

Business Applications, Profitable Results and Improved Business Performance

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ILOG



Changing the rules of business™

What We'll Cover ...

- **Supply Chain Challenges**
- **Impact of Oil Price**
- **Benefits of Flexibility**
- **Redundancy for Risk Management**
- **Offshoring vs. Inshoring**
- **Summary**

Today's Supply Chain Challenges

- Global supply chain with long lead times
- Rising customer expectations
- Increase in labor costs in developing countries

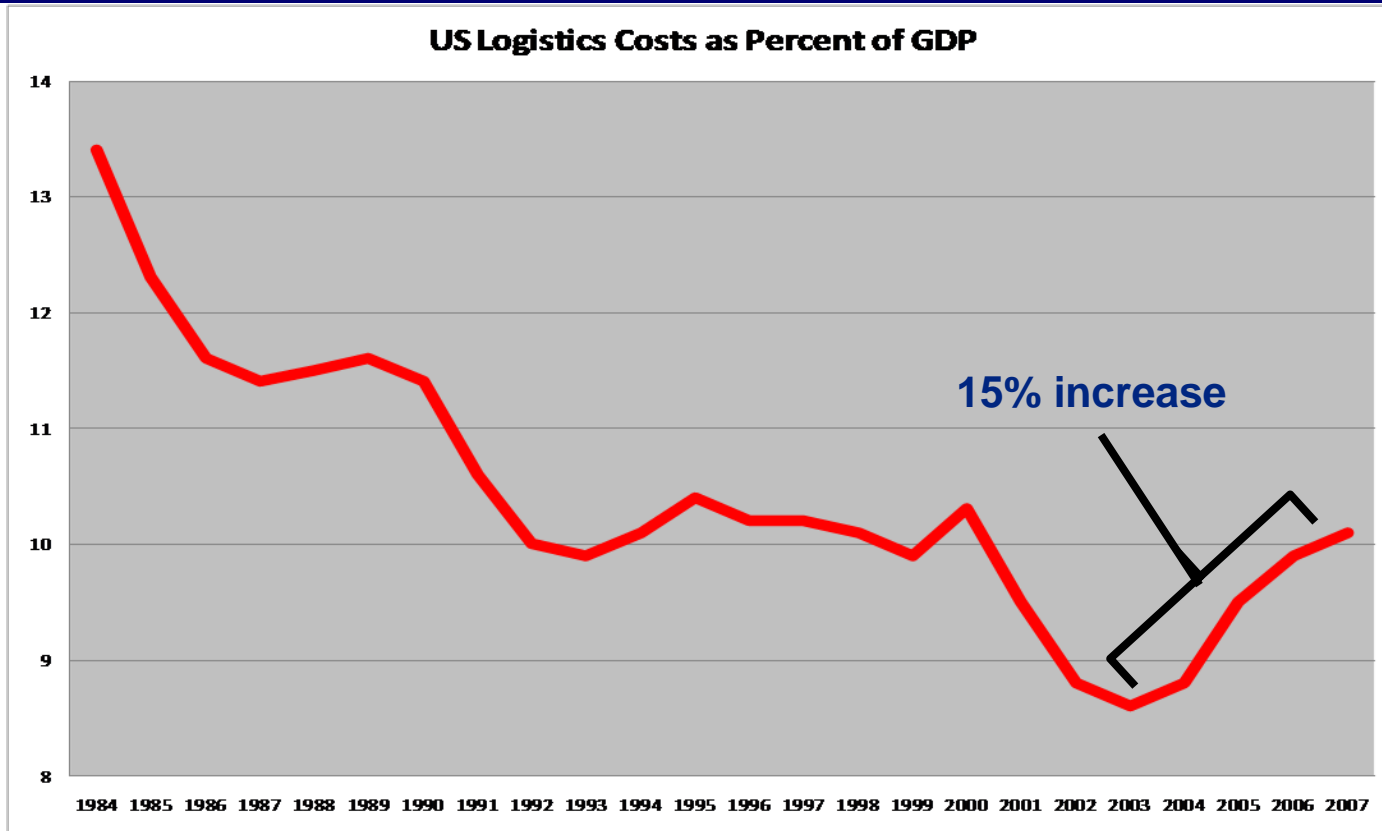
The Average Annual Wage Increase between 2003 and 2008 in different Countries

Country	Brazil	China	Malaysia	Mexico	US
Average Annual Wage Increase	21%	19%	8%	5%	3%

Today's Supply Chain Challenges

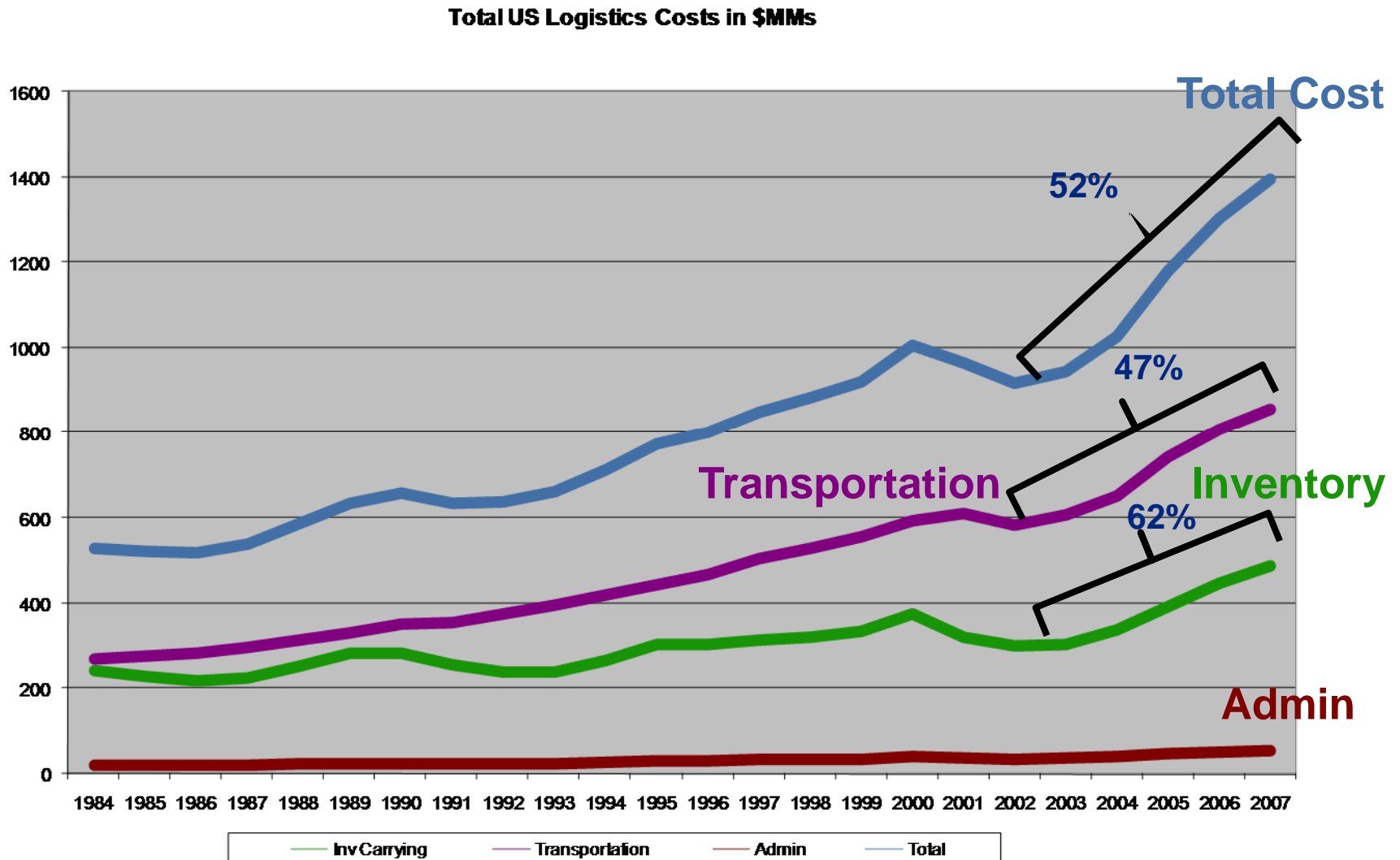
- Global supply chain with long lead times
- Rising customer expectations
- Increase in labor costs in developing countries
- **Increase in logistics costs**

