TÉCNICO LISBOA

Exercise 2

Inventory Management

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Introduction

Single Period Model

- One ordering opportunity only
- Order quantity to be decided before demand occurs

  - Order Quantity > Demand => Dispose excess inventory
  - Order Quantity < Demand => Lose sales/profits

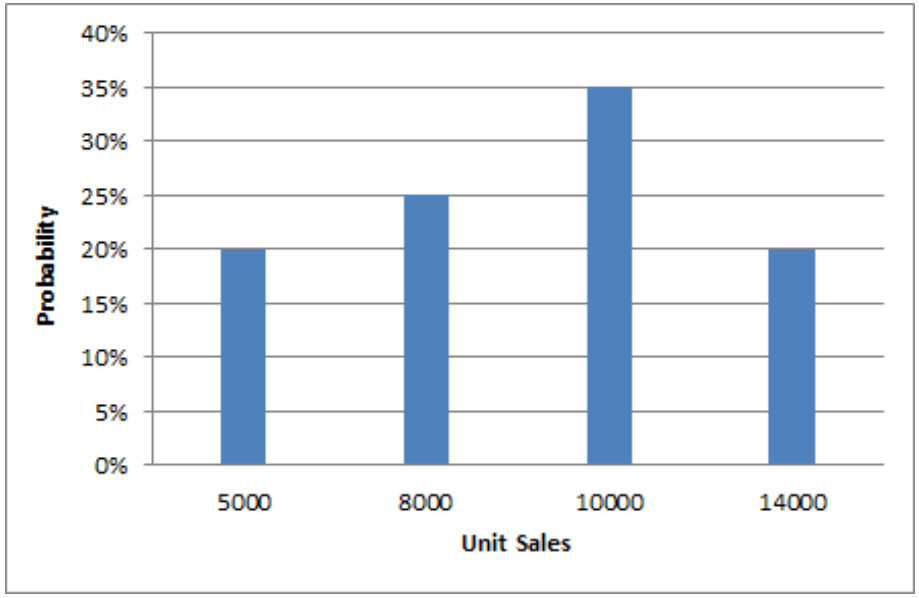
Introduction

- Using historical data:
  - identify a variety of demand scenarios
  - determine probability that each of these scenarios will occur
- Given a specific inventory policy:
  - determine the profit associated with a particular scenario
  - weight each scenario's profit by the likelihood that it will occur
  - determine the average, or expected, profit for a particular ordering quantity.

Order the quantity that maximizes the average profit.

Problem

- Christmas ornaments – Seasonal product
- Forecast based on company historical data from the last five years, current economic conditions and other factors



Problem

- Fixed cost of production is equal to 10.000€;
- Variable cost of production per unit is equal to 4€;
- During Christmas time the selling price of an ornament is 10€;
- Any ornament not sold during Christmas season is sold to a discount store for 2€ (Salvage value).

Resolution – a)

a) Determine the optimal production quantity. Represent in a graph the variation of the profit versus the produced quantity (consider all the points of produced quantities between 3.000 and 20.000, with an increment of 1.000 between points).

Resolution – a)

1. Fill out the table with forecasted demand and calculate the average demand.

	Demand	Probability	Weighted Demand
	5000	20%	
	8000	25%	
	10000	35%	
	14000	20%	
Average		100%	0

2. Fill out the table with the costs.

Item	Cost (€)
Variable Production Cost	4
Fixed Production Cost	10,000
Selling Price	10
Salvage Value	2

Resolution – a)

3. Calculate the profit for each combination of demand-produced quantity.

Demand	Probability	Profit for a Given Production Level								
		3000	4000	5000	6000	7000	8000	9000	10000	11000
5000	20%									
8000	25%									
10000	35%									
14000	20%									
	Average									
	Max profit	0 €								

Profit = ?

