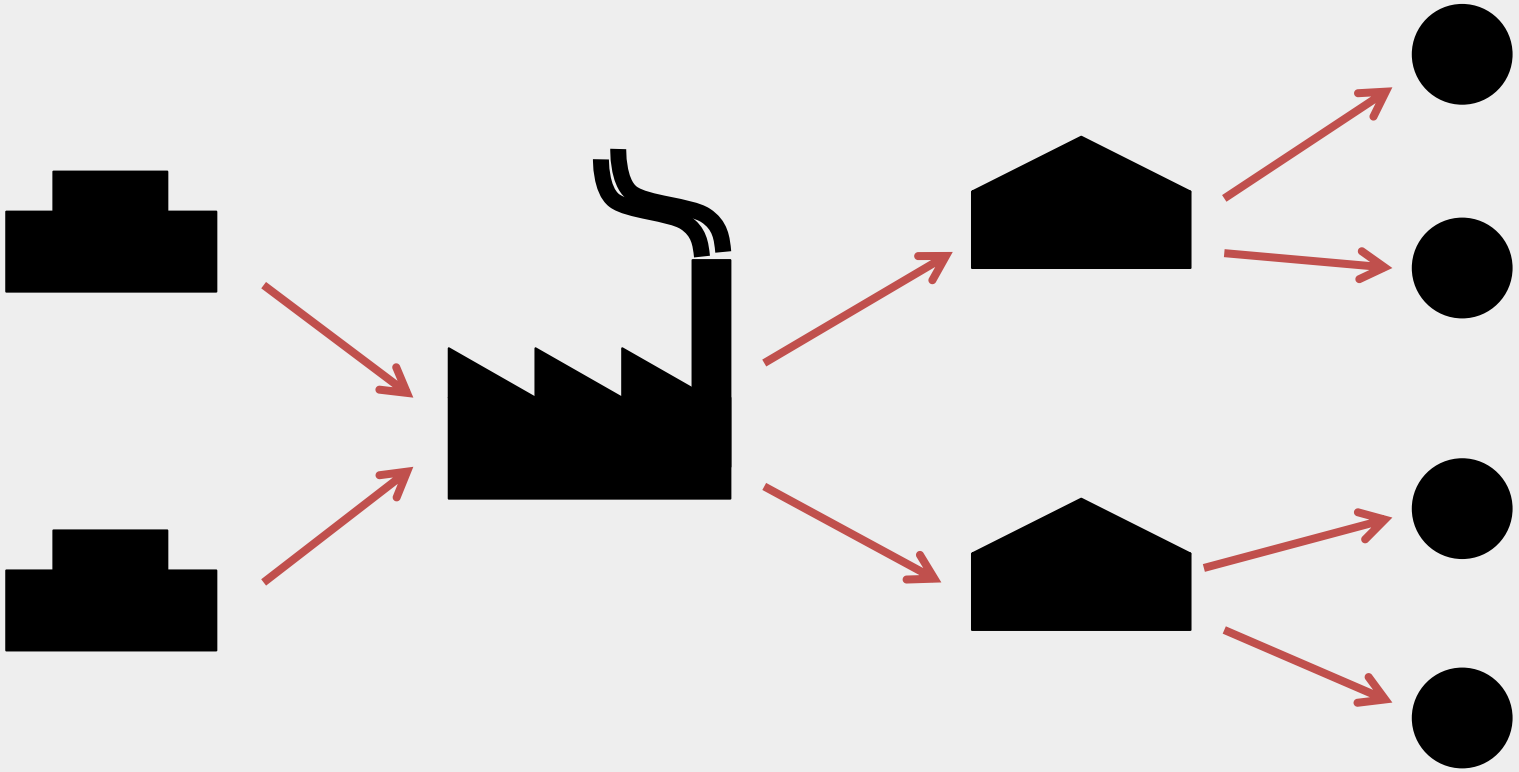
Supply Chain Contracts

Overview



Goals of this lecture

- Define and explain what is a Supply Chain Contract
- Define and exemplify what is double marginalization
- Contrast and compare different types of contracts

What is a contract?

A contract is a (legal) agreement between a buyer and a seller that defines the terms and conditions of sales.

Why do businesses use contracts?