Increase in Logistics Costs



- **Rising energy prices**
- **Rail capacity pressure**
- **Truck driver shortage**
- **Security requirements**

Total US Logistics Costs 1984 to 2007 (\$ Billions)



Source: 19th Annual Logistics Report

Today's Supply Chain Challenges

- Global supply chain with long lead times
- Rising customer expectations
- Increase in labor costs in developing countries
- Increase in logistics costs
- **Importance of sustainability**
- **Unprecedented Volatility**

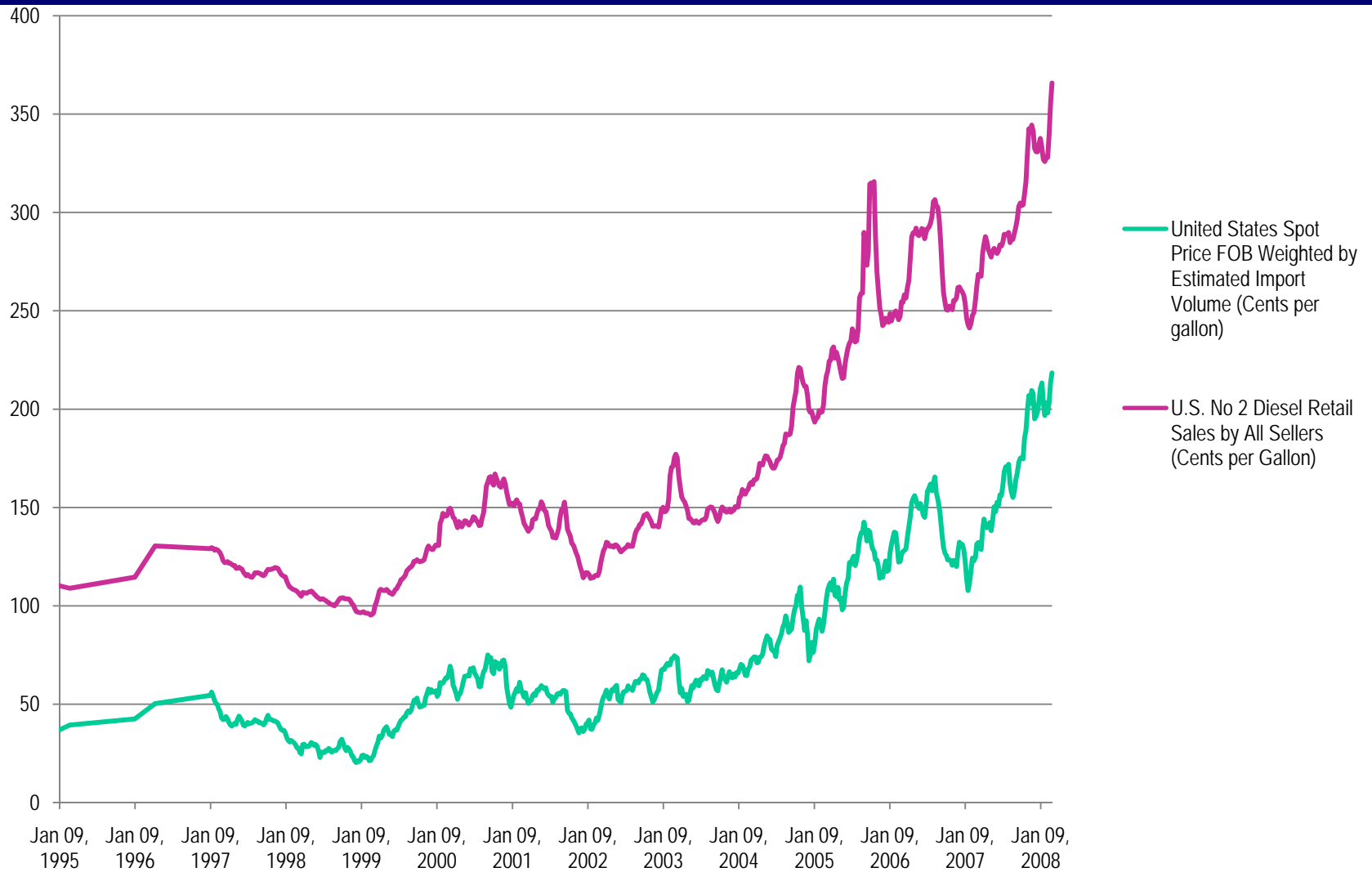
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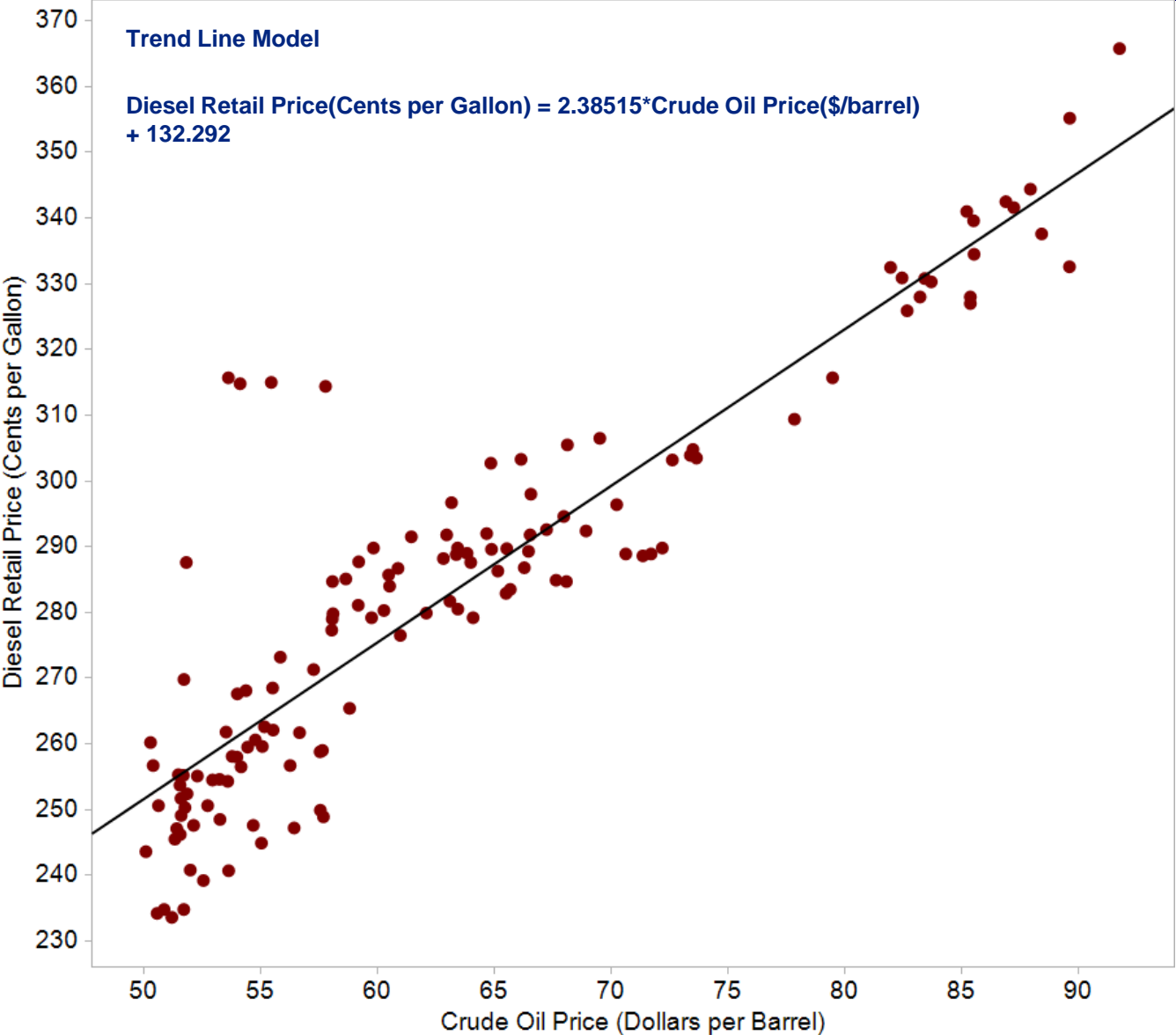
Impact of Oil Price on...

