



TÉCNICO
LISBOA

Exercise 3

Risk Pooling Game

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One of the most important concepts in SC: **Risk Pooling**

Risk Pooling: Involves the use of centralized inventory to take advantage of the fact that if demand is higher than average at some retailers, it is likely to be lower than average at others.

- **Risk Pooling Game shows:**

- 1) Risk pooling concept
- 2) Advantages of centralized inventory management
- 3) Risk pooling under different demand conditions

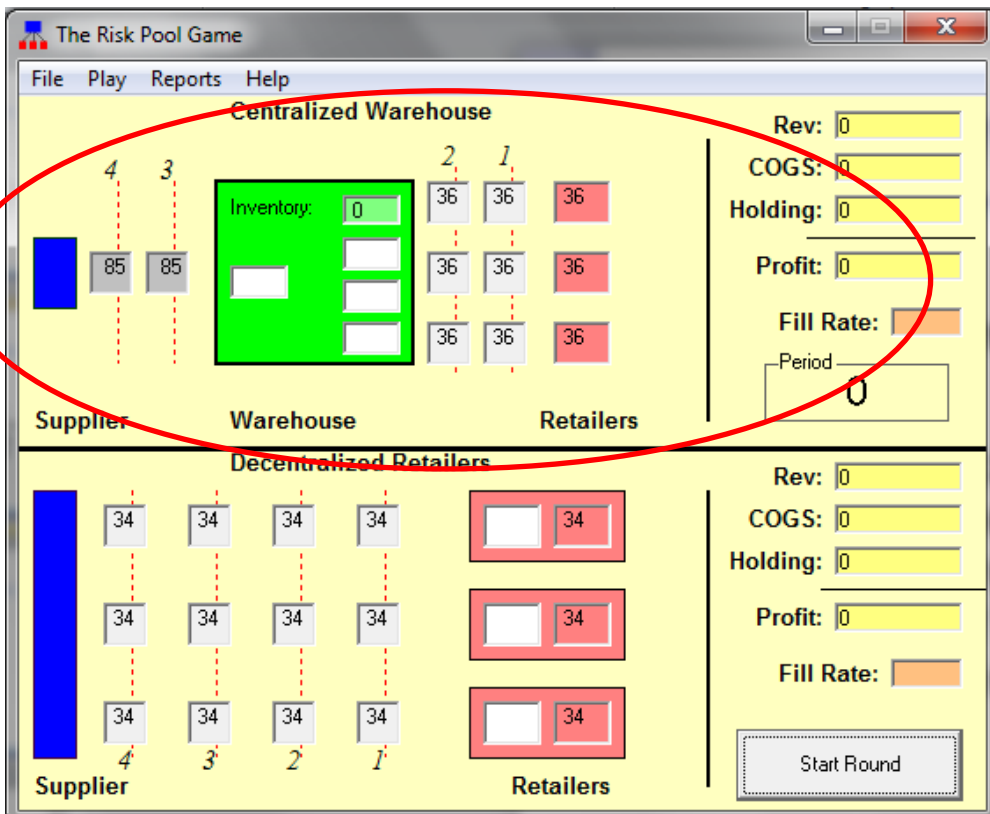
- **Risk Pooling Game simulates:**

A centralized inventory system, where a single warehouse serves three different retailers

vs.

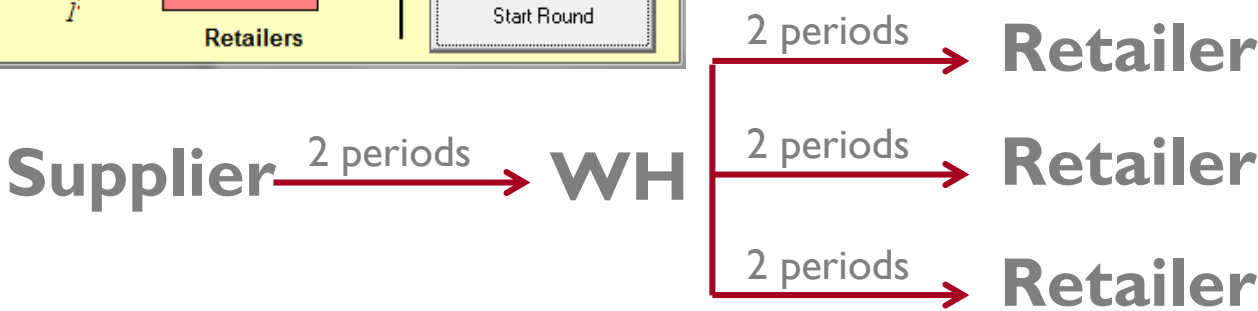
A decentralized system where three retailers maintain separate inventory and are served by a supplier separately.

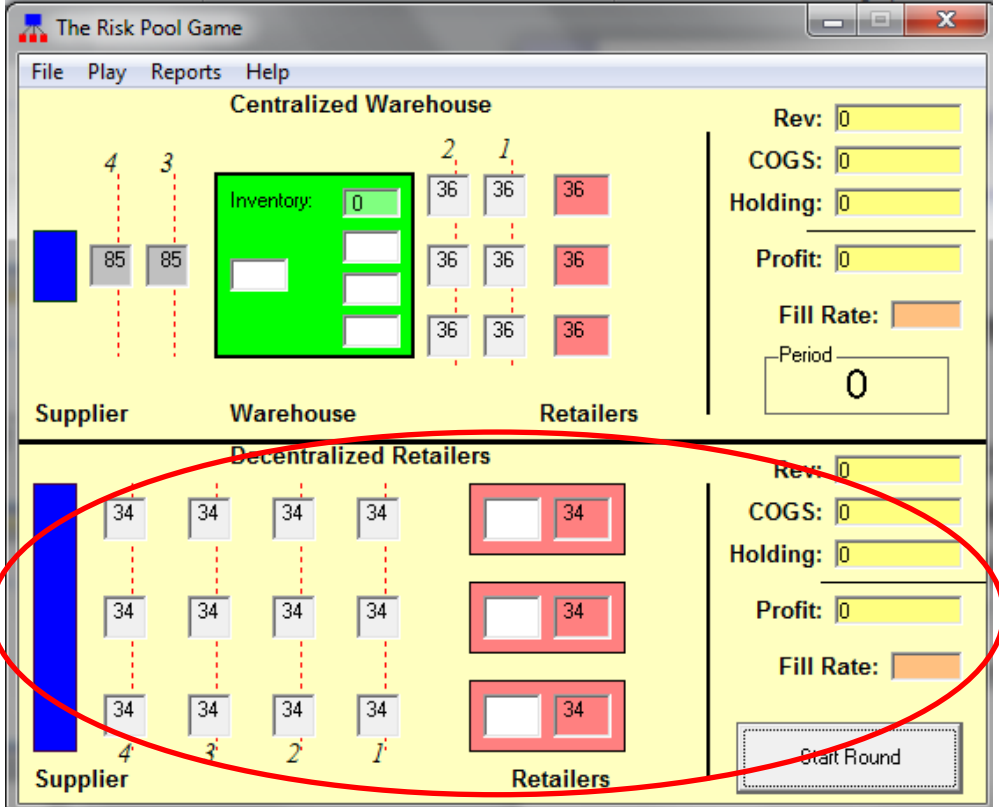
- **Run setup file and install the game!**
- **Note** that before playing each round of the game, you will need to initialize the game. We found that resetting will not initialize the game and you will need to exit the game each time before commencing a new round.