Resolution – a)

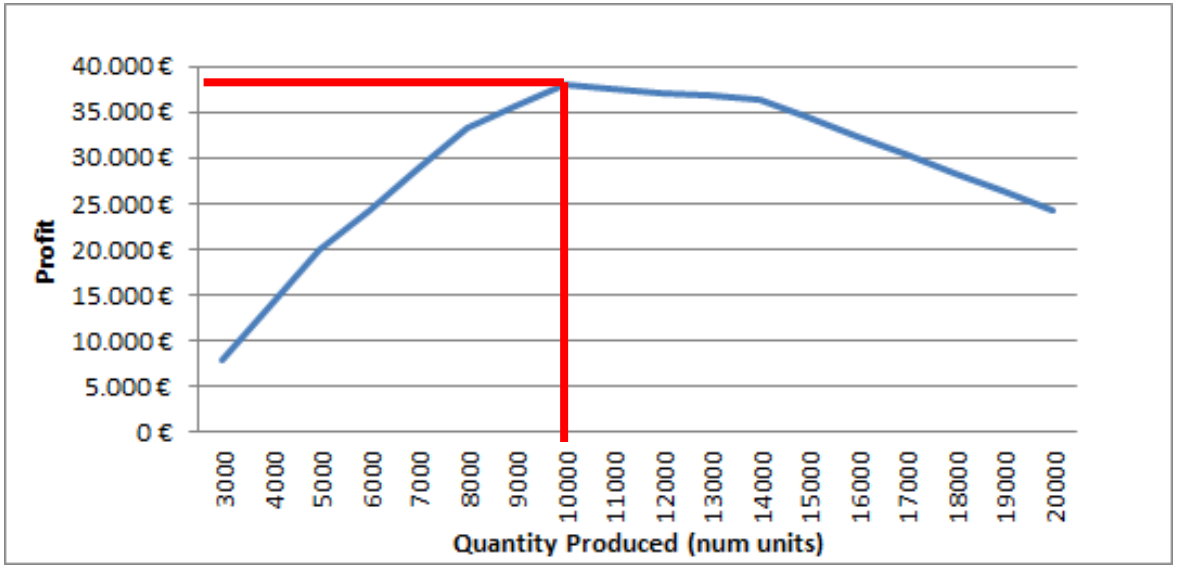
3. Calculate the profit for each combination of demand-produced quantity.

		Profit for							
	Units produced	3000	4000	5000	6000	7000	8000	9000	10000
Demand	Demand Probability								
5000	20%								
8000	25%								
10000	35%								
14000	20%								
	Average	0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
	Max profit	0 €							

Profit =

Min (Demand; Production) x Selling Price +
+ Max (Production - Demand ; 0) x Salvage Value –
- VPC x Production
- FC

Discussion – a)



Optimal Quantity to Produce = 10.000 units
=> Profit 38.000 €

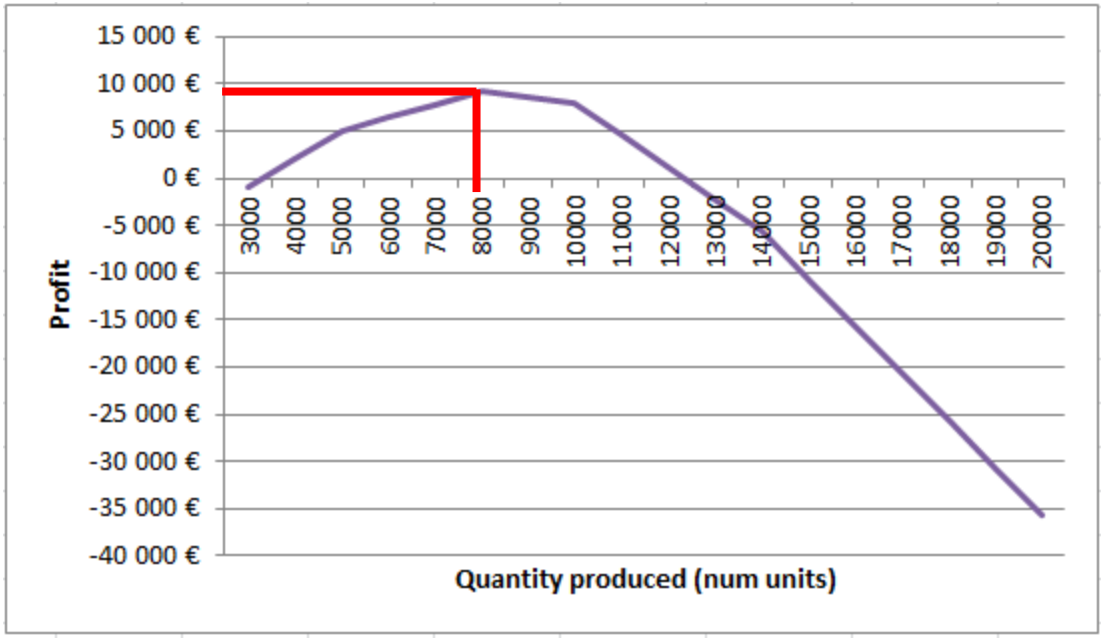
The average demand is 9.300 units, so why is the optimal quantity to produce higher than the average?