- **Transportation Costs**
- **Network Strategies**

US Diesel and Crude Oil Prices over time



Relationship between Crude Oil price and Diesel Fuel Price



Implications on crude oil price to transportation rates

- Given the relationship in the previous slide, we see that a \$10/barrel increase in crude oil will result in ~\$0.24/gallon increase in diesel fuel
- Standard fuel surcharge methodology is to increase surcharge \$0.01/mile for every \$0.06 increase in diesel fuel
- We conclude that for every \$10 increase per barrel of crude oil price, we have an additional \$0.04/mile increase in transportation rates.

Crude Oil (\$/Barrel)	30	75	100	125	150	175	200
TL (\$/Mile)	1.47	1.65	1.75	1.85	1.95	2.05	2.15
Increase (%)	0	12%	19%	26%	33%	39%	46%

Impact of Oil Price on...

- **Transportation Costs**

- **Network Strategies**

Impact of Oil Price on Network Strategy

- **Trading off oil price for...**
 - ♦ **Inventory costs**
 - ♦ **Facility costs**
 - ♦ **Manufacturing costs**

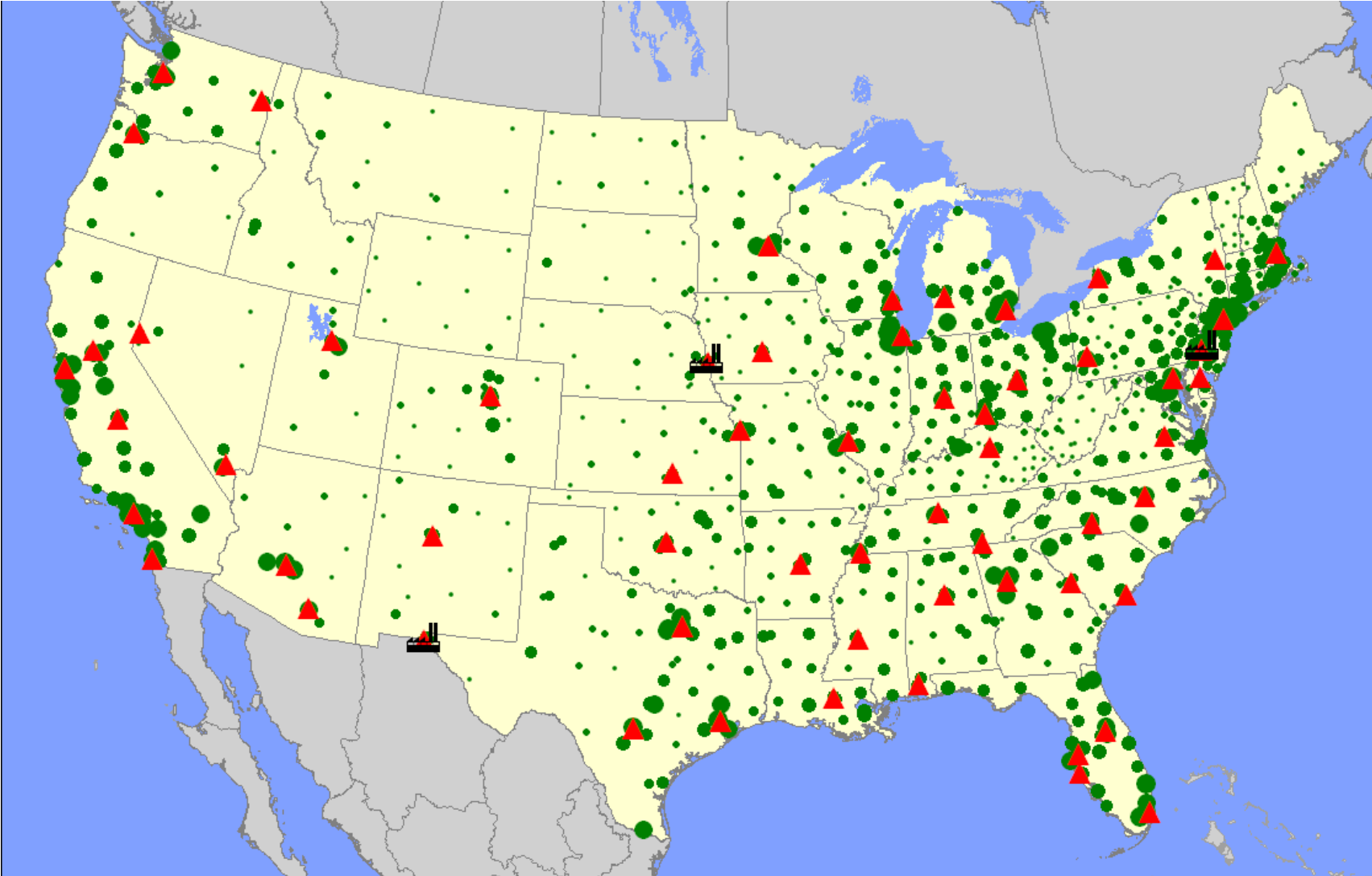
Case Study 1: Oil Prices and the Logistics Network

- **Manufacturer of consumer packaged goods**
- **Manufacturing is possible in three locations:**
 - ♦ Philadelphia- Highest production cost
 - ♦ Omaha-
 - ♦ Juarez, Mexico- Lowest production cost
- **60 potential DC locations**
- **888 aggregated customers**
- **Inbound transportation uses commercial TL carriers**
 - ♦ TL averages 40,000 lbs/shipment
- **Outbound transportation uses a private fleet**
 - ♦ Private fleet averages 20,000 lbs/shipment

Case Study - Objectives

- **Determine the best number and location of distribution centers, as well assignment of customers to DC's.**
- **Determine the best allocation of production to their manufacturing locations.**
- **Understand how the optimal network would change as oil prices fluctuate**
 - **Roughly 25% of the supply chain costs are in transportation**