Centralized SC

The material can be stored or shipped directly



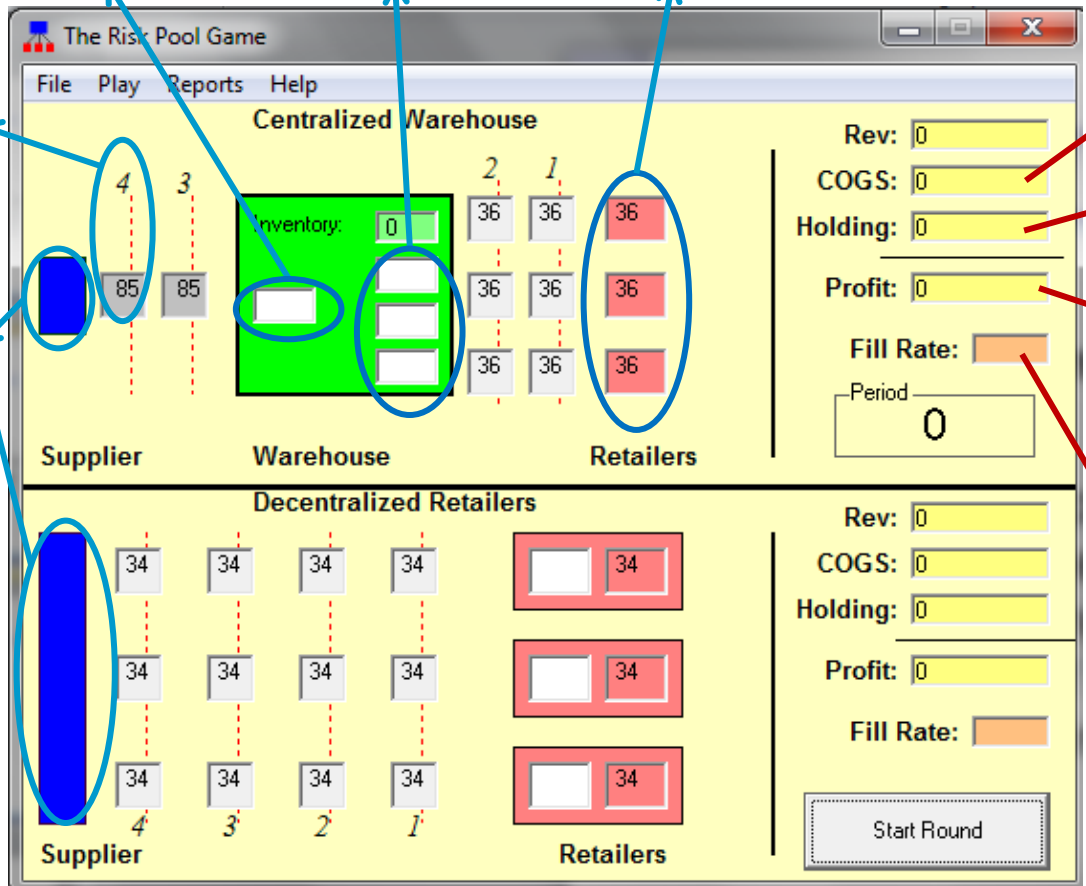


Decentralized SC



Supplier

Play the Game



Order from supplier

Allocation to retailers

Inventory of retailers

Inventory at least 4 period away from retailers

Supplier

Centralized Warehouse

Decentralized Retailers

Rev: 0

COGS: 0

Holding: 0

Profit: 0

Fill Rate:

Period:

Start Round

Cost Of Goods Sold

Holding Cost

= Revenue - (COGS + Holding Cost)

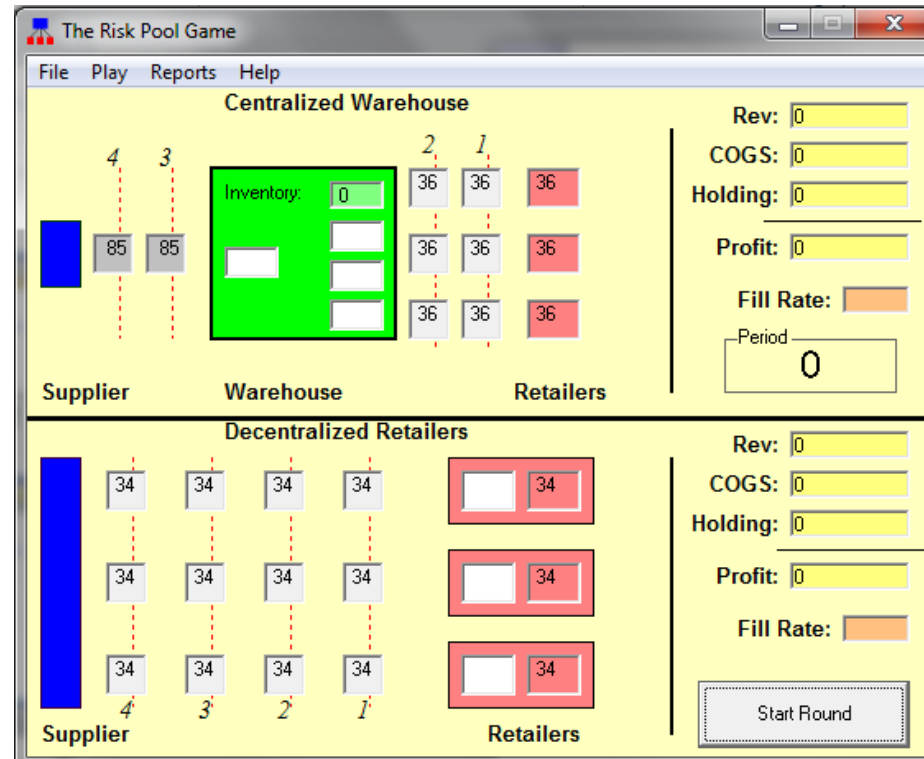
= Demand met / Total demand * 100

b) Run the game for 30 weeks knowing that the average demand is 25 units and the standard deviation is equal to 10 units. Record the profit values for the centralized and the decentralized supply chains for every week. Plot the profit VS the number of weeks for centralized and decentralized supply chain (use the same plot for both supply chains). What can be concluded from the analysis of this plot?