Resolution – b)

b) If the variable cost is 7€, what is the optimal production quantity? Can you take any conclusion regarding optimal production quantity and marginal profit and marginal cost?

1. Repeat again the previous steps using the variable cost of 7€.

Discussion – b)



Optimal Quantity to Produce = 8.000 units

=> Profit 9.200 €

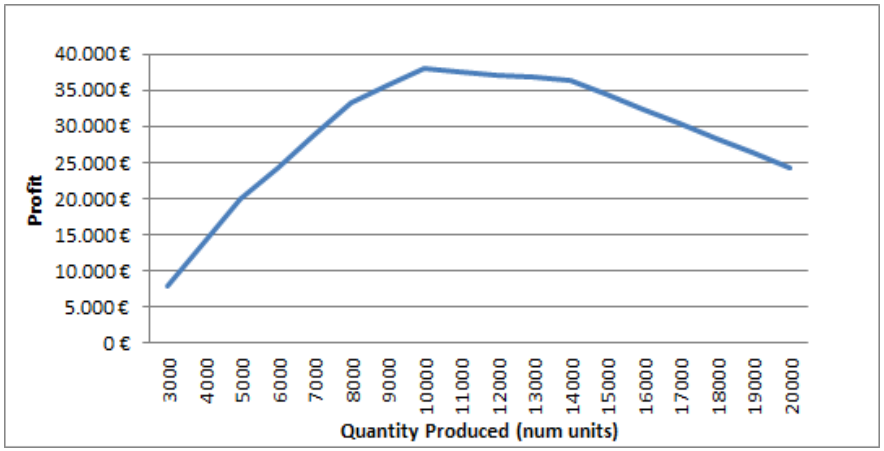
But why is the optimal quantity to produce now lower than the average demand (9.300 units)?

Resolution – b)

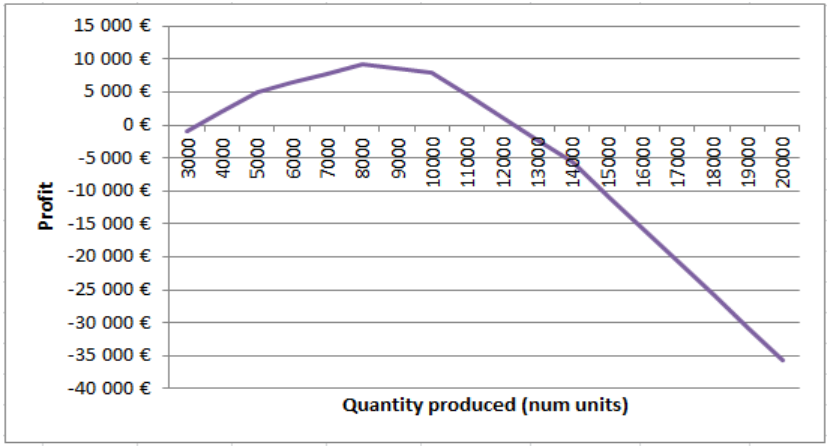
2. Calculate the marginal profit and the marginal loss.

