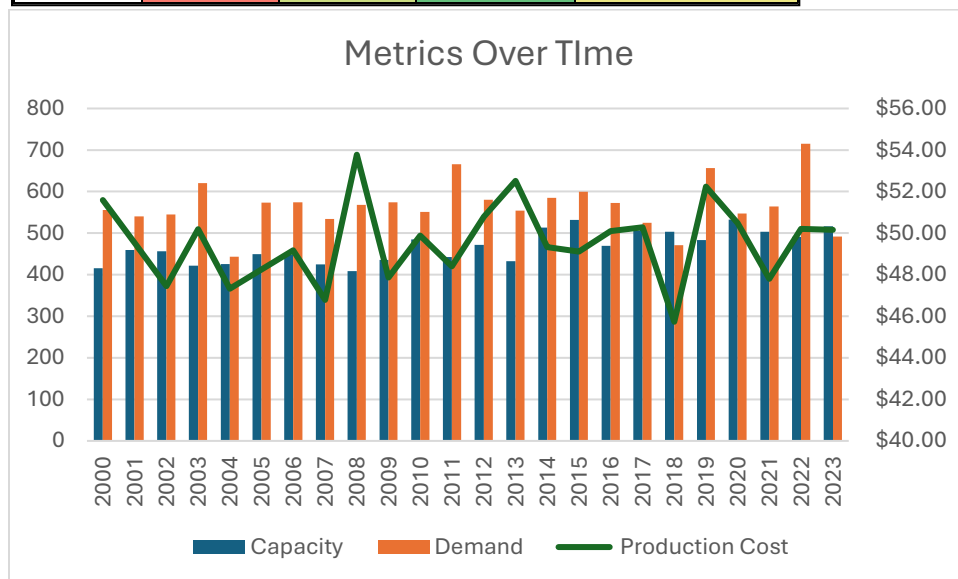


Module 03 – Production Modeling

Exploratory Data Analysis

Quarter	Capacity	Demand	Safety Stock	Production Cost
1	417	472	47.20	\$ 49.06
2	456	571	57.10	\$ 47.20
3	584	605	60.50	\$ 51.67
4	414	620	62.00	\$ 50.23



Model Formulation

Model Optimized for Cost Reduction

$$\text{MIN } 49.06X_1 + 47.20X_2 + 51.67X_3 + 50.23X_4 + 1.71(b_1 + b_2)/2 + 1.71(b_2 + b_3)/2 + 1.71(b_3 + b_4)/2 + 1.71(b_4 + b_5)/2$$

Production Levels:

$$\begin{aligned} X_1 &\leq 417 \text{ Quarter 1} \\ X_2 &\leq 456 \text{ Quarter 2} \\ X_3 &\leq 584 \text{ Quarter 3} \\ X_4 &\leq 414 \text{ Quarter 4} \end{aligned}$$

Ending Inventory:

$$\begin{aligned} B_1 &\geq 47 \\ B_2 &\geq 57 \\ B_3 &\geq 61 \end{aligned}$$

B4>=62

Non Negativity Constraint: $X_{ij} \geq 0$, $B_i \geq 0$

	1	2	3	4		
Beginning Inventory	500	404	289	268		
Units Produced	376	456	584	414		
Units Demanded	472	571	605	620		
Ending Inventory	404	289	268	62		
Minimum Production						
Maximum Production	417	456	584	414		
Minimum Inventory	47	57	61	62		
Maximum Inventory						
Average Inventory	452	347	279	165		
Unit Production Cost	\$49.06	\$47.20	\$51.67	\$50.23		
Unit Carrying Cost	\$1.71	\$1.71	\$1.71	\$1.71		
Quarterly Production Cost	\$18,446.87	\$21,523.01	\$30,175.52	\$20,795.22		
Quarterly Carrying Cost	\$772.92	\$593	\$476	\$282		
					Total Cost	\$93,064

This model finds the lowest possible total of inventory carrying and production costs by optimizing units produced.

Model with Stipulation

	1	2	3	4		
Beginning Inventory	500	445	330	309		
Units Produced	417	456	584	414		
Units Demanded	472	571	605	620		
Ending Inventory	445	330	309	103		
Minimum Production						
Maximum Production	417	456	584	414		
Minimum Inventory	47	57	61	62		
Maximum Inventory						
Average Inventory	473	388	320	206		
Unit Production Cost	\$49.06	\$47.20	\$51.67	\$50.23		
Unit Carrying Cost	\$1.71	\$1.71	\$1.71	\$1.71		
Quarterly Production Cost	\$20,458.37	\$21,523.01	\$30,175.52	\$20,795.22		
Quarterly Carrying Cost	\$807.98	\$663	\$546	\$352		
					Total Cost	\$95,321

The model illustrates that the total cost is \$2,257 more when production is not optimized to be less than or equal to the maximum production.