Play the Game – b)

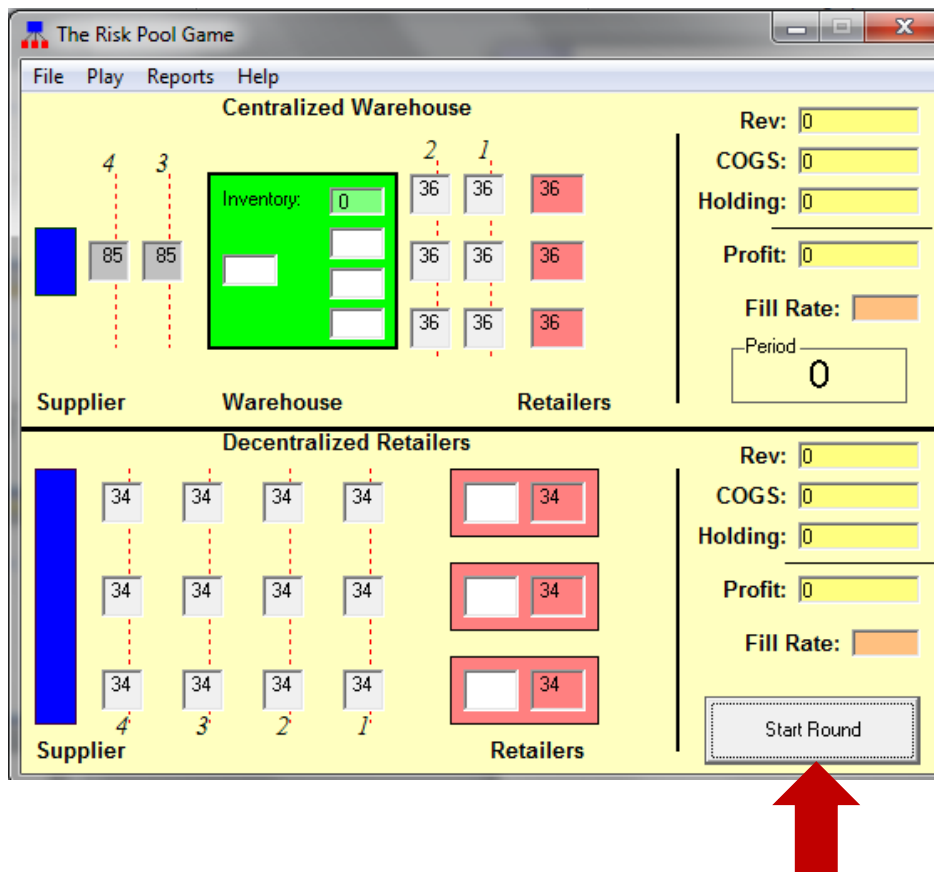
- Price = 20€
- Costs:
 - Holding Cost = 1,5€
 - Material Cost = 10€
- Average demand = 25 units
- Standard deviation = 10 units

**Demand is not back ordered!
Demand that
cannot be met is lost!!**



**Goal in both SCs:
Maximize profit**

Play the Game – b)



The screenshot displays the 'The Risk Pool Game' interface, divided into two main sections: 'Centralized Warehouse' and 'Decentralized Retailers'.

Centralized Warehouse:

- Supplier:** Represented by a blue bar with a value of 85.
- Warehouse:** A green box labeled 'Inventory' with a value of 0.
- Retailers:** Four retailers, each with a value of 36.
- Metrics:** Rev: 0, COGS: 0, Holding: 0, Profit: 0. Fill Rate is shown as a progress bar. Period is set to 0.

Decentralized Retailers:

- Supplier:** Represented by a blue bar with a value of 34.
- Retailers:** Four retailers, each with a value of 34.
- Metrics:** Rev: 0, COGS: 0, Holding: 0, Profit: 0. Fill Rate is shown as a progress bar.
- Action:** A 'Start Round' button is highlighted with a red arrow.

Step 1:
Press the Start Round button

The inventory is advanced

Play the Game – b)

The Risk Pool Game

File Play Reports Help

Centralized Warehouse

Rev: 0
COGS: 0
Holding: 0
Profit: 0
Fill Rate:
Period: 0

Supplier: 85 85
Warehouse: Inventory: 0
Retailers: 36 36 36, 36 36 36, 36 36 36

Decentralized Retailers

Rev: 0
COGS: 0
Holding: 0
Profit: 0
Fill Rate:

Supplier: 34 34 34 34
Retailers: 34 34 34 34

Start Round

The Risk Pool Game

File Play Reports Help

Centralized Warehouse

Rev: 0
COGS: 0
Holding: 0
Profit: 0
Fill Rate:
Period: 1

Supplier: 85
Warehouse: Inventory: 85
Retailers: 44 29 64, 36 36 36, 36 36 36

Decentralized Retailers

Rev: 0
COGS: 0
Holding: 0
Profit: 0
Fill Rate:

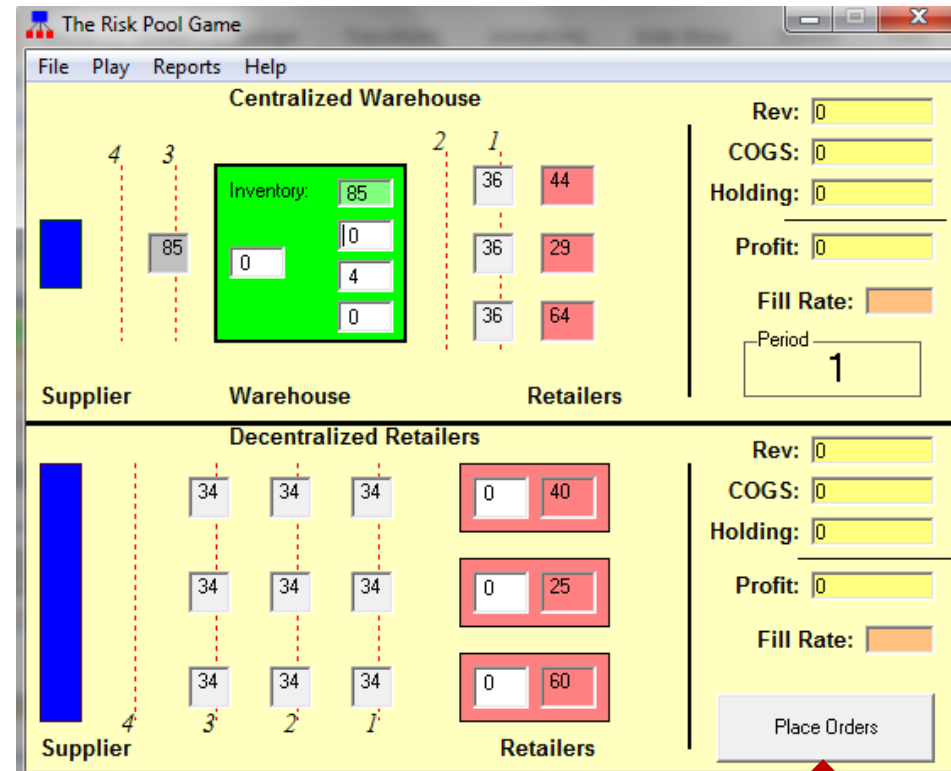
Supplier: 34 34 34
Retailers: 40 25 60, 0 0 0