Network Visualization



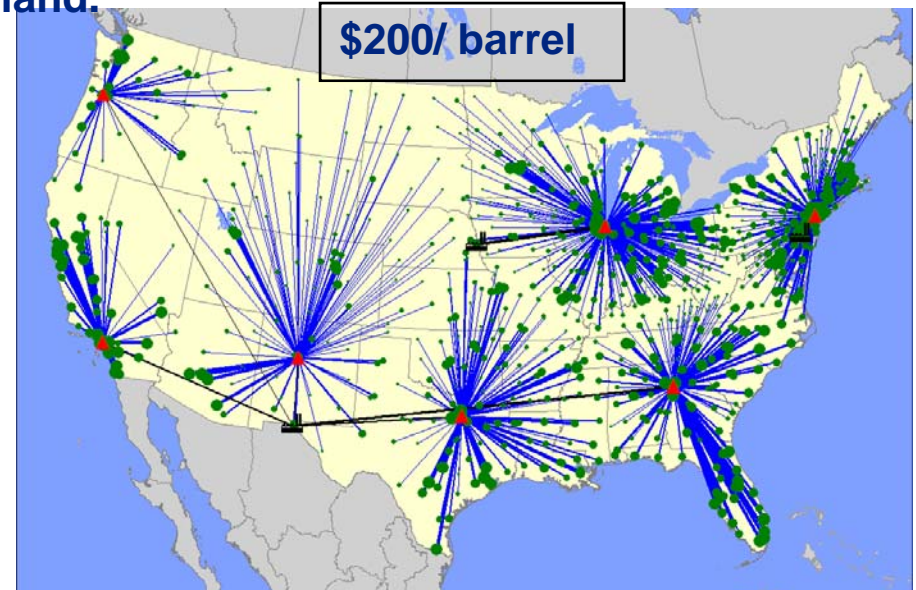
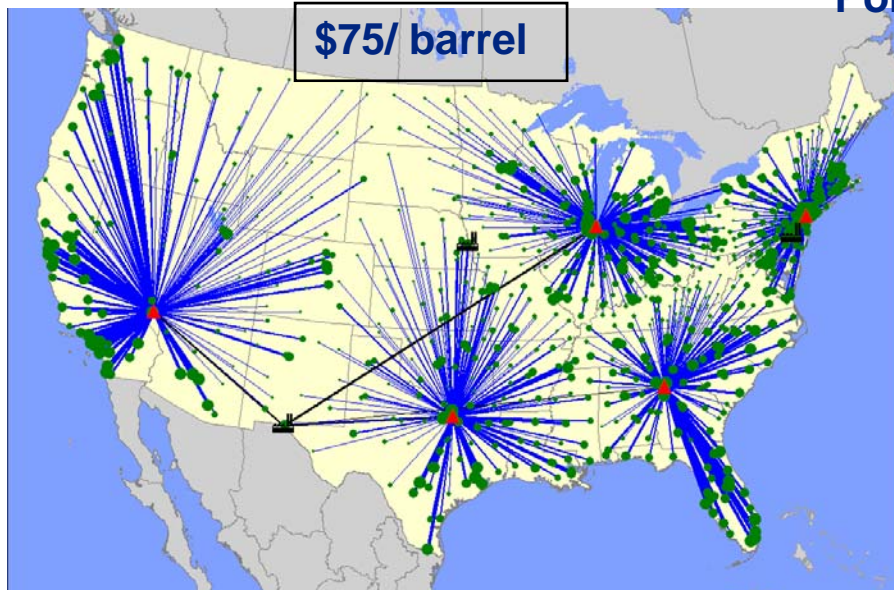
Discussion of Tradeoffs

- **As crude oil price increases, transportation costs become more important relative to production, inventory and facility fixed costs.**
- **Oil price vs. inventory carrying and facility costs**
 - ◆ **Additional DCs are more attractive**
 - ▶ **As outbound transportation becomes more expensive, it becomes increasingly important to minimize the distance of the final leg.**
- **Oil price vs. production costs**
 - ◆ **Production moves nearer to demand**
 - ▶ **Cheaper manufacturing in Mexico is offset by higher transportation costs.**

Oil price vs. inventory carrying and facility costs

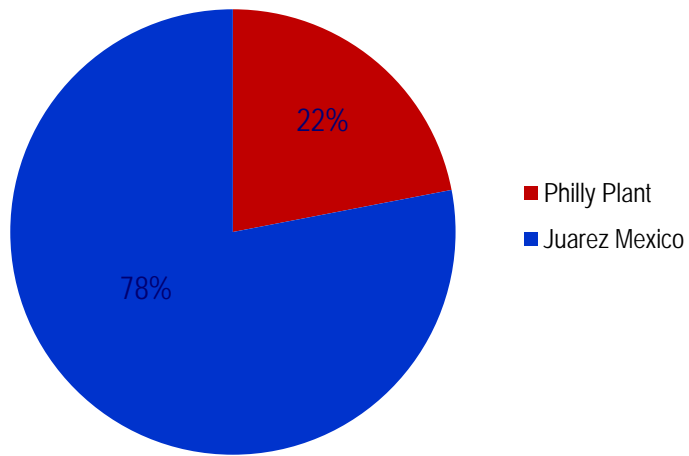


Moving from \$125/ barrel to \$150/ barrel changes the optimal number of DC's from 5 to 7. In particular, you can think of Las Vegas being replaced by Los Angeles, Albuquerque, and Portland.

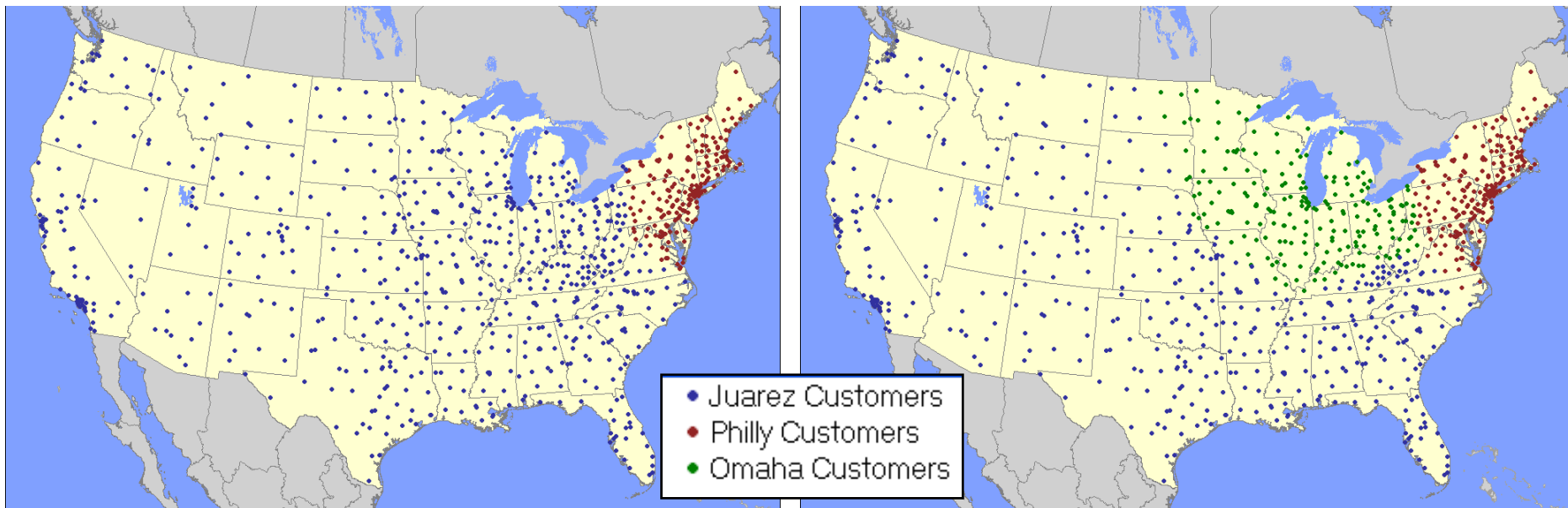
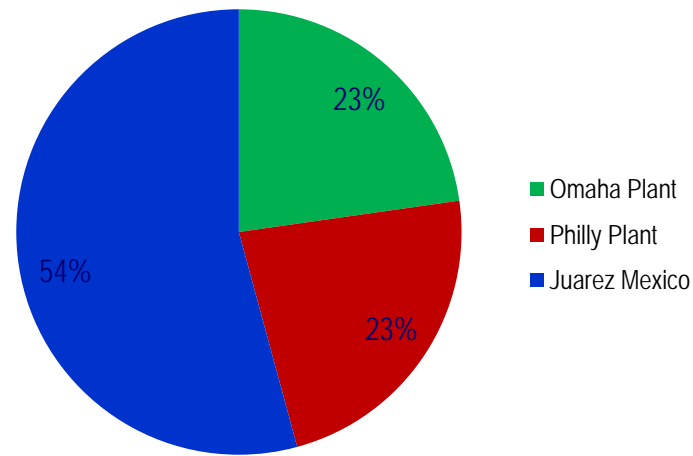


