

# Contract Design for Minimizing Waste in Supply Chains

## Research Question

- When the product has fixed multi-period shelf life, retailers are incentivized to purchase the products with longer remaining shelf life
- Suppliers need to satisfy the demand with older inventory to avoid product losses and costs of production of fresher products.
- Can we find a coordination mechanism (a contract) to reconcile these contradictory incentives?

## What has been done

### Literature part:

- Conducted literature search on several aspects of supply chain modeling: contractual design, information sharing, incentives of members of supply chain and coordination mechanisms, supply chain resiliency.
- Analyzed literature on the reasons of perishable goods waste generation in supply chains and at the household levels.
- Analyzed preferences of a supplier and a retailer for the degree of freshness of perishable products (food produce).

### Modeling part:

- Modeled a multi-period newsvendor model for a perishable good with a multi-period shelf life.
- Analyzed types of contracts that can achieve coordination of the supply chain: buy-back contracts and revenue-sharing contract. Analyzed a non-coordinating wholesale price contract and a centralized system.
- Derived a simplified one-period newsvendor model:
  - Derived objective functions under 4 contractual systems, found analytical expressions for optimal retail price and order quantities.
  - Laid out a strategy for finding numerical values for optimal decision variables and incentives-compatible transfers between supplier and retailer.

## Future work

- Concluding the numerical simulation in the simple model to find the equilibrium profits, total supply chain costs and generated costs due to the wastage under each contract type and assumed parameters of the model.
- Finding equilibrium values for the multi-period model of a perishable good with several periods of shelf life. Equilibrium values include profits, total costs for each player, wastage costs.
- Extending the model to multiple retailers and/or suppliers, potentially facing different demand functions and using individual forecast strategies. Can we find a channel-coordinating contract for such supply chain?
- Having access to a real supply chain data on production costs, inventory levels, order volumes and prices, product expiry date, and retail sales data could allow us to calibrate the model on real data.