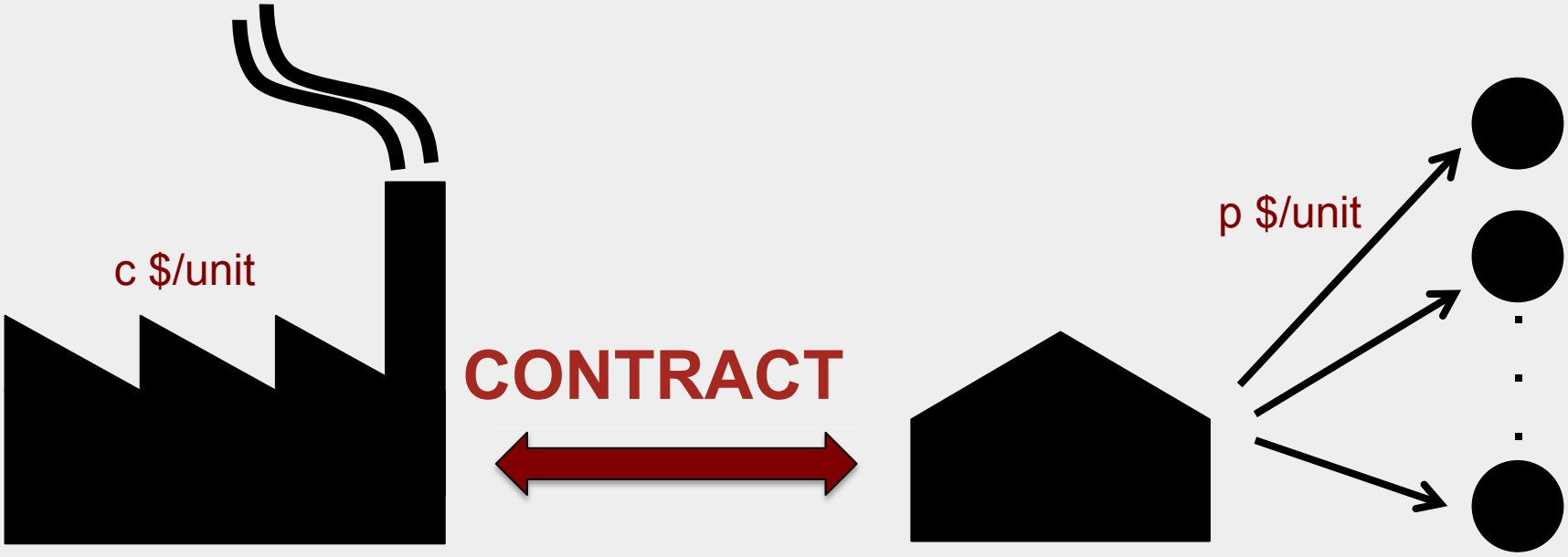
- They reduce uncertainty (both in demand and manufacturing cost)
- Help to share risk
- Incentivize sales efforts
- Important for information sharing

Why do businesses use contracts?

- **Can you come up with examples of contracts in your projects?**

- **What are the risks/uncertainties in the supply chain?**

Contracts in an abstract Sense



Manufacturer

Production Cost: c $/unit

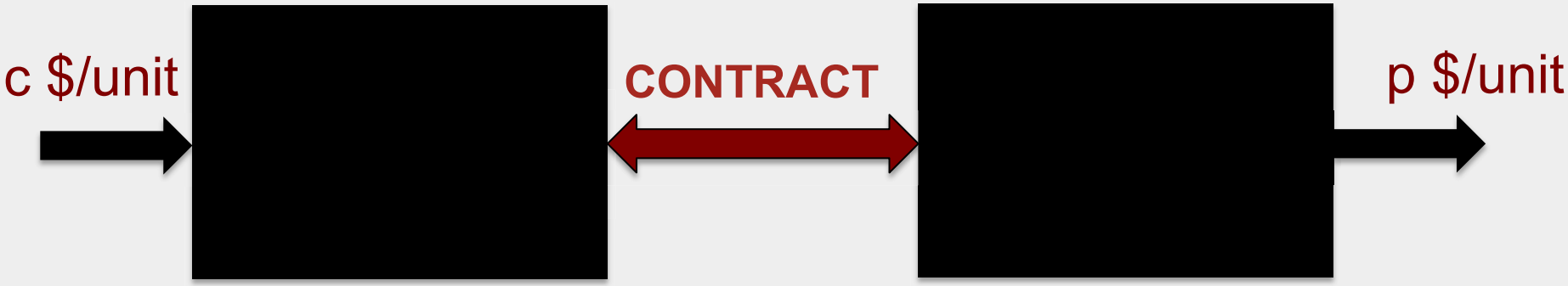
Retailer

Sale Price: p $/unit

Clients

Demand: D units

Contracts in an abstract Sense



Some ingredients of a contract:

