Global Supply Chain Management with Unknown Demand Distribution

Arnab Bisi
Krannert School of Management, Purdue University

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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
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

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
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

GSC Manager

Market 1  Market 2  ..........  Market N

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.


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.
Sequence of Events

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

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.
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.

Model Extensions

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

Second Model: A Schematic Representation

GSC Manager
Selling Season 1

GSC Manager
Selling Season 2

GSC Manager
Selling Season N

Market 1 Market 2 ..... Market M

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