Oil price vs. production costs

\$75/ barrel



\$200/ barrel



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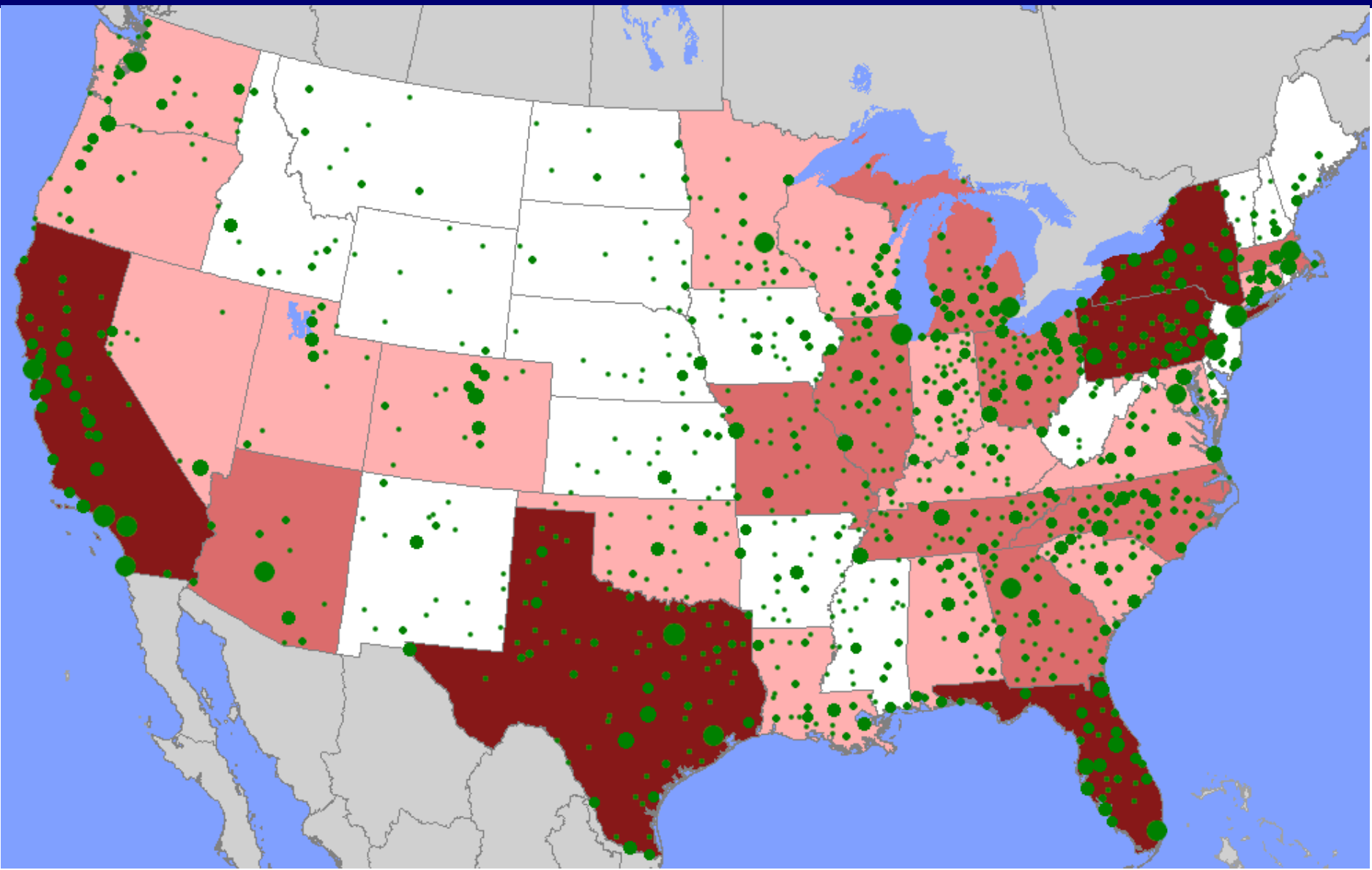
Case Study 2: Flexibility and the Manufacturing Network

- **Manufacturer in the Food & Beverage industry.**
- **Currently each product family is manufactured in one of five domestic plants.**
- **Manufacturing capacity is in place to target 90% line efficiency for projected demand.**
- **Objectives:**
 - ◆ **Determine the cost benefits of manufacturing flexibility to the network.**
 - ◆ **Determine the benefit that flexibility provides if demand differs from forecast;**
 - ◆ **Determine the appropriate level of flexibility**

Summary of Network

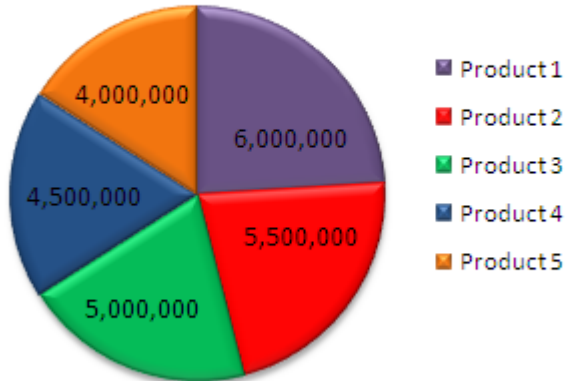
- **Manufacturing is possible five locations with the following average labor cost:**
 - Pittsburgh, PA \$12.33/hr
 - Dayton, OH \$10.64/hr
 - Amarillo, TX \$10.80/hr
 - Omaha, NE \$12.41/hr
 - Modesto, CA \$16.27/hr
- **8 DC locations: Baltimore, Chattanooga, Chicago, Dallas, Des Moines, Los Angeles, Sacramento, Tampa**
- **Customers aggregated to 363 Metropolitan Statistical Areas & 576 Micropolitan Statistical Areas**
 - Consumer product- Demand is very closely proportional to population
- **Transportation**
 - Inbound transportation Full TL
 - Outbound transportation LTL and Private Fleet

