# Global Supply Chain Management with Unknown Demand Distribution

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## Outline

- Motivation
- **Two Models:**
  - **Single Selling Opportunity** in each Market:
    - Markets are Geographically Dispersed and Separated by Selling Seasons
  - **Multiple Selling Opportunities** in each Market over Different Selling Seasons
- Results
- Research Questions

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# Motivation

- Demand distribution is **unknown** in many cases:
  - New innovative products: computers, fashion goods, clothing, Videos, CDs
- Lost sales are observed – **not** always **true**
- Unknown demand distribution and unobserved lost sales – a **practical** issue

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# A Motivating Example

- Consider a Fashion Retailer like **Zara**
- Multiple Locations and Selling Opportunities in Various Markets
- Frequent Restocking and Redistribution Opportunities during a Season
- Frequent Updates of Demand Forecasts
- **Scarcity and Stock Outs** made into a Virtue

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## Implications for Modeling

- Demand Information gets **censored** (lost sales are unobservable)
- Sales observations can be **pooled** across production centers
- Complex and Costly Logistics
- Flexibility in Manufacturing and Stocking Decisions
- **Tradeoff** between More Precise Demand Information and Higher Costs

## First Model: Single Selling Opportunity in Each Market


**One market in each selling season**

GSC= Global Supply Chain

## Model Applications

- Can be used to exploit **different timing** of selling seasons at geographically separated markets
- **Seasonal Products:** A US garment manufacturer can sell his summer fashion items to an Australian clothing retail chain this year or Asian markets in the next year.
- **Non-Seasonal Products:** Case study *New Balance Athletic Shoes* (1980) shows a six-month time lag of product life cycles in North American and European markets.

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## First Model: Single Selling Opportunity in Each Market

- **Objective:** Find right **stock level** for each market.
- **Costs:**
  - ordering cost
  - stockout penalty
  - holding cost
- **Demand:**
  - Some parameter of the demand distribution is **unknown**.

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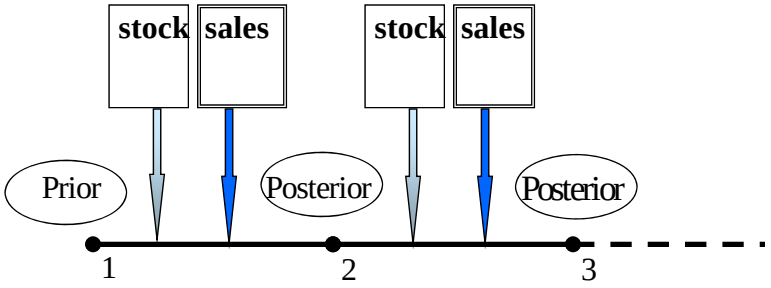
# Sequence of Events




- Supply Chain Manager observes **sales** ***but not demand*** in each market
  - Sales = *minimum* (Demand, Stock Level)

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# Some Managerial Insights

- Optimal stock level of early seasons **increase** with the number of markets.
- As stockout penalty increases, optimal stock level of early seasons also **increase**.
- Optimal stock level of early seasons **increase** as present value of future increases.

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## Some Managerial Insights

- As demand uncertainty increases, optimal cost always **decreases.**
- But, optimal stock levels may increase or decrease: **Risk pooling** decreases total cost **but not total inventory**.

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## Model Extensions

- Dynamic Pricing Flexibility
- Positive Lead Time
- Exchange Rate Uncertainty
- Transfer Price mechanism for Leftover Stock
- Decision on Transfer quantity
- Product Substitution

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## Second Model: A Schematic Representation


**Multiple markets in each selling season**

## Key Questions

- Relative to the Single Selling Opportunity Case: what is the benefit of having **multiple selling opportunities** in the same market?
  - Reduce exchange rate risk
- What is the additional benefit of **multiple markets** in each selling season?
  - Multiple demand data in each season
- **Coordination issues:**
  - Preference for centralized or decentralized system?
  - Should demand information across markets be **pooled** together or kept separate?

# Implications of this Research

- **Significantly benefits** for a supply chain when
  - Demand distribution is updated over selling seasons
  - Demand information across multiple markets are combined
  - Pooled demand information is strategically used
- This study aims to develop an approach to ***collaborative decision making*** in global supply chain networks.

Questions
and
Comments

Thank You

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