Valeria Santoni

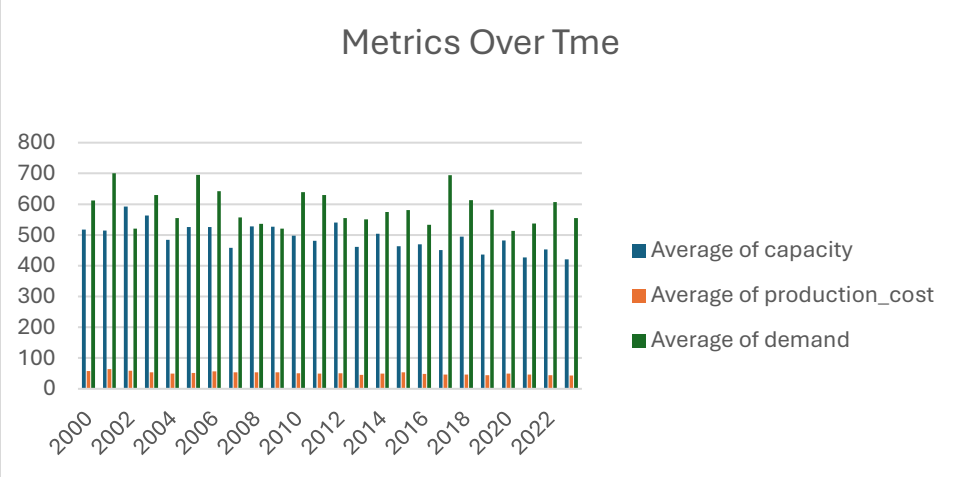
Module 03 – Production Modeling

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.*

Row Labels	Average of capacity	Average of demand	Average of Safety Stock	Average of production_cost
1	573.0	462.0	46.2	55.0
2	559.6	308.7	30.9	59.1
3	431.9	940.8	94.1	45.2
4	521.5	728.4	72.8	63.0
Grand Total	**524.12**	**596.76**	**59.68**	**55.66**



		1	2	3	4
Beginning Inventory		**500**	**611**	862	353
Units Produced		**573**	**560**	**432**	**448**
Units Demanded		**462**	**309**	**941**	**728**
Ending Inventory		**611**	**862**	**353**	**73**
Maximum Production		**573**	**560**	**432**	**522**
Minimum Inventory		46	31	94	73
Average Inventory		555	736	607	213
Unit Production Cost		**$55**	**$59**	**$45**	**$63**
Unit Carrying Cost		$1.17	$1.17	$1.17	$1.17
Monthly Production Cost		$31,497	$33,086	$19,506	$28,255
Monthly Carrying Cost		$650	$862	$711	$249
					$114,814

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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

Safety stock= demand *.1
Ending inventory- beginning inventory+ units produced- units Demanded
Average Inventory=(beginning inventory- ending inventory)/2
Monthly production cost= unit production costs* units produced
Monthly Carrying cost= Unit carrying costs* average inventory

Min= $55P_1+59P_2+45P_3+63P_4 +1.17(B_1+B_2)/2 + 1.17(B_2+B_3)/2 +1.17(B_3+B_4)/2 +1.17(B_4+B_5)/2$

Production level for Month 1: $P_1 \leq 573$
Production level for Month 2: $P_2 \leq 560$
Production level for Month 3: $P_3 \leq 432$
Production level for Month 4: $P_4 \leq 522$

Where:
$B_2=B_1+P_1 - 462$
$B_3=B_2+P_2 - 309$
$B_4=B_3+P_3 - 941$
$B_5=B_4+P_4 - 728$

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*

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.

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		1	2	3	4
Beginning Inventory		**500**	**340**	31	801
Units Produced		**302**	**0**	**1,711**	**0**
Units Demanded		**462**	**309**	**941**	**728**
Ending Inventory		**340**	**31**	**801**	**73**
Maximum Production		**573**	**560**	**432**	**522**
Minimum Inventory		46	31	94	73
Average Inventory		420	185	416	437
Unit Production Cost		**$55**	**$59**	**$45**	**$63**
Unit Carrying Cost		$0.00	$0.00	$0.00	$0.00
Monthly Production Cost		$16,577	$0	$77,279	$0
Monthly Carrying Cost		$0	$0	$0	$0
					$93,856

- *The second dataset may represent a scenario where production is adjusted significantly to meet demand fluctuations, while the first dataset likely reflects a more controlled and steady production schedule to maintain inventory balance.*

- *No expenses associated with storing, handling, or maintaining inventory during the period, so monthly production costs and monthly carrying costs lower.*

- *When I removed carrying costs and ran solver, the optimal solution lowered a lot.*

- *In this chart there large fluctuations in units produced and units demanded*