- Unit price
- Transfer payment
- Returns payments
- Sales rebates

Contracts in an abstract Sense

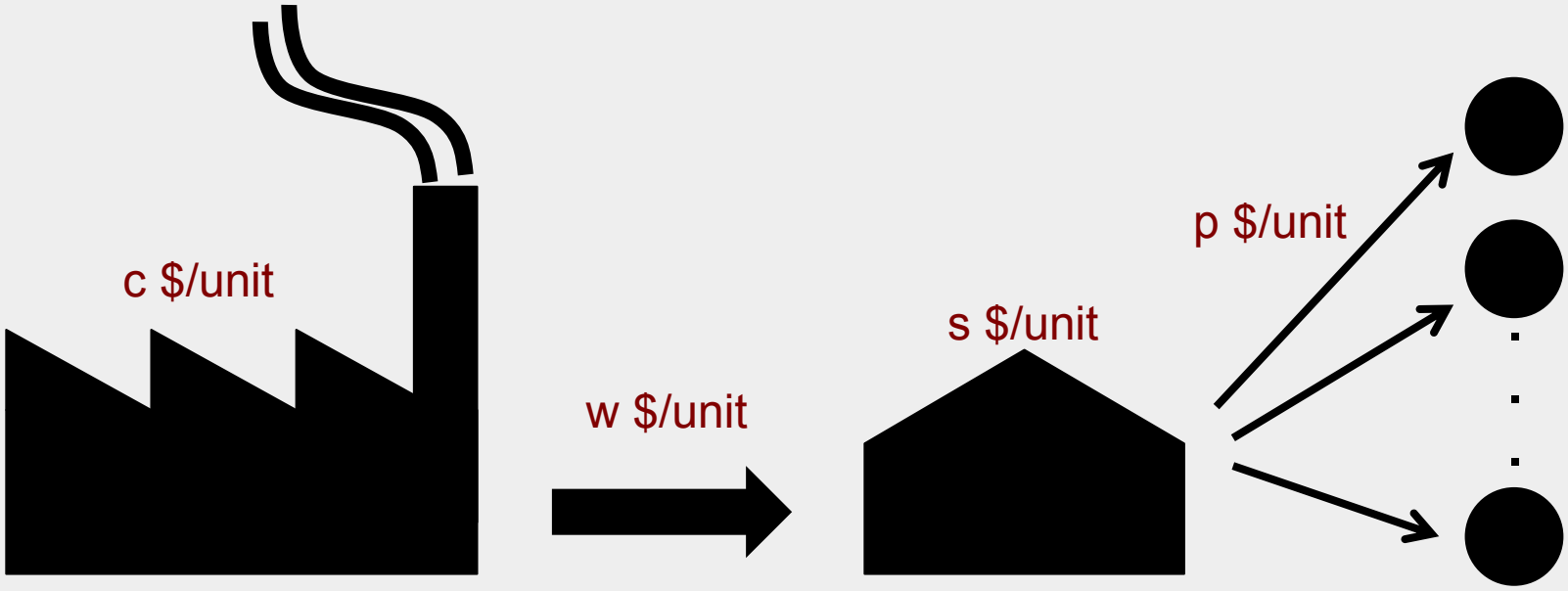
- The more “ingredients” the more complicated to implement

Not all contracts are created equal

Motivating Example

- You were hired to design a wholesale-price contract for distributors of a Plumpy Nut type product in Ethipoia
- Each jar costs $2 to produce
- The shelf life of this product is 6 months, and the suggested retail price is $4
- The salvage (recycling) value for unused jars is $1
- Demand is Uniform[0,100]
- What is the wholesale price that maximizes your profit?

