Adrienne Sands (April 2010)

**Question 1 (280 points)**

For this question we use the data set [http://econ413.wustl.edu/sp10/beef2-a6.wf1](http://econ413.wustl.edu/sp10/beef2.wf1) data set.

ls b c p p^2 yd 1/yd yd^2 @trend(1960) @trend(1960)^2



1. (ii) Display the slope equation of beef consumption with respect to price. Use C(.) notation for coefficients.
2. **Slope of beef consumption with respect to price= dB/ dP = C(2)+2C(3)\*P = -2.045 + 2(0.0129)\*P**

(iii) Is the slope negative for all values of price? If not, at what price does the estimated slope of demand change? Is this value within the range of the values of price in the data set? Why is this evidence in favor or against the estimates obtained above in (i) if the Law of Demand is true?

**We solve for P using the following equation, 0= -2.044918 + 2(0.012889)\*P. At P = 79.328, the slope changes from negative to positive. Thus, the slope is not negative for all values of price (for P> 79.328, the slope is positive). However, this price is not within the range of values of price in the data set; the maximum price for this data set is P=66.1. These estimates in (i) are evidence in favor of the law of demand because for the relevant range of prices, the slope is negative (as the law leads us to expect).**

1. Calculate the average, minimum, and maximum slope with respect to price for the data points in the data set. Display the result as a histogram.

**With respect to price, the average slope is -1.074; the min slope is -1.581; and the max slope is -0.341.**

1. Calculate the average, minimum and maximum elasticity of demand with respect to price in the data set by using a histogram and statistics. Why is or is not the estimated average elasticity reasonable? **With respect to price, the average elasticity of demand is -0.3186; the min elasticity of demand is -0.3707; and the max elasticity of demand is -0.2138. The estimated average elasticity is reasonable because all calculated elasticities are negative and therefore consistent with the law of demand.**
2. Calculate the average, minimum and maximum income elasticity in the data set using the histogram and statistics. **Average income elasticity is 0.732; minimum income elasticity is -0.791; and maximum income elasticity is 1.216.**



1. Graph the income elasticity on the vertical axis and YD on the horizontal axis. Why is or is not the estimated income elasticity reasonable? **The estimated income elasticity is not reasonable because income elasticity is negative until YD is about 6.5. Beef is a normal good; therefore, for both high and low levels of income, I expect positive income elasticity between 0 and 1. In the graph, income elasticity continues to increase until YD is about 10, where it then decreases. This decline is to be expected since otherwise, elasticity of demand would increase past ELASYD=1 (and it is at this point that beef would be considered a luxury good, not a normal good).**
2. Graph the income elasticity as a line graph (i.e., against time). What is troubling about this picture of estimated income elasticity?  
   **From 1960 to 1963, estimated income elasticity is negative. Also, between 1970 until 1986, income elasticity increases (until about 1973), decreases (until about 1977), increases again (until about 1983), then decreases again (until 1985) where the graph then levels out. Estimated income elasticity is neither constant, linear, logarithmic, nor a simple quadratic—a very troubling fact.**
3. Compare the average income elasticity to the income elasticity at the mean and discuss.

**Average income elasticity: 0.732**

**Income elasticity at the mean: 1.1643**

**The average income elasticity is less than the income elasticity of the mean. This is not remarkable since the distribution of income elasticity has a very leftward (negative) skew. Nonetheless, the average elasticity and elasticity at the mean have a difference of magnitude 0.43.**

1. Compare the two equation estimated coefficients in a table marking significance with colors (bold red significant at 1%, bold blue significant at 5%, bold green significant at 10%):   
   1. ls b c p p^2 yd 1/yd yd^2 @trend(1960) @trend(1960)^2   
   2. ls b c p p^2 yd 1/yd @trend(1960) @trend(1960)^2

|  |  |  |
| --- | --- | --- |
| Variable | Eq 1 | Eq 2 |
| C | **-1363.58** | **-330.780** |
| P | **-2.0449** | **-1.2204** |
| P^2 | **0.01289** | 0.00515 |
| YD | **171.314** | **28.888** |
| 1/YD | **4028.413** | **1577.505** |
| YD^2 | **-5.9951** |  |
| @TREND(1960) | **4.2028** | **6.3389** |
| @TREND(1960)^2 | **-0.14020** | **-0.2024** |

