

Capacity Allocation in Decentralized Supply Chains

by

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The Business Scenario

- Single supplier/manufacturer selling to multiple competing retailers or manufacturers, whose orders are based on private demand information
- Focus on situation when total customer orders exceed supplier's capacity or inventory

Tight Capacity: Examples

- **LCD panels** - many TFT LCD companies recently indicated that they are facing a 10-15% gap between their demand for glass substrates and what their glass suppliers will support.
- **"Hot" Christmas gifts** - Shortages of hot-selling gadgets and toys have become a commercial rite of the Christmas season
- **Nintendo's Wii** - In 2007, a year after the Nintendo Wii was launched, the system was still incredibly hard to find.
- **Carbon emission caps**
This year the European commission has given its final nod to Poland's national carbon allocation plan.

Supplier Often Puts Customers “On Fixed-Price Allocation”

- Practices vary, but “on fixed-price allocation” generally means
 - Each customer gets some or all of its order, based on metrics (e.g., Past Sales, Days-of-Supply) instead of willingness to pay
- ... are regarded as “fair” by some
 - Ex: Law Suits by auto makers
-but *not* by others
 - Ex: Law Suits by auto dealers

can result in gaming behavior..

- In order to get higher allocations, customers exaggerate their real needs when they order
- When demand cools, orders disappear and cancellations pour in..
- Companies such as Hewlett-Packard, Motorola, IBM have experienced this..

Research Questions

- How can gaming behavior by customers be avoided?
- Do capacity allocation policies exist that will maximize supplier profit?
- What level of capacity should the supplier provide to maximize his/her profit?
- What is the impact of customer competition on capacity allocation and capacity choice?

Research Insight - 1

- To prevent gaming behavior by customers, use variable pricing policies and/or capacity allocation policies that are independent of order sizes.

Research Insight - 2

- Some capacity allocation policies used in practice, such as the linear and proportional allocation schemes, can be optimal for the supplier *if* used in conjunction with variable pricing.

Insight 3: Linear Allocation Mechanism

Definition: Add the order quantities of all customers/retailers and subtract the supplier capacity to calculate excess market demand. Allocate capacity so that this excess demand (pain) is shared equally by all customers.

Linear Allocation scheme is optimal for the supplier if marginal revenues (and information rents) are linear in the allocated quantities.

Insight 4: Proportional Allocation Scheme

Definition: Calculate the ratio of the sum of order quantities of all customers/retailers to supplier capacity. Scale every customer order by this ratio to decide allocated capacity.

Proportional Allocation scheme is optimal for the supplier if marginal revenues (and information rents) are scalable in the allocated quantities.

Insight 5 : Optimal Capacity Choice

Optimal capacity choice depends on a number of factors including number of customers, level of competition, level of demand uncertainty, and cost of adding capacity.

Increasing market competition results in a decrease in the level of optimal supplier capacity.

Supplier's share of supply-chain profit increases with increasing retail competition.

Research Contributions

- Analyzed gaming behavior between customers and ways of overcoming them
- Established precise conditions under which commonly used allocation policies, such as linear and proportional allocation, are optimal for the supplier
- Described the determination of the optimal supplier capacity
- Measured the impact of competition on capacity choice and allocation.