Motivating Example



Manufacturer

Production Cost: c $/unit

Wholesale Price: w $/unit

Retailer

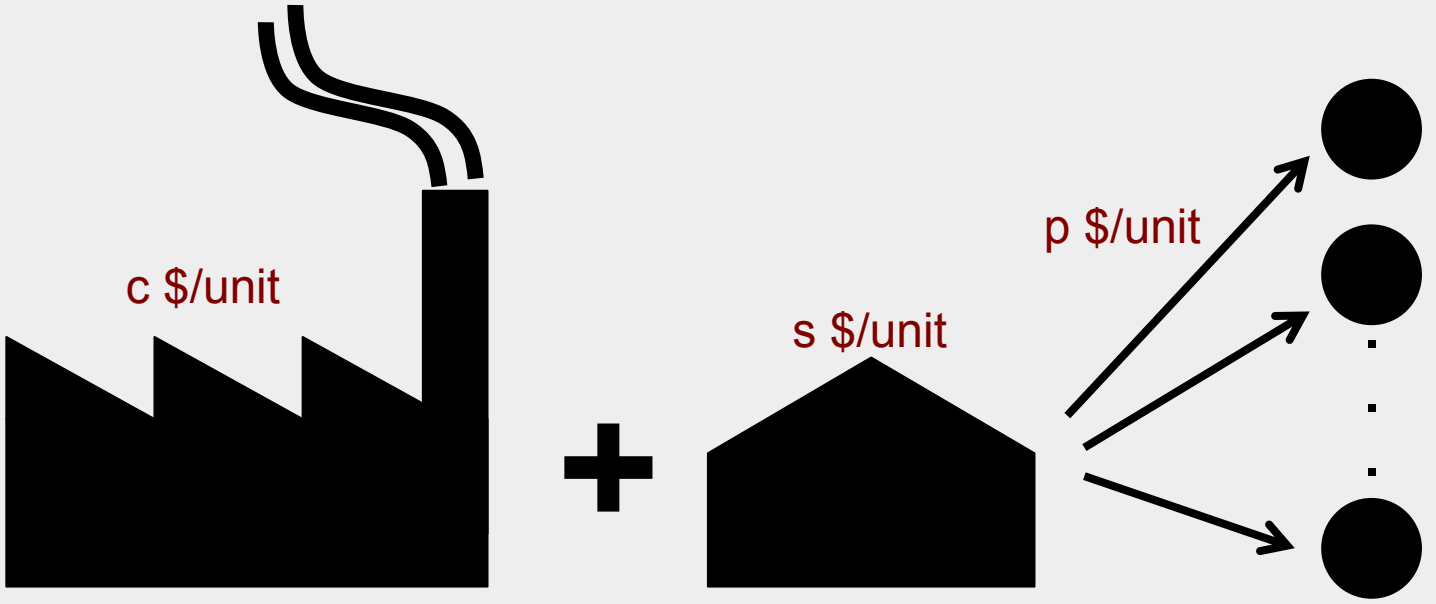
Sale Price: p $/unit

Salvage value: s $/unit

Customers

Demand: D units

Motivating Example – Part 2



Manufacturer = Retailer

Production Cost: c $/unit
Sale Price: p $/unit
Salvage value: s $/unit

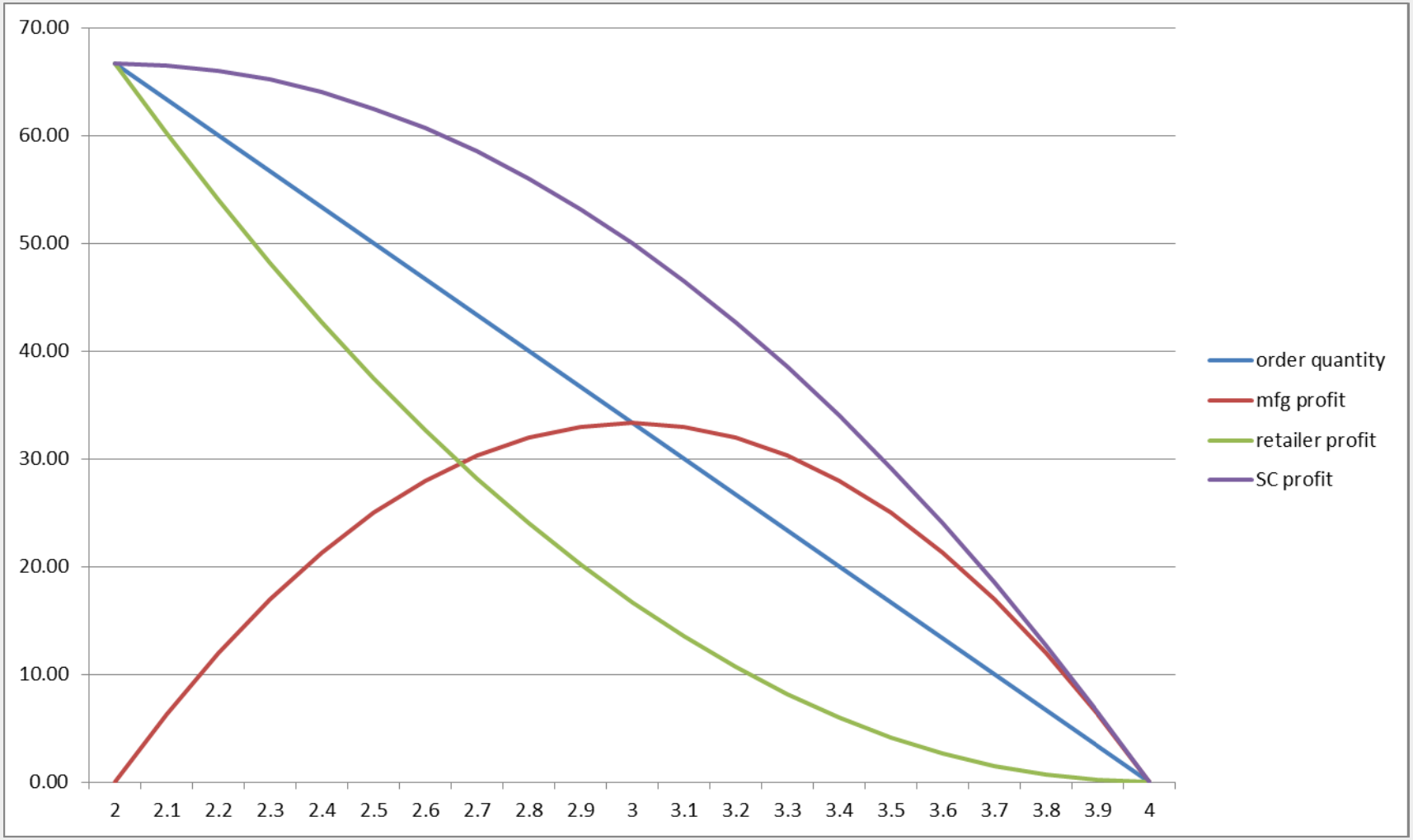
Customers

Demand: D units

What just happened?