Argue whether you would drop the p^2 term based on t the second equation? Explain the difference in significance of the p^2 term with and without the term yd^2. Do a Ramsey RESET test on both equations and comment, especially about the significance of the p^2 term. **Based on the second equation, I would not drop the P^2 term. The second equation does not pass the Ramsey with 2, 3, or 4 terms at the 5.7% level. Thus, the estimates in the 2nd equation are biased from a specification error. In fact, the coefficient of Y^2 was significant in the first equation (at the 5% level). Thus, it is likely that the misspecification in the second equation was due to the exclusion of the P^2 term.**

**Equation 1 Equation 2**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Two Terms** |  | **Probability** |  | |  | | **Probability** | |
| **Log likelihood ratio** | **1.717095** | **0.423777** | **Log likelihood ratio** | | **8.383941** | | **0.015116** | |
| **Three Terms** |  |  | |  | |  | |  |
| **Log likelihood ratio** | **1.857572** | **0.602487** | | **Log likelihood ratio** | | **8.494778** | | **0.036820** |
| **Four Terms** |  |  | |  | |  | |  |
| **Log likelihood ratio** | **2.405791** | **0.661581** | | **Log likelihood ratio** | | **9.152341** | | **0.057402** |

1. Estimate ls log(b) c log(p) log(yd). What are the (constant) estimated elasticities of price and income? **The estimated (constant) elasticity of price is -0.344453, and the estimated elasticity of income is 1.071477 for this data set.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Dependent Variable: LOG(B) | | |  |  |
| Method: Least Squares | | |  |  |
| Date: 03/28/10 Time: 21:01 | | |  |  |
| Sample: 1960 1987 | | |  |  |
| Included observations: 28 | | |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| C | 3.594003 | 0.141279 | 25.43895 | 0.0000 |
| LOG(P) | -0.344453 | 0.062218 | -5.536229 | 0.0000 |
| LOG(YD) | 1.071477 | 0.148486 | 7.216019 | 0.0000 |
|  |  |  |  |  |
|  |  |  |  |  |
| R-squared | 0.709853 | Mean dependent var | | 4.665195 |
| Adjusted R-squared | 0.686641 | S.D. dependent var | | 0.095799 |
| S.E. of regression | 0.053627 | Akaike info criterion | | -2.912583 |
| Sum squared resid | 0.071896 | Schwarz criterion | | -2.769847 |
| Log likelihood | 43.77616 | F-statistic | | 30.58155 |
| Durbin-Watson stat | 0.299194 | Prob(F-statistic) | | 0.000000 |

1. Calculate the slope of beef with respect to price in the log-log equation above. Graph the slope of beef on the vertical axis and year on the horizontal axis (a line graph). What is troubling about the picture of the slopes over time? **Slope of beef with respect to price is -0.3445(P/B). This graph is troubling because it has 13 points of inflection (very nonlinear) and is rapidly increasing towards 0, aside from several dips after 1962, 1973, and 1979.**
2. Estimate

ls log(b) c log(p) log(yd)@trend(1960) @trend(1960)^2

ls log(b) c log(p) log(yd)



Discuss whether you prefer the equation with the trend terms to the one without the trend variables using, in part, Ramsey tests and any other criteria you feel necessary.  **The equation including the trend terms (equation 1) fails the Ramsey at less than 1% while equation 2 passes the Ramsey at 15%. However, in equation 2, the Ramsey has less power since the trend variables are excluded; nonetheless, the estimates are biased in equation 1 due to the failing Ramsey so I prefer the equation without the trend terms (though it is in no way ideal).**

1. **The trend command starts from a particular base year, e.g. 1950 or 1960, and denotes years after that point with reference to the base year. For example, if the base year is 1950 and the year to be represented is 1972, then the command would be @trend(1950) and the year’s data point value would be 22. Thus, if t1= @trend(1960) and t2= @trend(1950), then years which would be t1= Y would be t2= Y+10. Thus, we write t2= t1 + 10 or t1= t2-10. For equation 1, we write the following:**

**C(1) + C(2)\*P + C(3)\*YD + C(4)\*t1 + C(5)\*(t1)^2.**

**Substituting t1=t2 -10, we get:**

**C(1)+C(2)\*P+C(3)\*YD+C(4)\*(t2-10)+C(5)\*(t2-10)^2=**

**C(1) + C(2)\*P + C(3)\*YD + C(4)\*t2 -10\*C(4)+ C(5)\*(t2)^2 – C(5)\*20\*t2 +C(5)\*100=**

**[C(1) – 10\*C(4) + C(5)\*100] + C(2)\*P + C(3)\*YD + [C(4)-20\*C(5)]\*t2+ C(5)\*(t2)^2**

**Substituting C(1), …, C(5) from equation 1, we get the coefficients from equation 2. Hence, the coefficients of price, income, and the trend squared terms are the same.**

 **Equation 1 Equation 2**