Marginal Profit = Selling Price – Variable Cost

Marginal Loss = Variable Cost – Salvage Value

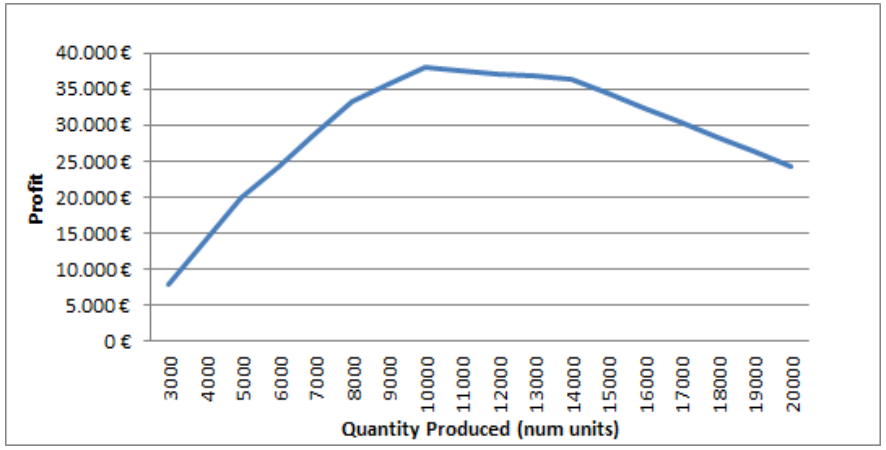


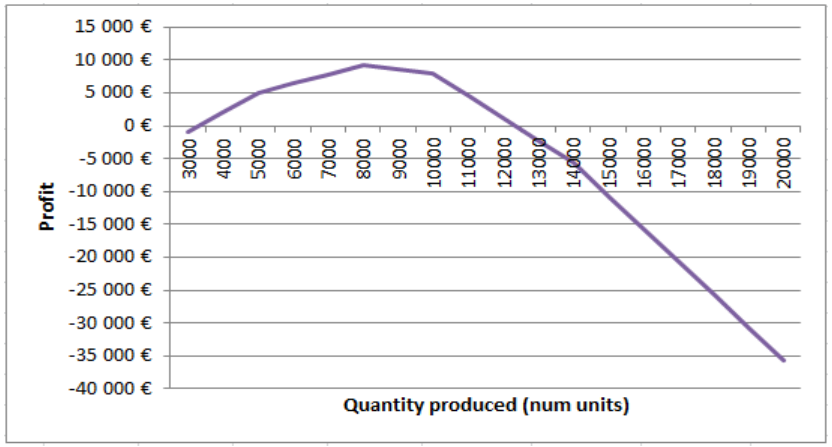
1. Variable Cost = 4€



2. Variable Cost = 7€

Discussion – b)





1. Variable Cost = 4€

Marginal Profit (MP)= 10 – 4 = 6

Marginal Cost (MC) = 4 – 2 = 2

MP > MC

=> OQP > Average demand

2. Variable Cost = 7€

Marginal Profit (MP) = 10 – 7 = 3

Marginal Cost (MC) = 7 – 2 = 5

MC > MP

=> OQP < Average demand

Resolution – c)