Place Orders



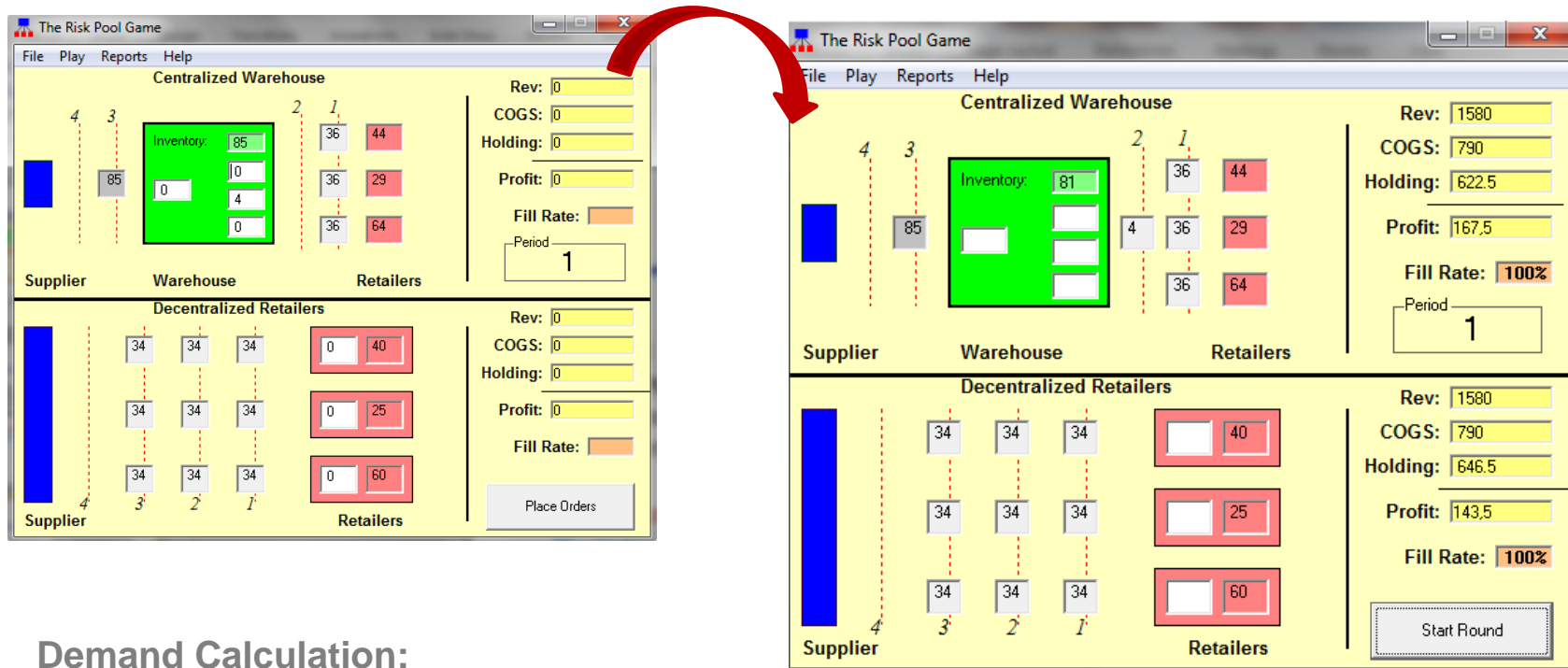
Inventory

Step 2: Place Orders



The screenshot displays the 'The Risk Pool Game' interface, divided into two main sections: 'Centralized Warehouse' and 'Decentralized Retailers'. Both sections show a 'Supplier' on the left, a 'Warehouse' or 'Retailers' in the middle, and a 'Retailers' section on the right. The 'Centralized Warehouse' section shows an inventory of 85, with three retailers (1, 2, 3) having demand values of 36, 36, and 36 respectively. The 'Decentralized Retailers' section shows three retailers (1, 2, 3) each with a demand of 34. The interface includes a menu bar (File, Play, Reports, Help), a 'Place Orders' button at the bottom right, and various performance metrics (Rev, COGS, Holding, Profit, Fill Rate) for each section. A red arrow points to the 'Place Orders' button.

Play the Game – b)



Demand Calculation:

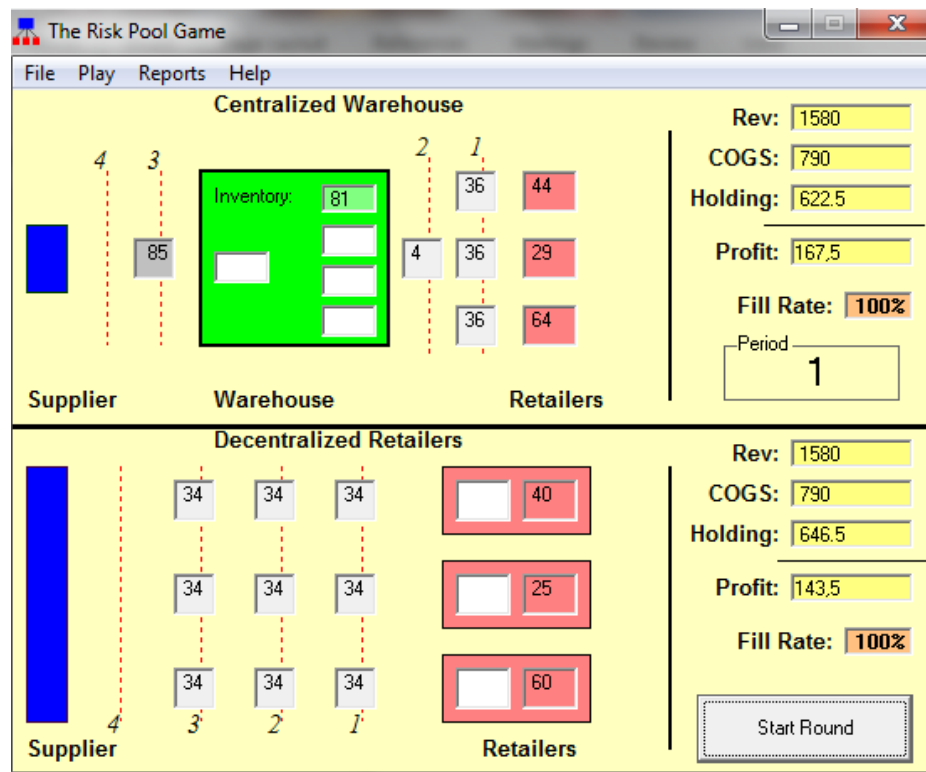
Example for the 1st retailer:

Centr SC: 36 (initial inventory at ret) + 36 (inventory arrived at ret from 1) – Demand = 44 (final inventory at ret)

