We shall fit a regression of the form,

$$y_t = \beta_0 + \beta_1 t + \beta_2 Q_2 + \beta_3 Q_3 + \beta_4 Q_4 + \epsilon_t$$

With Q_i dummy variables for the i^{th} quarter of a given year.

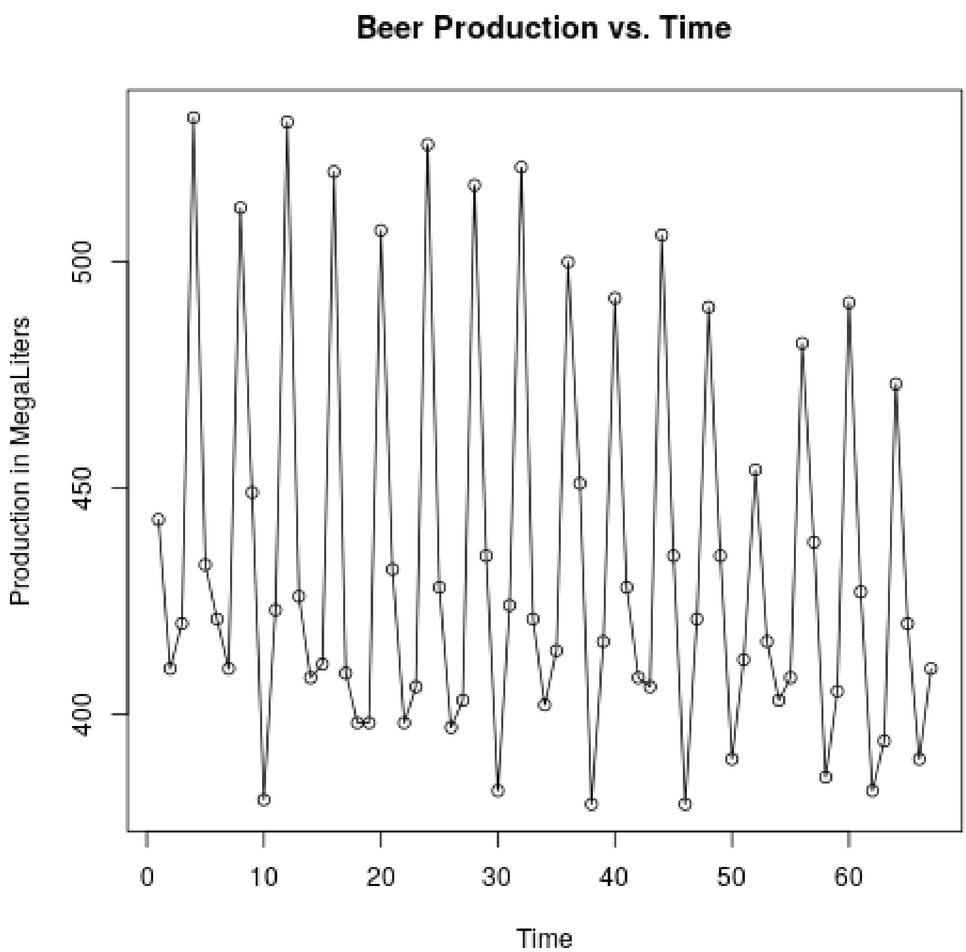
1. First, we define the dummy variables as follows.

$$Q_2 = \begin{cases} 1 & t \in \text{Quarter } 2 \\ 0 & t \notin \text{Quarter } 2 \end{cases}$$

$$Q_3 = \begin{cases} 1 & t \in \text{Quarter } 3 \\ 0 & t \notin \text{Quarter } 3 \end{cases}$$

$$Q_4 = \begin{cases} 1 & t \in \text{Quarter } 4 \\ 0 & t \notin \text{Quarter } 4 \end{cases}$$

2. Next, we plot the data to analyze the overall data trends to see if we need to scale for constant seasonal variation.



We see here that the overall trend of the data is negative, but there is no major increase or decrease in seasonal variation over the experimental region. As such, we expext β_1 to have a negative value, and we will not log or scale the y variable at all to approximate constant variation.