Network Visualization- Customer Demand



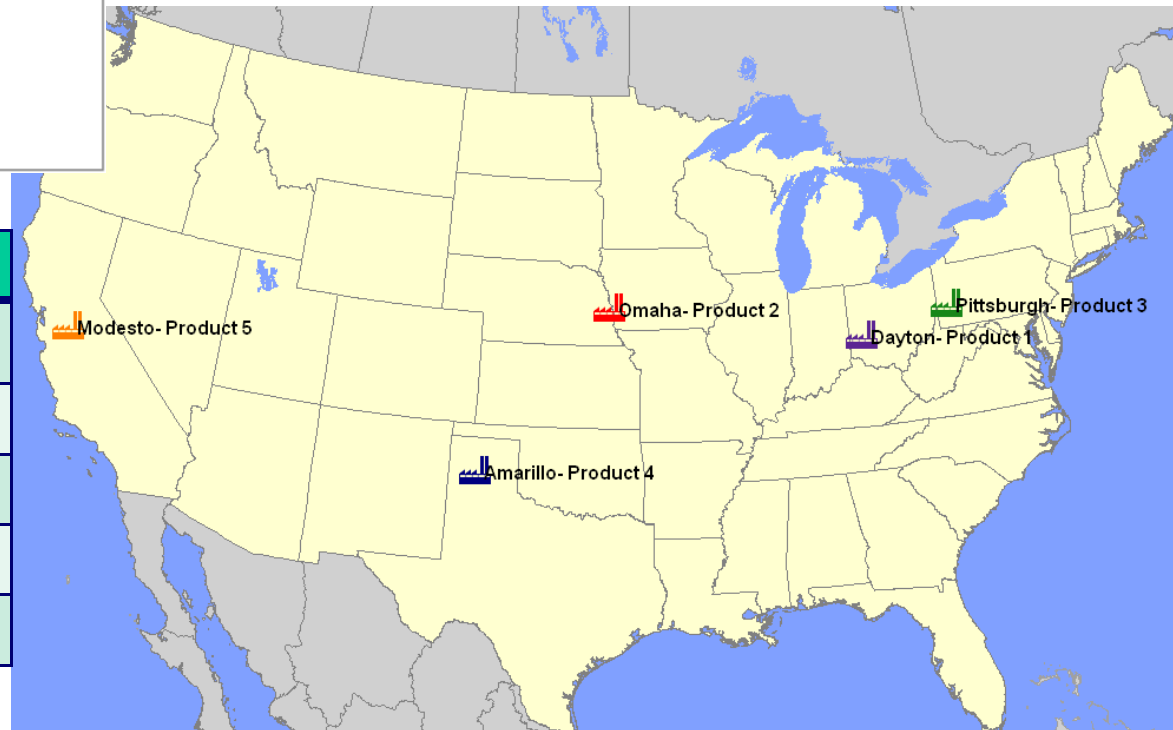
Baseline Summary

Mean National Forecast



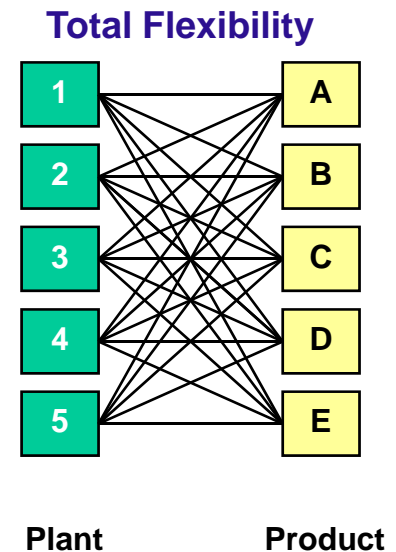
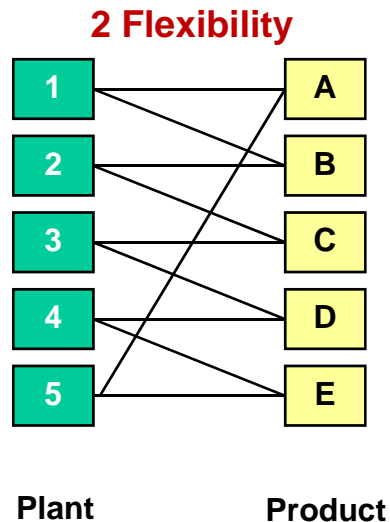
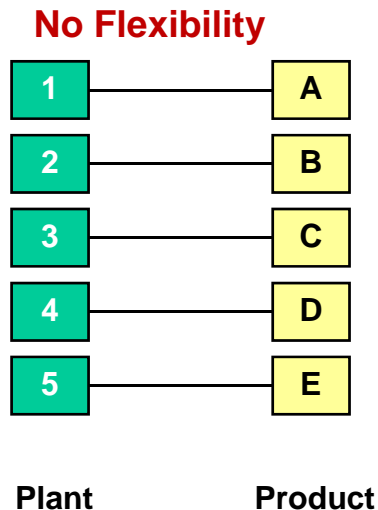
Cost Description	Baseline
Production Cost	34,960,649
Plant to Whse Shipping Cost	20,264,858
Whse to Cust Shipping Cost	11,751,467
Warehouse Fixed Costs	8,400,000
TOTAL COST	75,376,974

Plant	Labor Rate
Pittsburgh, PA	\$12.33/hr
Dayton, OH	\$10.64/hr
Amarillo, TX	\$10.80/hr
Omaha, NE	\$12.41/hr
Modesto, CA	\$16.27/hr



Supply Chain Flexibility: Introduction

- **The ability to respond to changes:**
 - ♦ Demand volume and mix
 - ♦ Commodity prices
- **The objective is to**
 - ♦ Reduce cost, Reduce the amount of unsatisfied demand, Improve capacity utilization



