

Assignment 02, Question 3

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Question 3

We have the log linear regression equation:

$$\ln Q_{it} = 915 - 1.5 \ln P_{it} - .3 \ln P_{ct} + .9 \ln P_{st} + .009 \ln Y_t + .045 \ln AD_t \quad (1)$$

```
beta_Pi <- -1.5
beta_Pc <- -.3
beta_Ps <- .9
beta_Y <- .009
beta_AD <- .045
Pi2013 <- 200 # Average market price of (i) in 2013
Qi2013 <- 55000 # Average quantity demanded of (i) in 2013
Y2013 <- 120000 # Average income in 2013
```

a. With respect to price, what kind of good is (i) . For a high demand season, should the company increase the price or decrease it?

To determine what kind of good is (i) w.r.t. P_{it} , we find the price elasticity of i as follow:

```
epsilon_Pi <- beta_Pi * Pi2013 / Qi2013 # Price elasticity of (i)
```

$$\begin{aligned} \epsilon_{P_{it}} &= \hat{\beta}_{P_{it}} \frac{\bar{P}}{\bar{Q}_i} \\ &= (-1.5) \frac{200}{5.5 \times 10^4} \\ &= -0.0054545 \end{aligned} \quad (2)$$

Since $|\epsilon_{P_{it}}| < 1$, (i) is a price inelastic (necessity) good, i.e. price increases leads to total revenue increases. Thus, for a high demand season, the company should increase the price to increase their total revenue.

b. With respect to income, what kind of good is (i).

To determine what kind of good is (i) w.r.t. Y_t , we find the income elasticity of i as follow:

```
epsilon_Y <- beta_Y * Y2013 / Qi2013 # Income elasticity of (i)
```

$$\begin{aligned}\epsilon_{Y_t} &= \hat{\beta}_{Y_t} \frac{\bar{Y}}{\bar{Q}_i} \\ &= (0.009) \frac{1.2 \times 10^5}{5.5 \times 10^4} \\ &= 0.0196364\end{aligned}\tag{3}$$

Since $\epsilon_{Y_t} < 1$, thus (i) is an income inelastic good (necessity), i.e. a jump in income is less than proportionate than the increase in the quantity demanded.

c. Is the amount of money spent on advertising right amount? Should the company spend more on advertising or less? Why?

```
AD2013 <- 2800000 # Ad spent for 2013
```

```
epsilon_AD <- beta_AD * AD2013 / Qi2013 # Advertising elasticity of demand in 2013
```

We have the advertising elasticity of demand as follow:

$$\begin{aligned}\epsilon_{AD_t} &= \hat{\beta}_{AD_t} \frac{\overline{AD}}{\bar{Q}_i} \\ &= (0.045) \frac{2.8 \times 10^6}{5.5 \times 10^4} \\ &= 2.2909091\end{aligned}\tag{4}$$

We can see that quantity demanded of (i) is advertising elastic so the company should spend more as it would lead to revenue increases.

The optimum advertising amount in 2013 is:

```
AD_2013Optimum <- Pi2013 * Qi2013 * epsilon_AD / abs(epsilon_Pi)
```

$$\begin{aligned}AD_{2013}^* &= P_{it} Q_{it} \frac{\epsilon_{AD}}{|\epsilon_{P_{it}}|} \\ &= (200)(5.5 \times 10^4) \frac{(2.2909091)}{|(-0.0054545)|} \\ &= 4.62 \times 10^9\end{aligned}\tag{5}$$

d. What is your forecast of the quantity demanded for 2014?

```
# Changes from 2013 to 2014
delta_Pi <- .05 # Price of good (i) increases 5%
delta_Y <- .04 # Income growth 4 %
delta_Ps <- .1 # 10% tax add on to price of substitute good

delta_Qi <- beta_Pi*delta_Pi + beta_Ps*delta_Ps + beta_Y*delta_Y
```

We have the forecast % change in Q_i for 2014 as follow:

$$\begin{aligned}
\% \Delta Q_i &= \hat{\beta}_{P_{it}} \Delta P_{it} + \hat{\beta}_{P_{st}} \Delta P_{st} + \hat{\beta}_{Y_t} \Delta Y_t \\
&= (-1.5)(0.05) + (0.9)(0.1) + (0.009)(0.04) \\
&= 0.01536 \\
&= 1.536\%
\end{aligned} \tag{6}$$

```
Qi2014 <- Qi2013*(1+delta_Qi)
```

Thus, the quantity demanded of (i) increases by 1.536% from 2013 to 2014 or 5.58448×10^4 .

e. What is the optimum amount of advertiising spending for 2014?

The optimum advertising amount in 2013 is:

```
Pi2014 <- Pi2013 * (1+delta_Pi) # Price of (i) in 2014

AD_2014Optimum <- Pi2014 * Qi2014 * epsilon_AD / abs(epsilon_Pi)
```

$$\begin{aligned}
AD_{2014}^* &= P_{it} Q_{it} \frac{\epsilon_{AD}}{|\epsilon_{P_{it}}|} \\
&= (210)(5.58448 \times 10^4) \frac{(2.2909091)}{|(-0.0054545)|} \\
&= 4.9255114 \times 10^9
\end{aligned} \tag{7}$$