	Original	Manuf. = Distributor
Order quantity	33.3	66.6
Expected Profit Retailer	16.6	66.6
Expected Profit Manufacturer	33.3	
Expected total Profit	50	66.6

33% Loss due to lack of coordination



Wholesale Price

Fixed Price (wholesale) Contracts

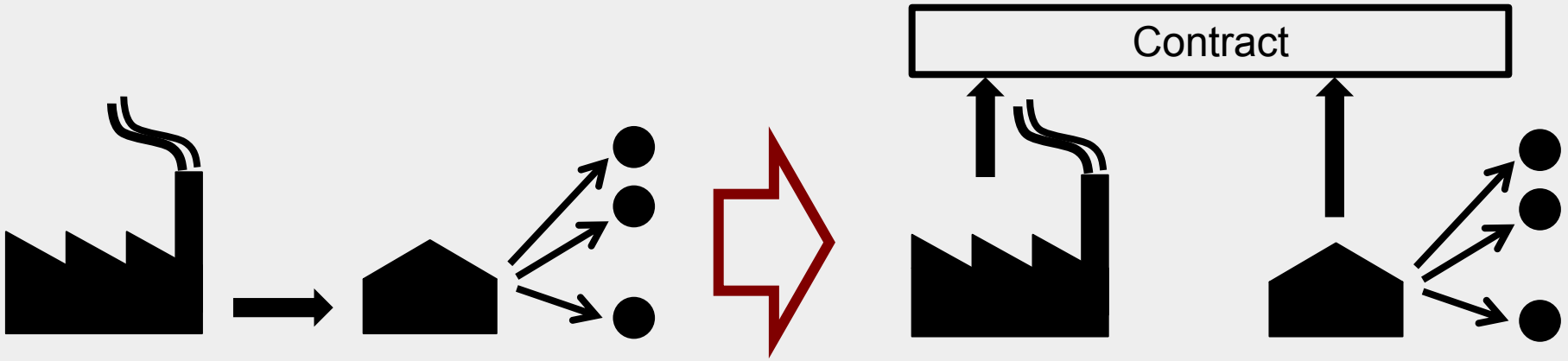
- First case is an example of a **Fixed-Price Contract**

- This reduction in profit is called **Double Marginalization:**

If every firm chooses to maximize its own expected profit, the result is a higher market price, lower market demand, and lower total profit compared to the SC's maximum profit.

What can we do to reduce Double Marginalization?

- We change the contract between manufacturer and retailer!