----- Demand = 28

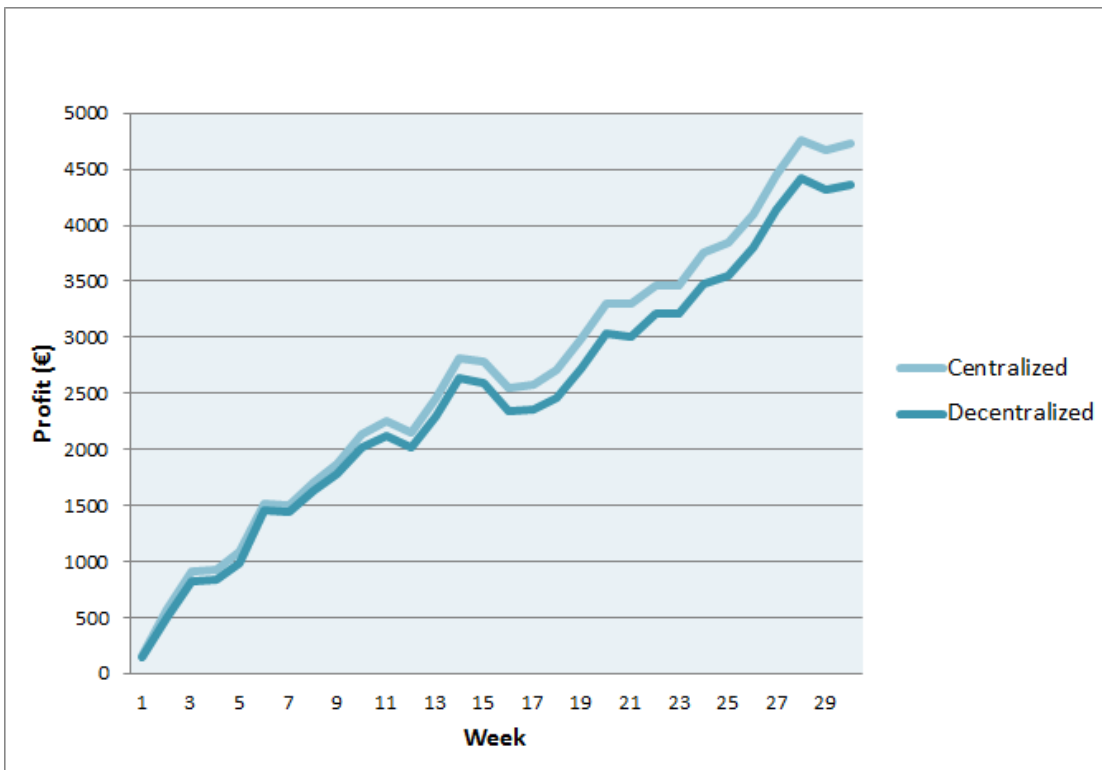
Decentr SC: 34 (initial inventory at ret) + 34 (inventory arrived at ret from 1) – Demand = 40 (final inventory at ret)

----- Demand = 28



Step 3:
Repeat until
completing the 6
weeks required

Profit variation during the 30 Weeks



- Higher profit in the **centralized SC**
- As the time passes the gap between the profits is higher

c. How can you explain the decrease of profit in some weeks? (Plot demand profile VS the number of weeks for 16 weeks. On the menu bar go to *Reports* -> *Demands* and take the demand profile for the three retailers).

Play the Game – c)

To see the demand profile

The screenshot shows the 'The Risk Pool Game' interface. At the top, there is a menu bar with 'File', 'Play', 'Reports', and 'Help'. The 'Reports' menu is open, showing 'Orders' and 'Demands'. The main area is divided into two sections: 'Centralized' and 'Decentralized Retailers'.

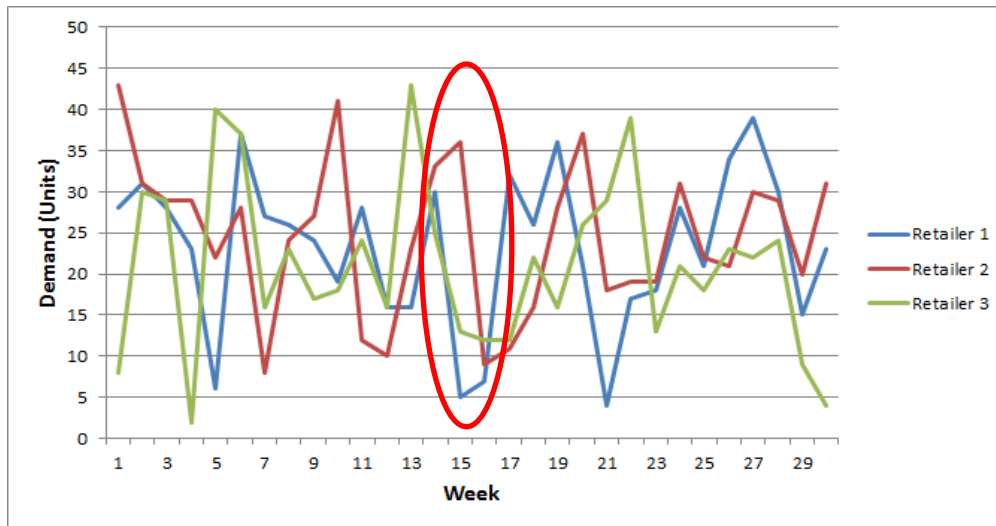
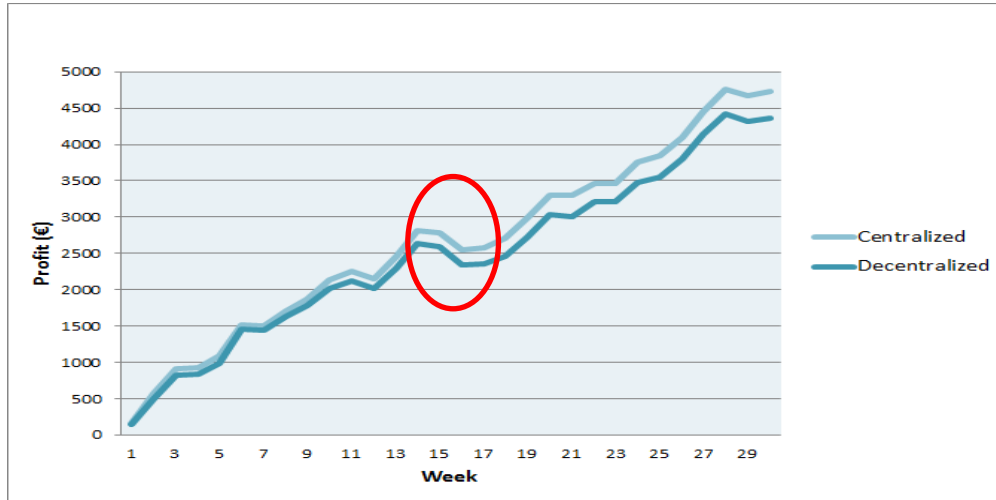
Centralized Section:

- Supplier:** A blue bar representing inventory, with a value of 85.
- Warehouse:** A green box representing inventory, with a value of 0.
- Retailers:** Three retailers, each with a demand of 36. The demands are shown in a 3x3 grid.
- Orders:** A menu showing 'Orders' and 'Demands'.
- Summary:** Rev: 0, COGS: 0, Holding: 0, Profit: 0, Fill Rate: 0, Period: 0.