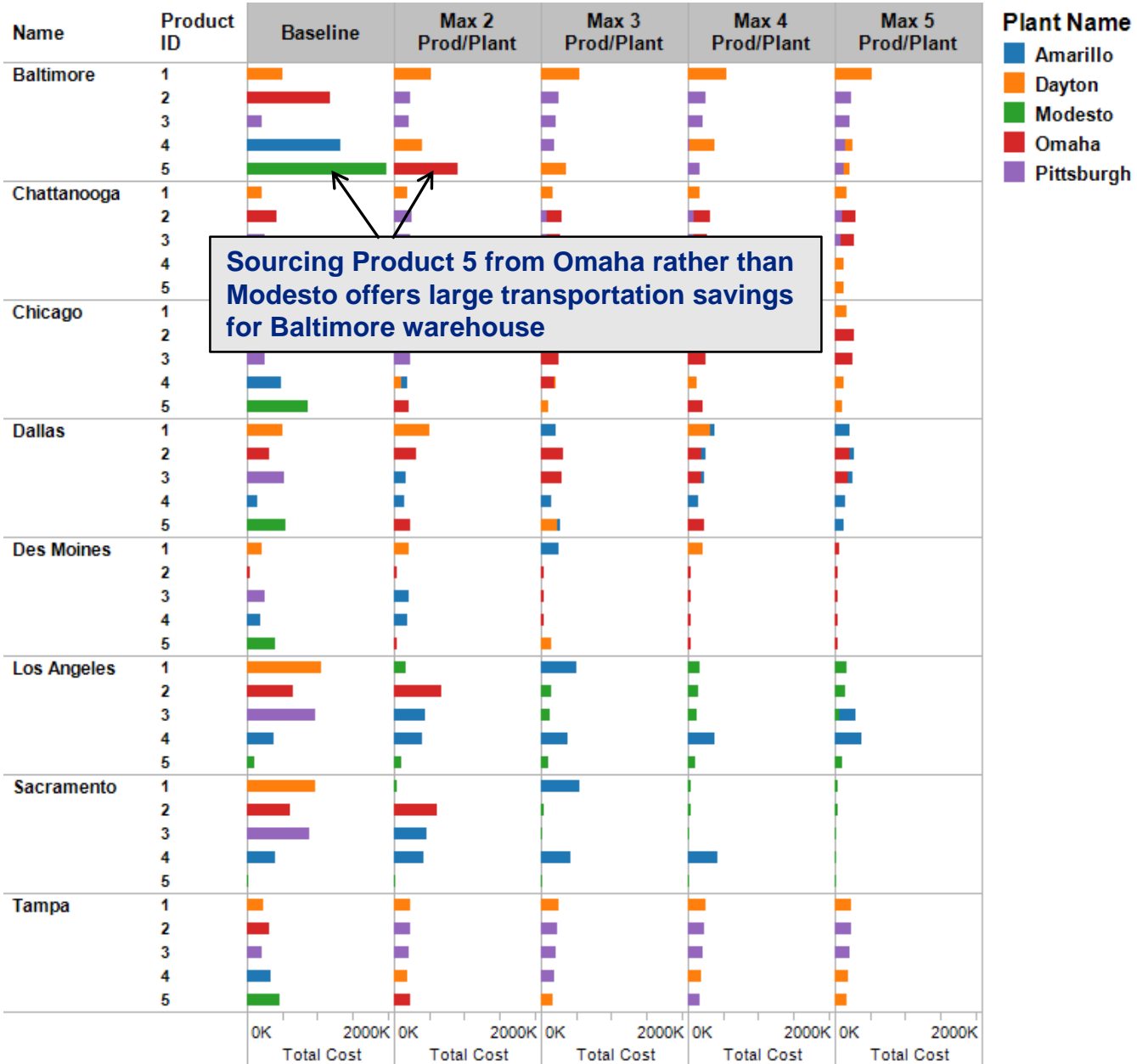
Introducing Manufacturing Flexibility

- To analyze the benefits of adding manufacturing flexibility to the network, the following scenarios were analyzed:
 1. **Base Case: Each plant focuses on a single product family**
 2. **Minimal Flexibility: Each plant can manufacture up to two product families**
 3. **Average Flexibility: Each plant can manufacture up to three product families**
 4. **Advanced Flexibility: Each plant can manufacture up to four product families**
 5. **Full Flexibility: Each plant can manufacture all five product families**

Plant to Warehouse Shipping Comparison

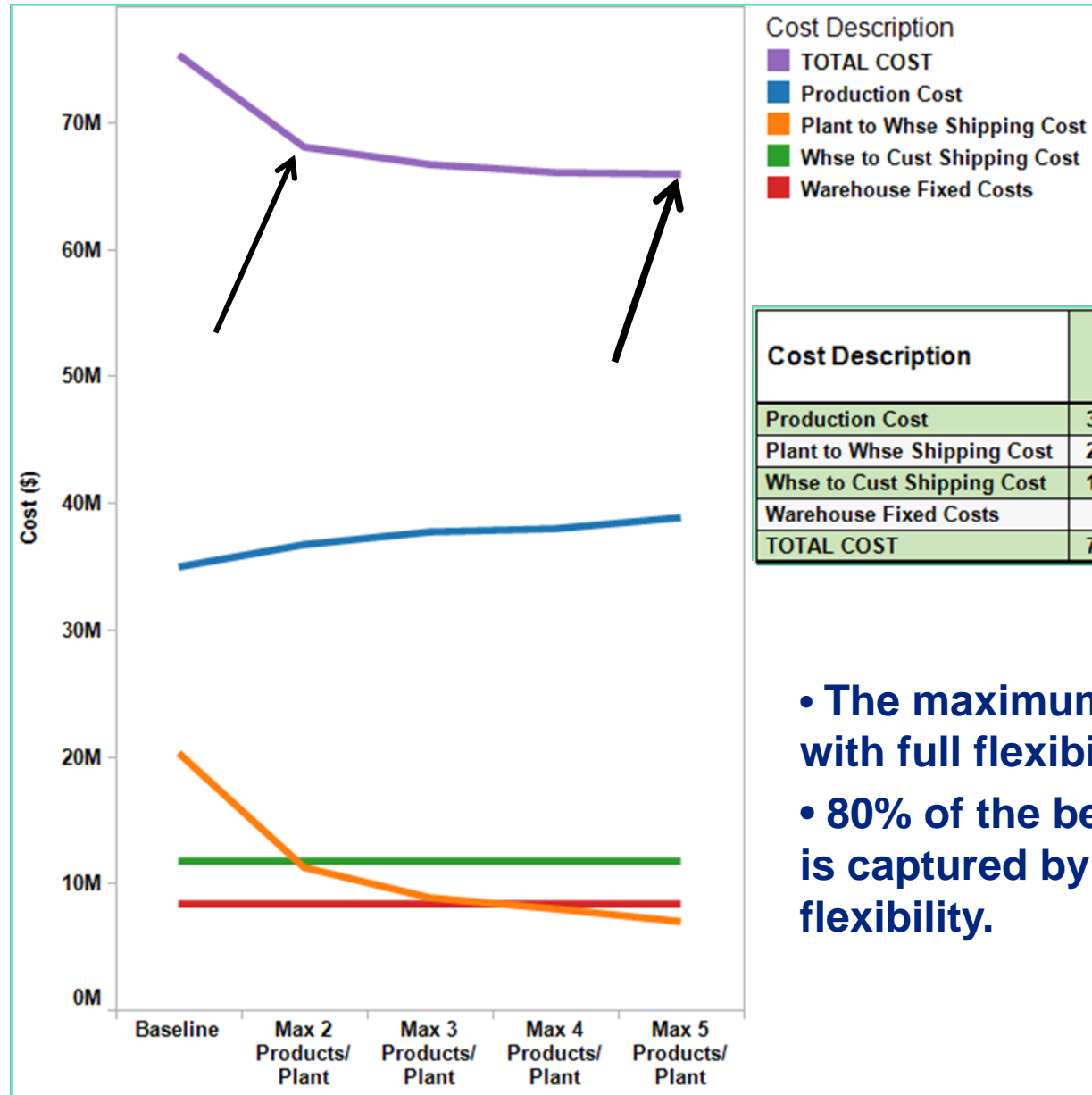


Plant to Warehouse Shipping Comparison



Sourcing Product 5 from Omaha rather than Modesto offers large transportation savings for Baltimore warehouse

Total Cost Comparison



- The maximum variable cost savings with full flexibility is 13%
- 80% of the benefits of full flexibility is captured by adding minimal flexibility.

Impact of Changes in Demand Volume

Sensitivity analysis to changes above and below the forecast:

- 1. Growth for leading products (1 & 2) by 25% and slight decrease in demand for other products (5%).**
- 2. Growth for the lower volume products (4 & 5) by 35% and slight decrease in demand for other products (5%).**
- 3. Growth of demand for the high potential product (3) by 100% and slight decrease in demand for other products (10%).**

Impact of Changes in Demand Volume

	Scenario	Demand Satisfied	Shortfall	Cost/ Unit	Avg Plant Utilization
Demand Scenario 1	Baseline	25,520,991	1,505,542	\$ 2.94	91%
	Min Flexibility	27,026,533	0	\$ 2.75	97%
Demand Scenario 2	Baseline	25,019,486	1,957,403	\$ 2.99	91%
	Min Flexibility	26,976,889	0	\$ 2.75	96%
Demand Scenario 3	Baseline	23,440,773	4,380,684	\$ 2.93	84%
	Min Flexibility	27,777,777	43,680	\$ 2.79	100%