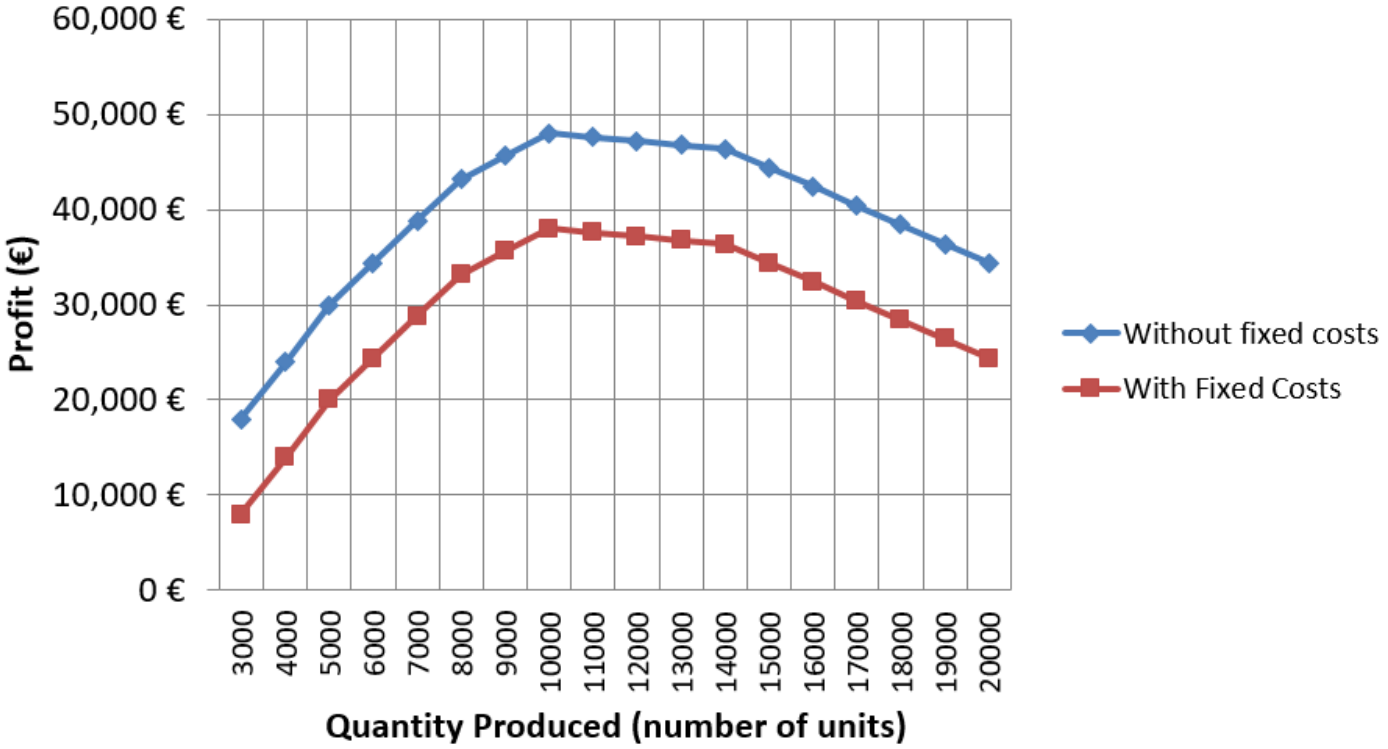
c) Company has still some remains from the previous year, 4000 units. Managers are considering not producing any units. Do you think this is the best option? If not, how many units would you produce? And if you have 8000 units in stock, do you have the same opinion?

1. Plot the curve of profit without taking into account the fixed costs.
2. Determine the profit for the two scenarios:

   Scenario 1: No production

   Scenario 2: Production of items until optimal value is reached

Discussion – c)



Profit (Not producing) = Profit (without fixed costs)
+ Variable Cost (of the Initial Inventory)

Profit (Producing) = Profit (with fixed costs)
+ Variable Cost (of the Initial Inventory)

Discussion – c)

Initial Inventory = 4.000 units

	Profit (€)	Units to Sell	Units to Produce
No Production	40.000 €	4.000	0
Production	54.000 €	10.000	6.000

Initial Inventory = 8.000 units

	Profit (€)	Units to Sell	Units to Produce
No Production	75.200 €	8.000	0
Production	70.000 €	10.000	2.000

Discussion – c)