Decentralized Section:

- Supplier:** A blue bar representing inventory, with a value of 34.
- Retailers:** Three retailers, each with a demand of 34. The demands are shown in a 3x4 grid.
- Summary:** Rev: 0, COGS: 0, Holding: 0, Profit: 0, Fill Rate: 0.
- Start Round:** A button to start the round.

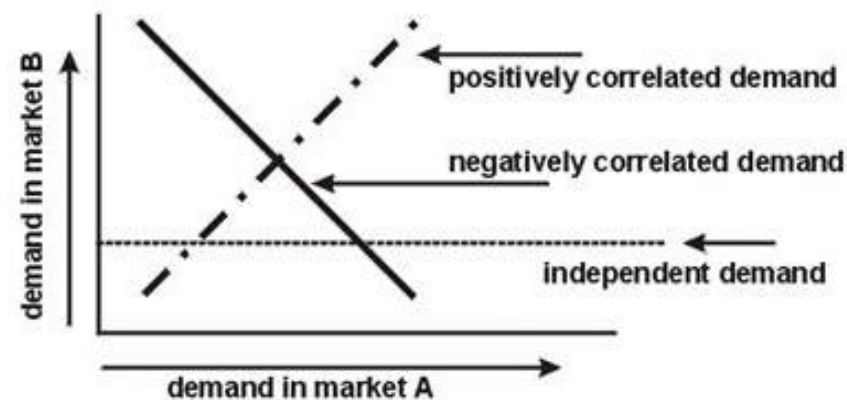
Play the Game – c)



- Demand decreases
- Excess of inventory
- Profit decreases

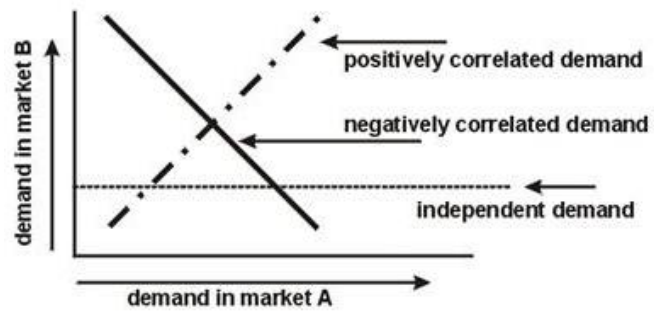
d. Evaluate how profit of the firms varies under different demand conditions in different markets.

Profit data should be recorded for 30 weeks. Compare the results.

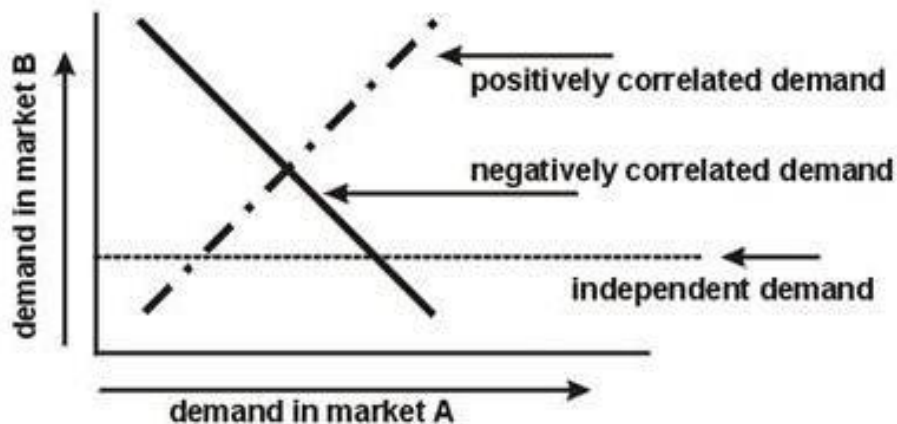


Run no.	Demand Correlation	Mean demand	Standard Deviation of demand
1	Strongly Positive	25	10
2	Strongly Positive	25	15
3	Strongly Positive	25	5
4	Independent	25	10
5	Independent	25	15
6	Independent	25	5
7	Strongly Negative	25	10
8	Strongly Negative	25	15
9	Strongly Negative	25	5

Play the Game – c)



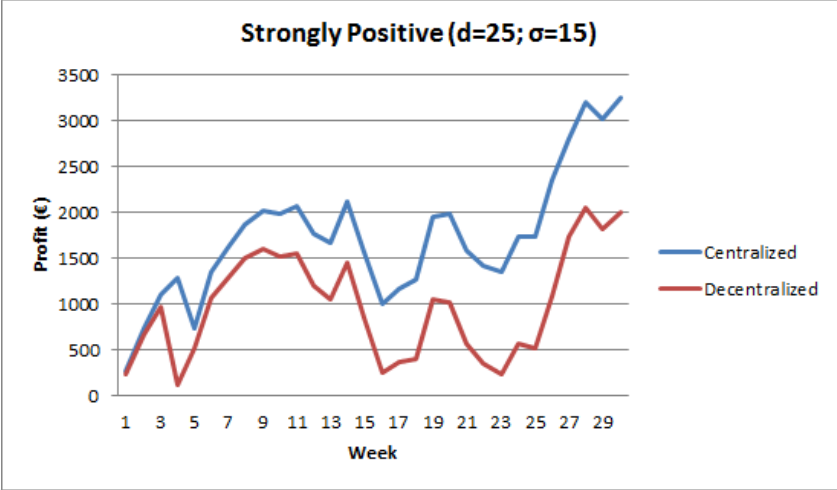
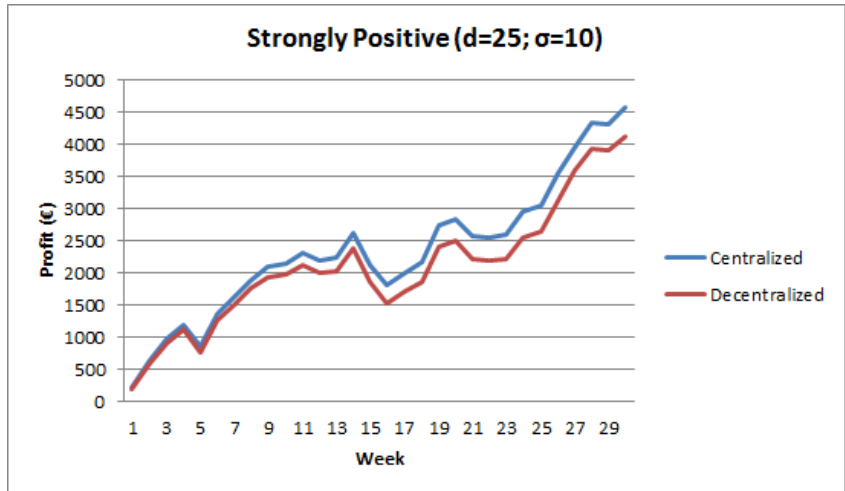
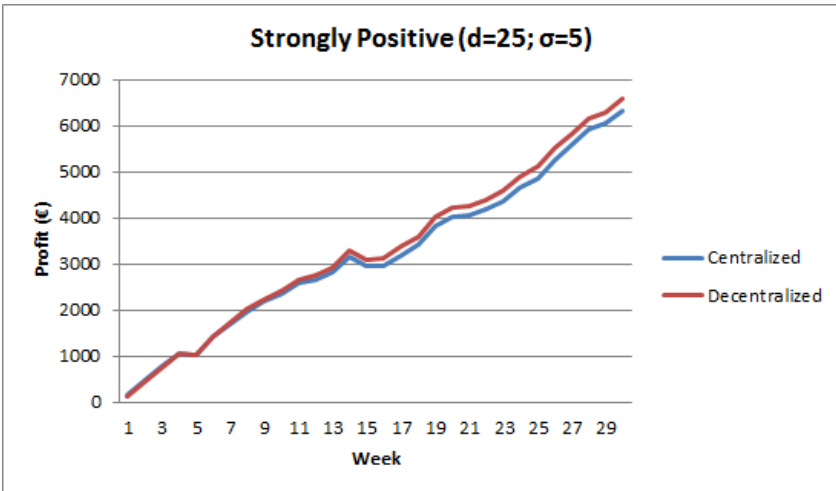
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9	Strongly Negative	25	5