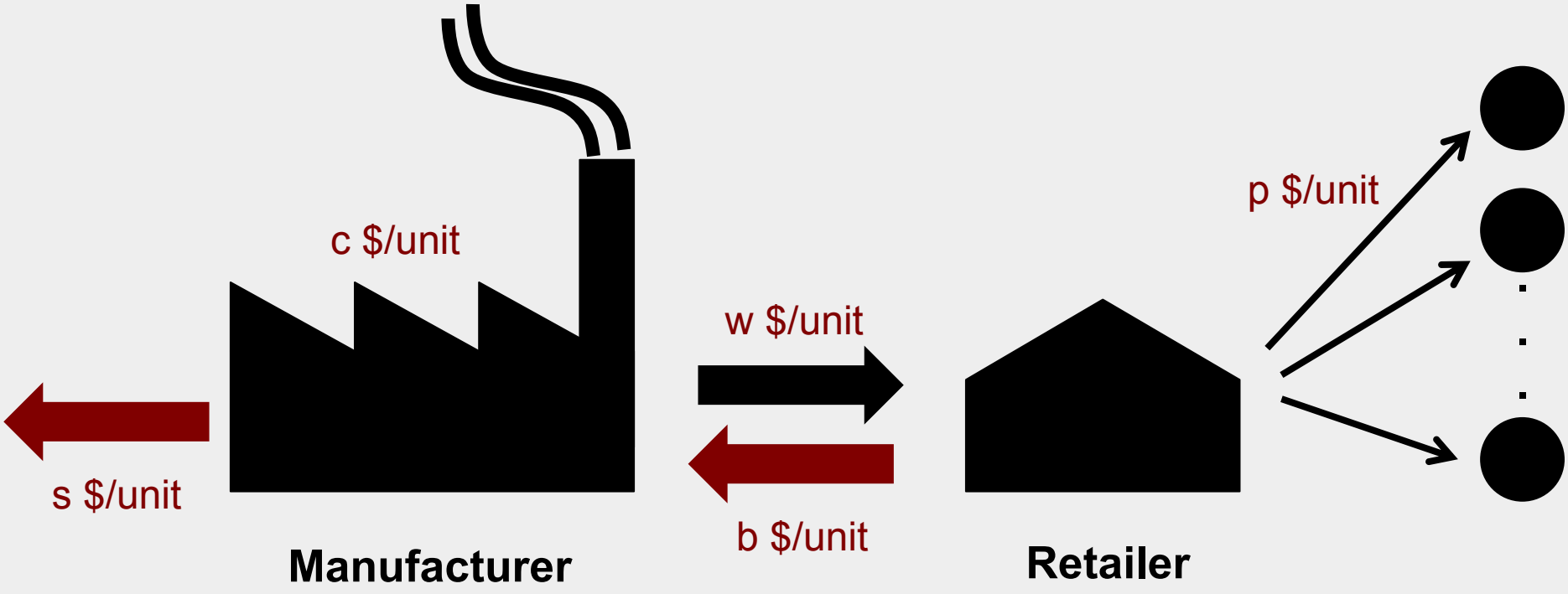


- The maximum profit that can be obtained is through perfect coordination

Buy Back Contracts

- Retailer receives credit from manufacturer on units leftover at the end of the selling season
- Reduces the risk for the retailer due to demand uncertainty (overstock)
- Do you know any real-world examples?

Impact of Buy Back Contracts



Production cost: c $/unit

Wholesale price: w $/unit

Salvage price: s $/unit

Sale price: p $/unit

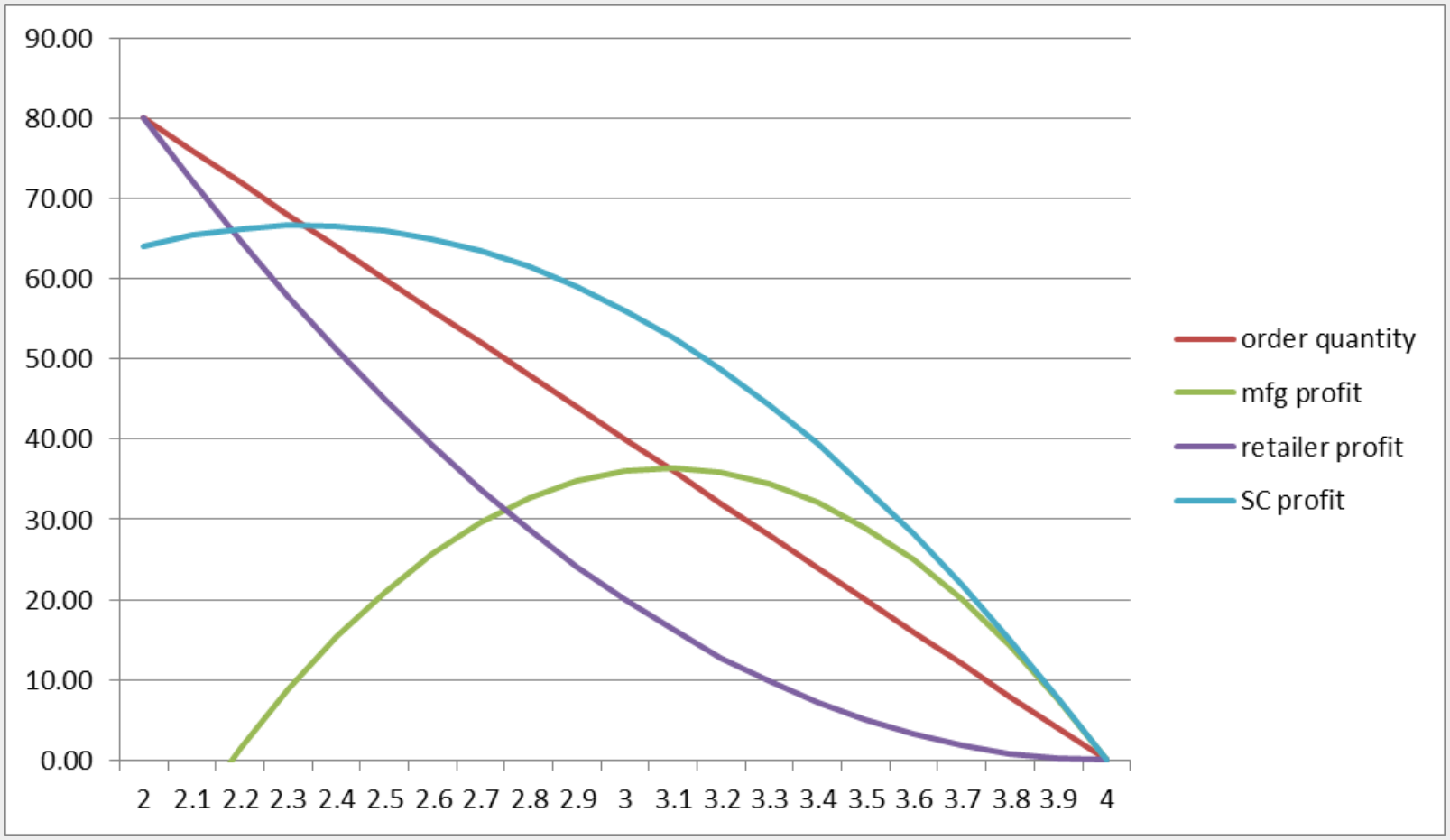
Buy back price: b $/unit

Comparison with Maximum Profit

	Original	Buy Back	Manuf. = Distributor
Order Quantity	33.3	40	66.6
Expected Profit Retailer	16.6 (33%)	**20 (36%)**	66.6
Expected Profit Manufacturer	33.3 (66%)	36 (64%)	
Expected total Profit	50	**56**	66.6