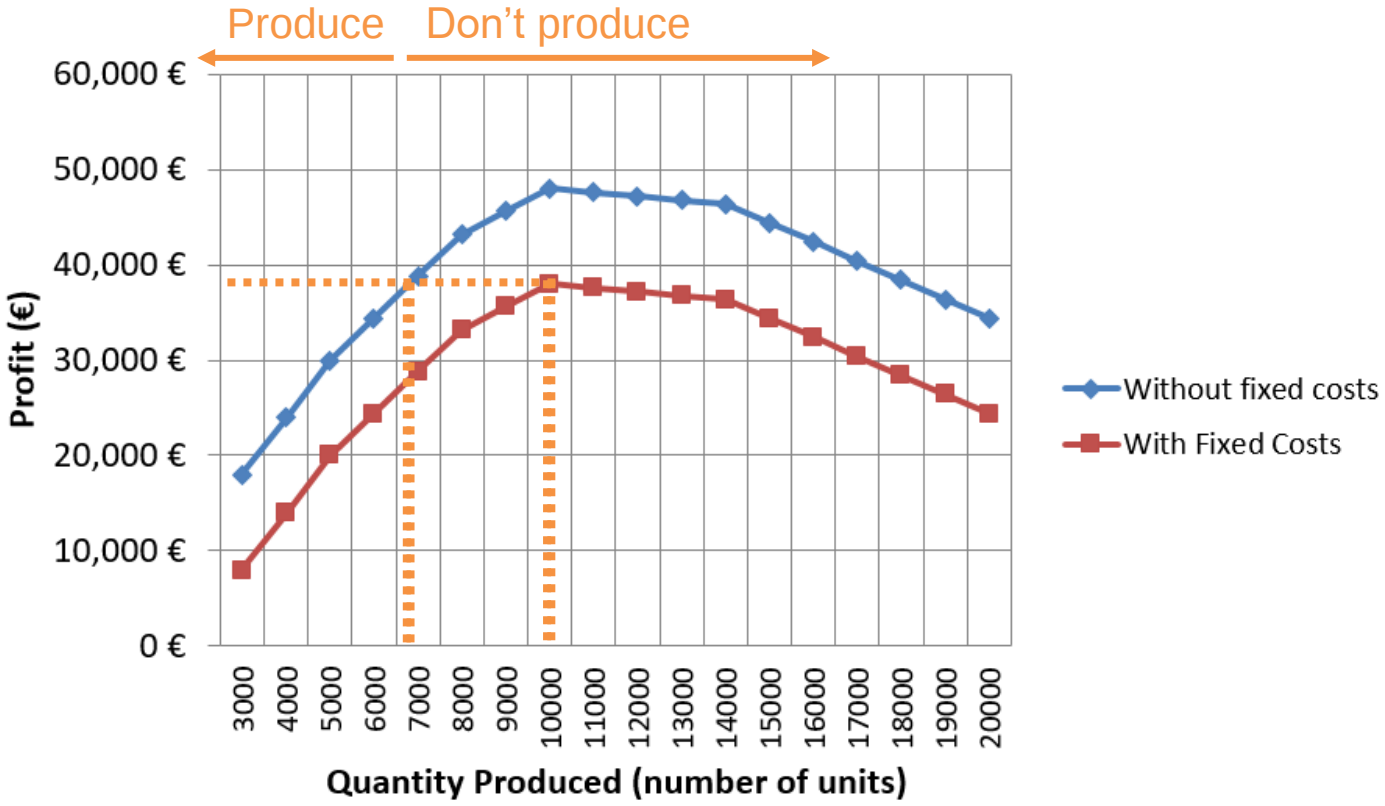
Initial Inventory = 4.000 units

	Profit (€)	Units to Sell	Units to Produce
No Production	40.000 €	4.000	0
Production	54.000 €	10.000	6.000

Initial Inventory = 8.000 units

	Profit (€)	Units to Sell	Units to Produce
No Production	75.200 €	8.000	0
Production	70.000 €	10.000	2.000

Discussion – c)



Profit (Not producing) = Profit (without fixed costs)
+ Variable Cost (of the Initial Inventory)

Profit (Producing) = Profit (with fixed costs)
+ Variable Cost (of the Initial Inventory)

Conclusions

- Single period models (one chance of ordering) are based on forecasts.

- Forecasts are always wrong, so use different scenarios to evaluate profit and produce the amount that optimizes the profit.

- Marginal Profit and Marginal Loss influence the production decision:

  When MP > MC => OQP > Average Demand

  When MC > MP => OQP < Average Demand

- When initial inventory exists, evaluate if it is worth to produce more units or not (Fixed costs).