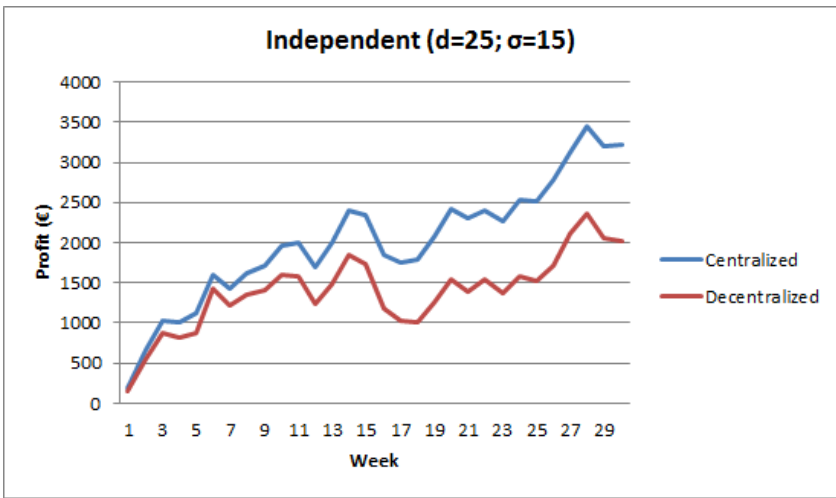
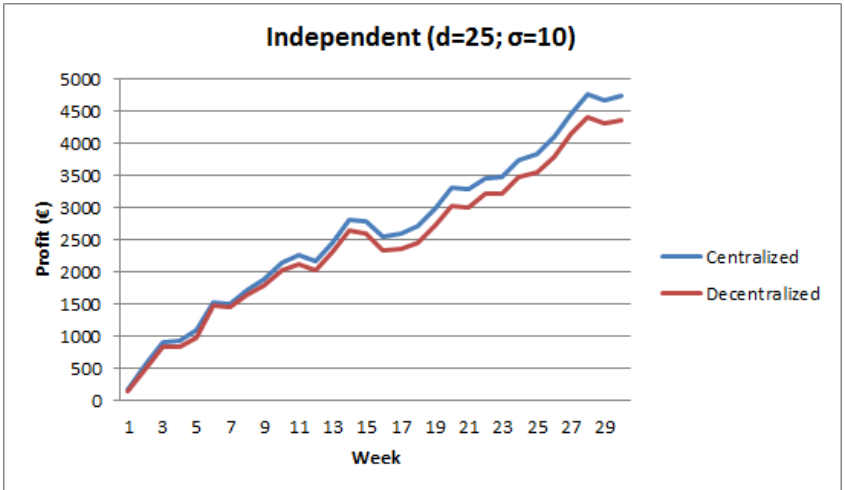
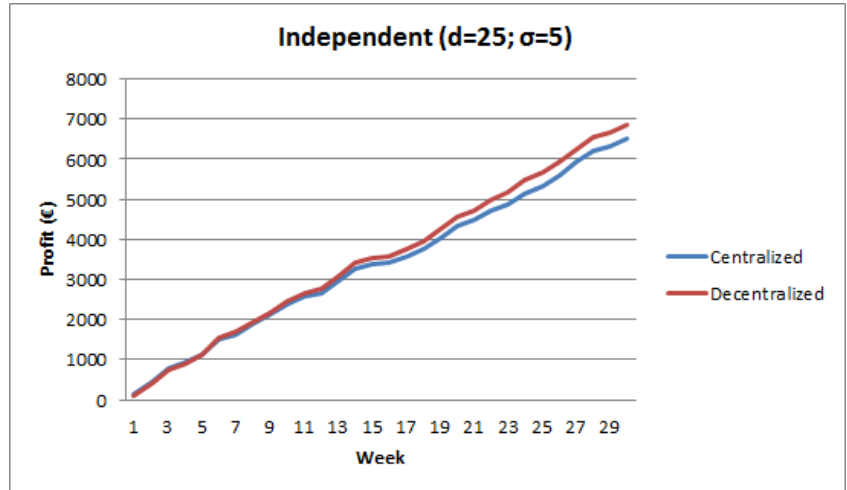
Positively correlated demand
If one retailer has demand greater than average, demand from another retailer is likely to be greater than average

Negatively correlated demand
If one retailer has demand higher than average, demand from another retailer is likely to be lower than average

