = \beta_0 + \beta_1 P_{ice-cream,t} + \beta_2 P_{butter,t} + \beta_3 P_{milk,t} + \beta_4 t + \epsilon_t$$

   Where

   $Per\ Capita\ Q\ Supplied_{ice-cream,t}$ – per capita quantity supplied of ice-cream in period t

   $P_{ice-cream,t}$ - real price of ice-cream in period t,

   $P_{butter,t}$- real price of butter in period t

   $P_{milk,t}$ - real price of milk in period t

   t– time trend (an approximation of the technological change)

   1.1. What do you expect the signs of $\beta_1, \beta_2, \beta_3, \beta_4$ and to be? Explain.

   1.2. Display the table in your write-up. Are the signs as expected? Interpret $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$.

   1.3. Calculate the own-price elasticity of supply at the mean. Interpret.

   Does ice-cream follow the Law of Supply? Is it own-price elastic?

   1.4. Calculate the cross-price elasticity of supply (related to price of butter) at the mean. Interpret.

   Are ice-cream and butter substitutes or complements in production? Explain.

2. Why might the specification listed above suffer from omitted variable bias? What variables may be missing? Name <u>at least two variables</u> (*Hint: Think of technology and other possible inputs used in ice-cream production, other than milk*).

   2.1. Suppose you were aware that a big policy change affecting in ice-cream production occurred in 2007. How would you account for this in your model?

   2.2. As a smart economist, you realize that some production decisions are likely not a function of the current price, but what price suppliers *expect* to receive (some time in the future). How would you account for the price expectations in your model?

2.3. Write out your regression with new additional independent variables: a variable for policy change in 2007 and lagged prices of ice-cream, milk and butter.

- Interpret the new coefficients.

- According to your results:

    - Do you reject or fail to reject the hypothesis that production changed substantially in 2007 (at the 5% level), holding other factors constant?

    - Are past or current prices more important drivers of ice-cream production?

3. Test your data for econometric issues.

   Your tests will be based on regression in part (2).

   3.1. Testing for Multicollinearity

    - Use test for multicollinearity ("vif" in R). Specify the null hypothesis, alternative hypothesis, rejection rule, result and conclusion.

   3.2. Testing for Heteroscedasticity:

    - Use plots (plot your residuals against other independent variables). Interpret your findings.
    - Use Breusch-Pagan test for heteroscedasticity ("bptest" in R). Specify the null hypothesis, alternative hypothesis, rejection rule, result and conclusion.

   3.3. Testing for Autocorrelation:

    - Use plots (plot your residuals against their first lags). Interpret your findings.
    - Use Durbin-Watson test for autocorrelation ("dwtest" in R). Specify the null hypothesis, alternative hypothesis, rejection rule, result and conclusion.