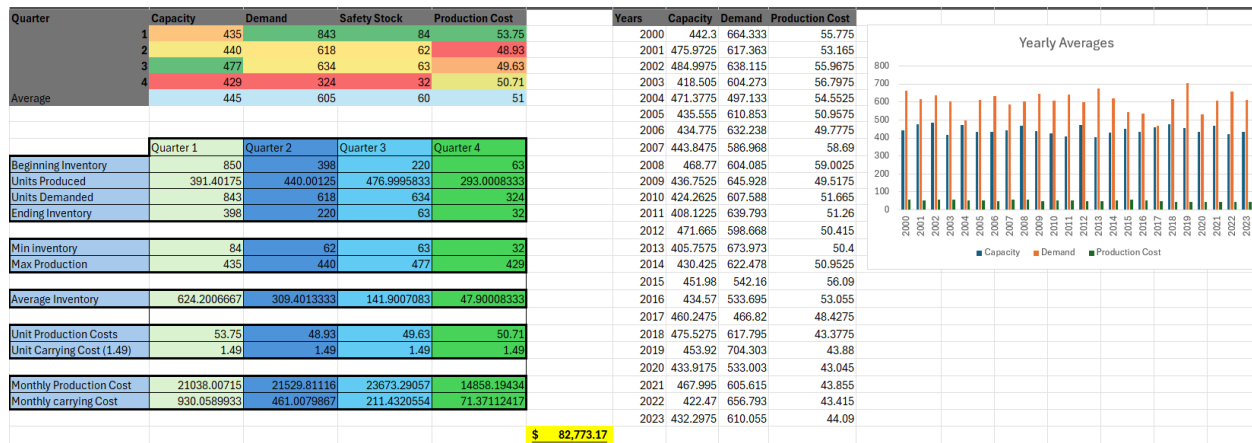


Module 03 – Production Modeling

Exploratory Data Analysis

In this section, you should perform some data analysis on the data provided to you. Please format your findings in a visually pleasing way and please be sure to include these cuts:

- Make a table of average demand, production capacity, and costs for each quarter, are there differences between quarters?
- Since we have temporal data (i.e. year and quarter), see if you can make a yearly and/or quarterly chart showing these metrics over time.



\$ 82,773.17

Model Formulation

Write the formulation of the model into here prior to implementing it in your Excel model. Be explicit with the definition of the decision variables, objective function, and constraints

$$\text{Min} = 53.75P_1 + 48.93P_2 + 49.63P_3 + 50.71P_4 + 1.49(B_1 + B_2) + 1.49(B_2 + B_3) + 1.49(B_3 + B_4) + 1.49(B_4 + B_5)$$

$$P_1 \leq 435$$

$$P_2 \leq 440$$

$$P_3 \leq 477$$

$$P_4 \leq 429$$

$$84 \leq B_2$$

$$62 \leq B_3$$

$$63 \leq B_4$$

$$32 \leq B_5$$

Model Optimized for Cost Reduction

Implement your formulation into Excel and be sure to make it neat. This section should include:

- A screenshot of your optimized final model (formatted nicely, of course)
- A text explanation of what your model is recommending

| | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | |
|---------------------------|-------------|-------------|-------------|-------------|--------------|
| Beginning Inventory | 850 | 398 | 220 | 63 | |
| Units Produced | 391.40175 | 440.00125 | 476.9995833 | 293.0008333 | |
| Units Demanded | 843 | 618 | 634 | 324 | |
| Ending Inventory | 398 | 220 | 63 | 32 | |
| Min inventory | 84 | 62 | 63 | 32 | |
| Max Production | 435 | 440 | 477 | 429 | |
| Average Inventory | 624.2006667 | 309.4013333 | 141.9007083 | 47.90008333 | |
| Unit Production Costs | 53.75 | 48.93 | 49.63 | 50.71 | |
| Unit Carrying Cost (1.49) | 1.49 | 1.49 | 1.49 | 1.49 | |
| Monthly Production Cost | 21038.00715 | 21529.81116 | 23673.29057 | 14858.19434 | |
| Monthly carrying Cost | 930.0589933 | 461.0079867 | 211.4320554 | 71.37112417 | |
| | | | | | |
| | | | | | \$ 82,773.17 |

Model with Stipulation

Please copy the tab of your original model before continuing with the next part to avoid messing up your original solution. If we remove the production capacity constraint from the model & we removed the carrying cost, what do you think will happen? Try it out and see if it matches your expectation. Try to explain what is happening and talk a bit about fallbacks of models.

| | Quarter 1 | Quarter 2 | Quarter 3 | Quarter 4 | |
|---------------------------|-------------|-------------|-------------|------------|--------------|
| Beginning Inventory | 850 | 84 | 990 | 356 | |
| Units Produced | 77.30045833 | 1524.102958 | 0 | 0 | |
| Units Demanded | 843 | 618 | 634 | 324 | |
| Ending Inventory | 84 | 990 | 356 | 32 | |
| Min inventory | 84 | 62 | 63 | 32 | |
| Max Production | 435 | 440 | 477 | 429 | |
| Average Inventory | 467.1500208 | 537.3508958 | 673.4013333 | 194.4005 | |
| Unit Production Costs | 53.75 | 48.93 | 49.63 | 50.71 | |
| Unit Carrying Cost (1.49) | 1.49 | 1.49 | 1.49 | 1.49 | |
| Monthly Production Cost | 4154.931844 | 74576.26288 | 0 | 0 | |
| Monthly carrying Cost | 696.053531 | 800.6528348 | 1003.367987 | 289.656745 | |
| | | | | | \$ 78,731.19 |

Without the production capacity constraints, it produces everything in the second quarter where the production costs are the cheapest. It only produces in quarter 1 because it needs to fulfill the safety stock. This mass production in Q2 is also enabled by the elimination of the carrying costs from the objective formula because it would drive the Q2 and Q3 inventory costs through the roof doubling the Q2 carrying costs and 5xing the Q3 carrying costs.