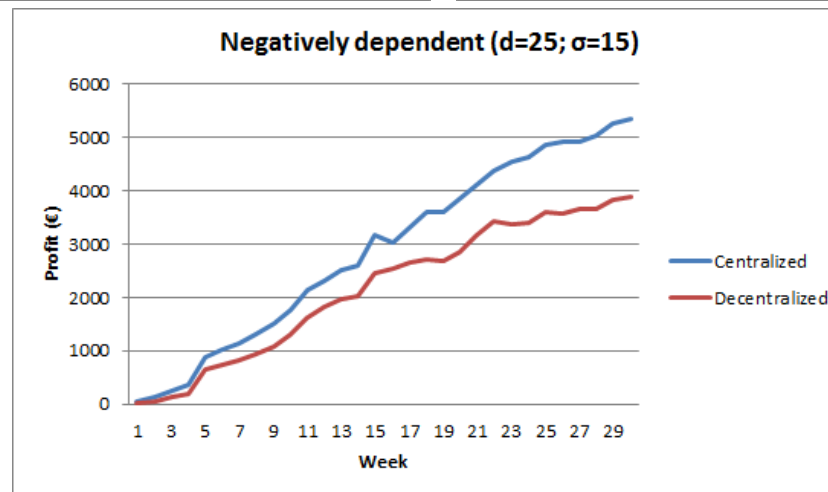
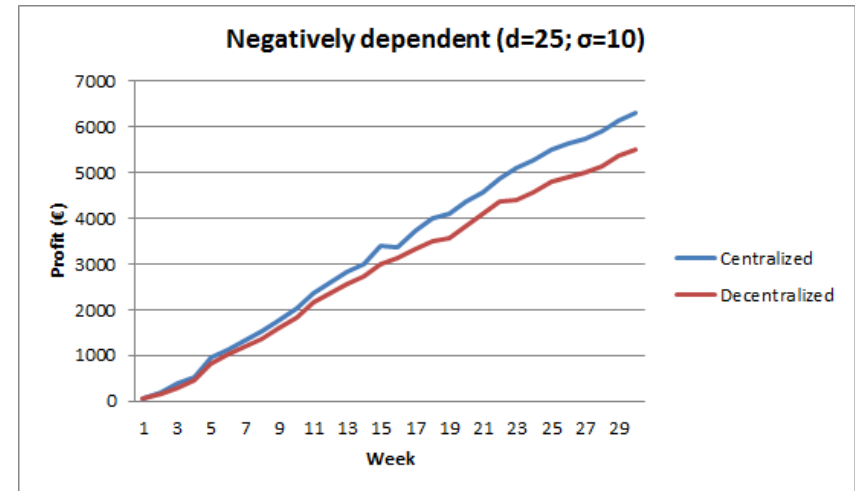
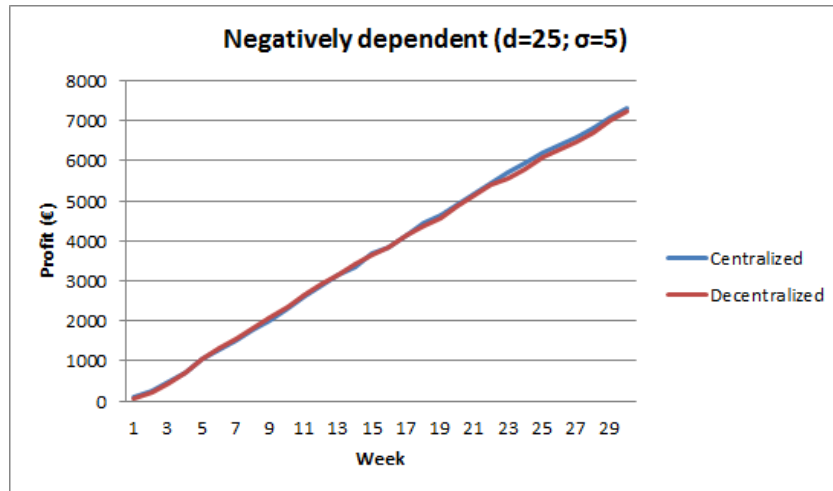
Strongly positively correlated demand: **Increase variability**



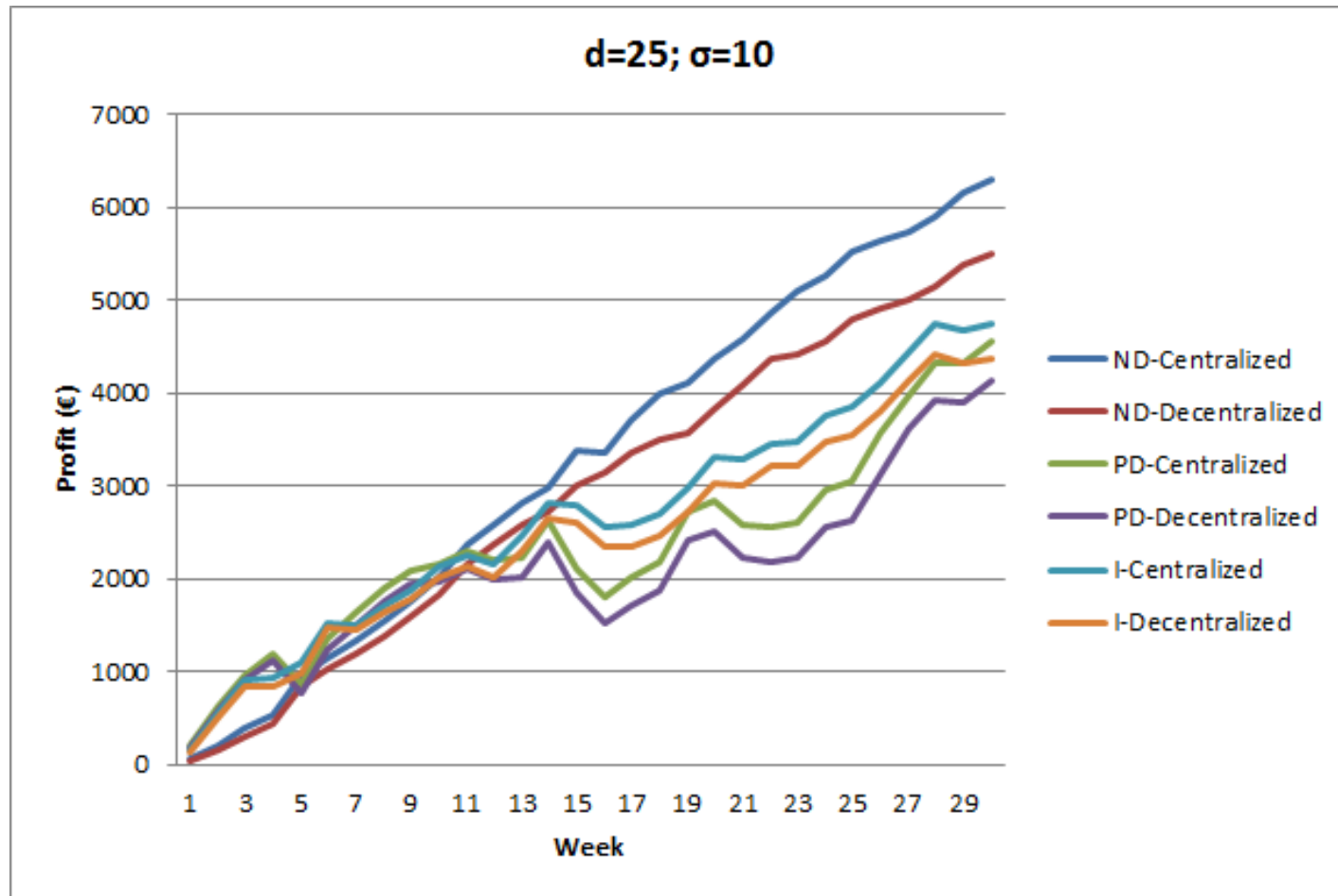
Independent demand: Increase variability



Strongly negatively correlated demand: **Increase variability**



Same demand variability: Different types of market correlation



- The Risk Pooling Game shows the effectiveness of centralization of inventory under certain conditions.
- Risk pooling is most effective when demands across markets are strongly negatively dependent. Risk pooling is less effective when the markets are strongly positively dependent.
- When the demand variability is high, risk pooling effect is higher and consequently it is better to adopt a centralized SC (gap between centralized SC and decentralized SC is higher).