Drawbacks:

- Requires manufacturer to verify leftover units
- May reduce buyer selling effort



Wholesale price

Buy Back price = $1.5/unit

There are many others…

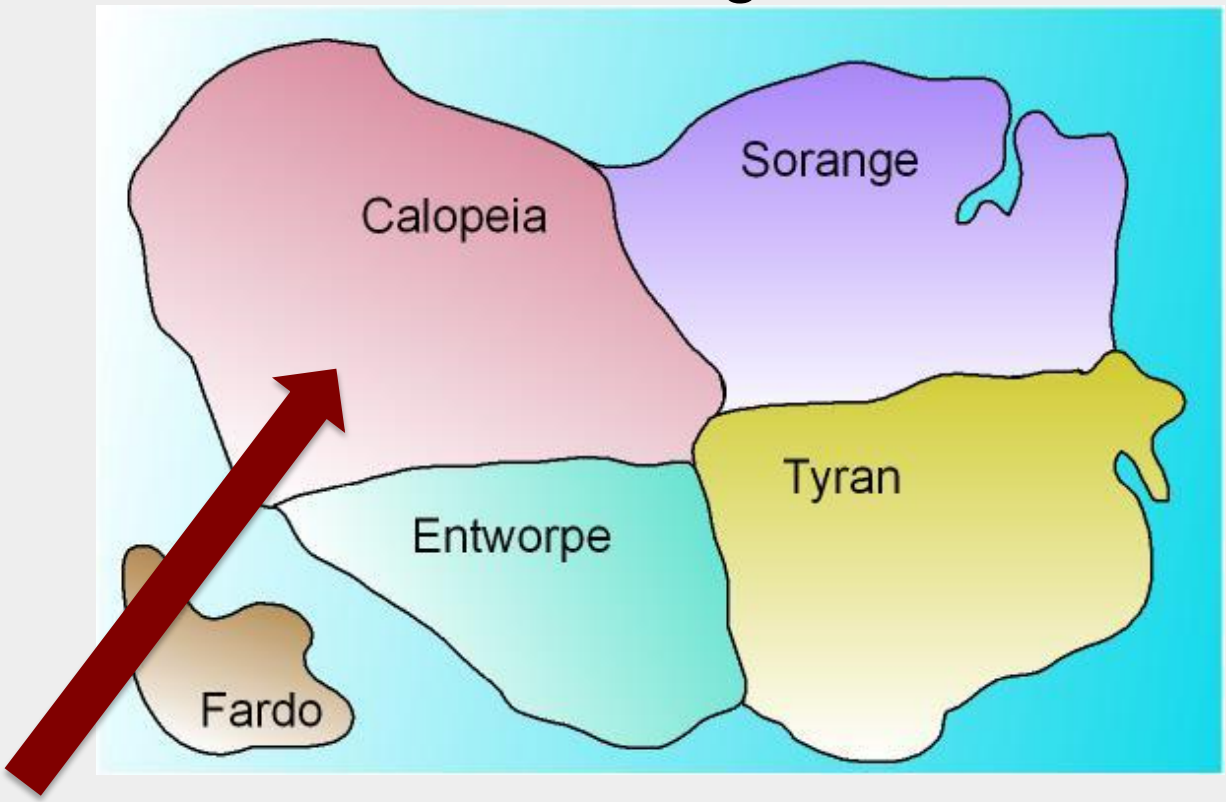
- Quantity Flexibility, Fixed price incentive…

Moral:

Working together with the other players in the SC can help increase the size of the "pie", even if your slice is proportionally smaller.