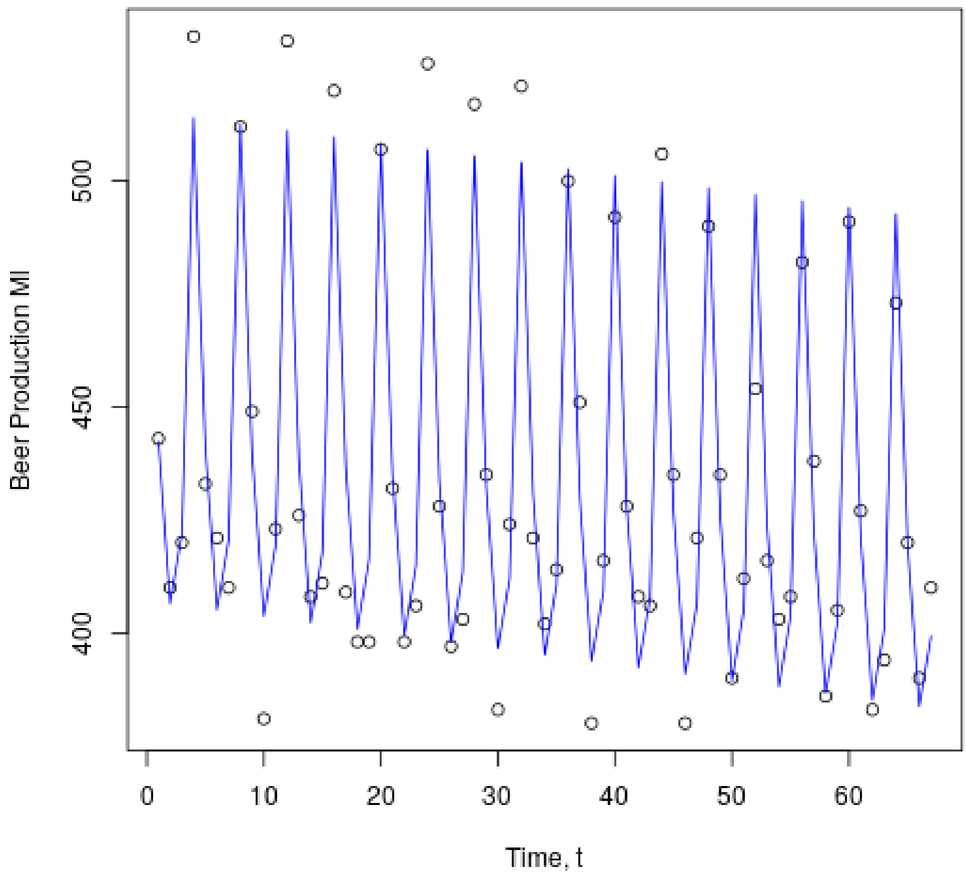
3. What are the values of beer production for 2009? We consider the following points,

Point	Definition
$\hat{y}_{68}$	Q_4 of 2008
$\hat{y}_{69}$	Q_1 of 2009
$\hat{y}_{70}$	Q_2 of 2009
$\hat{y}_{71}$	Q_3 of 2009
$\hat{y}_{72}$	Q_4 of 2009

4. We now construct our prediction equation as,

$$\hat{y} = 442.62153 - 0.35486t - 35.40985Q_2 - 19.58440Q_3 + 72.78868Q_4$$

With Q_i defined as above. We consider the fit as follows,



We see that this fit fairly accurately follows the trend, and so, we may compute,

$$\begin{aligned}\hat{y}_{68} &= 442.62153 - 0.35486(68) + 72.78868(1)\\ &= 491.31\text{Ml}\\ \hat{y}_{69} &= 442.62153 - .035486(69)\\ &= 418.17\text{Ml}\end{aligned}$$

5. We now construct our prediction equation and approximate,

y_*	Prediction	Interval
y_{69}	418.17	(391.89, 444.44)
y_{70}	382.40	(356.13, 408.68)
y_{71}	397.87	(371.60, 424.15)
y_{72}	489.89	(463.50, 516.28)