The Supply Chain Game

Pangea:

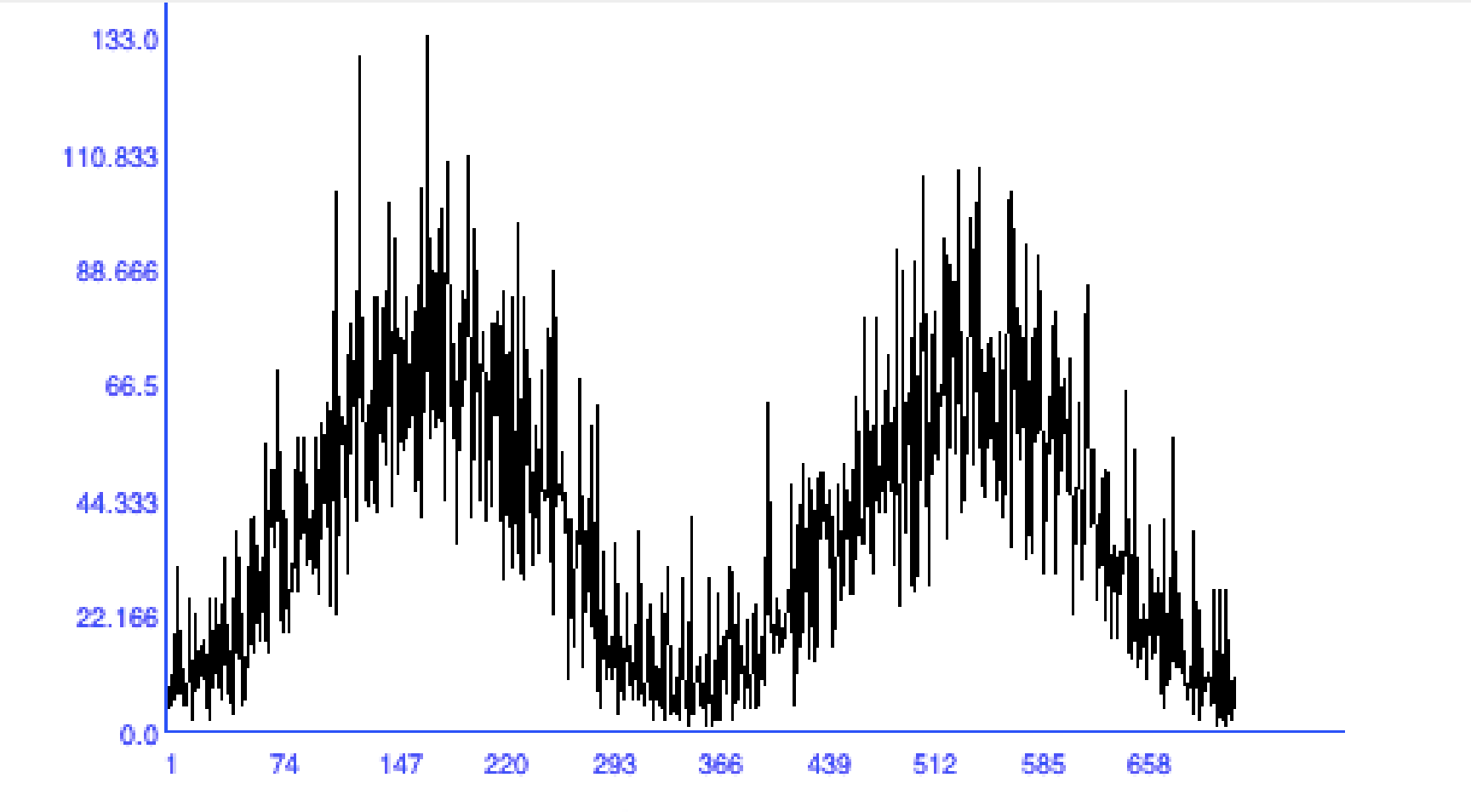


You will operate here with 1 warehouse and 1 factory

The Supply Chain Game

- You sell foam for insulation
- Demand is highly seasonal but stable
- The game starts at day 730, two years after Jacobs began producing and marketing the chemical.
- Game ends at day 1460, when a new product is introduced and the foam becomes obsolete

Demand


133.0
110.833
88.666
66.5
44.333
22.166
0.0
1
74
147
220
293
366
439
512
585
658

Operations

- Single factory, single warehouse
- No backorders: when client doesn’t find product, he goes somewhere else

- Your team can make:
  - Capacity additions to the factory.
  - The finished goods inventory threshold that triggers production of a new batch in the factory.
  - The factory's production batch size.
  - Whether batches are transported to the warehouse by mail or by truck.

The winning team is the one with the highest cash position on day 1460.

Next steps

- Register your team (detailed instructions coming soon)
- Figure out how you will manage inventory
- Have fun!

Overcoming demand uncertainty

- Three examples of contracts
  - Buyback contracts
  - Quantity flexibility (option) contracts
  - Revenue Sharing contracts

Buyback contracts

- Manufacturer pays the distributor for leftover units at the end of selling season
- Encourages high buyer orders
- Examples:
  - Publishing industry
  - Music industry
- Disadvantages
- Would it work in an emerging marker?

Quantity Flexibility

- Manufacturer places an order at the beginning of the season, but the quantity can be adjusted up or down

- Also encourages higher ordering quantities

- Examples: Fashion industry
- Disadvantages

Revenue Sharing

- Manufacturer receives some fraction of sales revenue
- Both share risk due to demand uncertainty
- Example: Blockbuster
- Would it work in an emerging market?

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