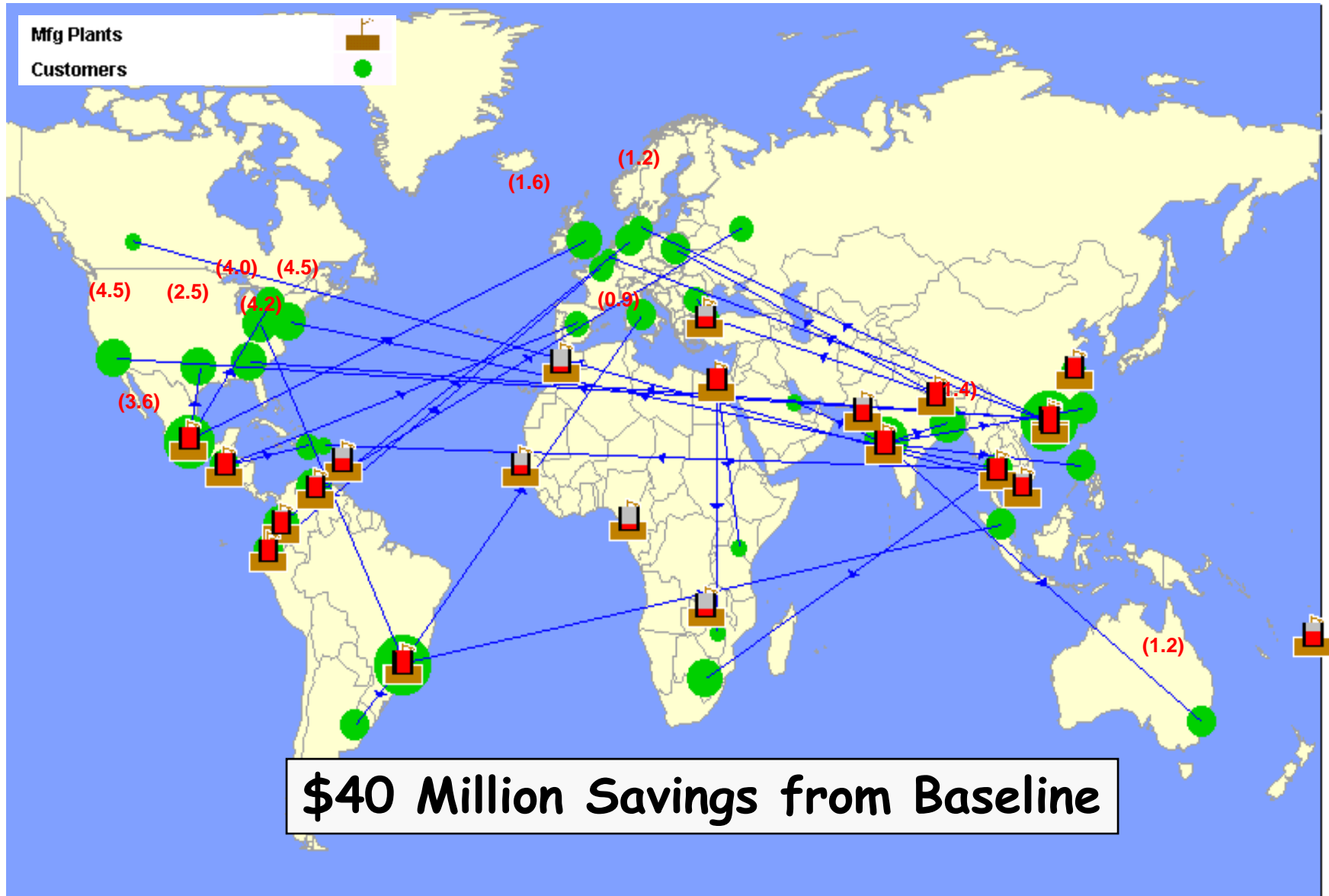
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Case Study 3: Risk Management

- **Manufacturer of consumer packaged goods**
 - ◆ Household goods
- **Global network**
 - ◆ About 40 manufacturing facilities
 - ◆ Many distribution centers
- **Two objectives:**
 - ◆ Plant rationalization
 - ◆ Risk management

Optimized Network



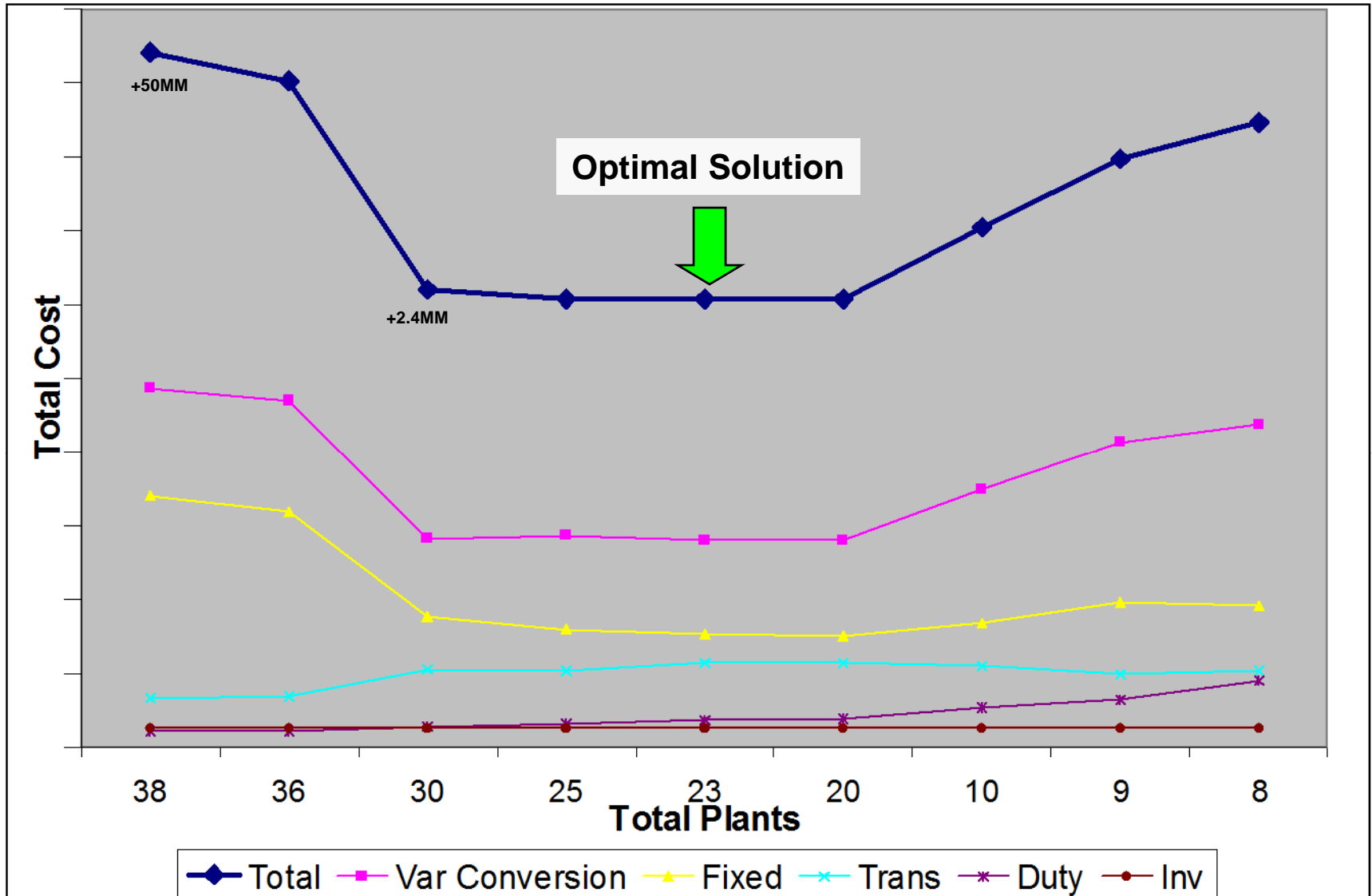
Impact of Lean Supply Chain Design

- **Significant reduction in total cost, but....**
- **.... Higher risk**
 - ♦ **Utilization of manufacturing facilities in Asia and Latin America is maximized; any disruption of supply will make it impossible to satisfy many market areas**
 - ♦ **No manufacturing facilities in North America and Europe; long and variable supply lead times**

Trade-Off Curve

Current Number of Plants

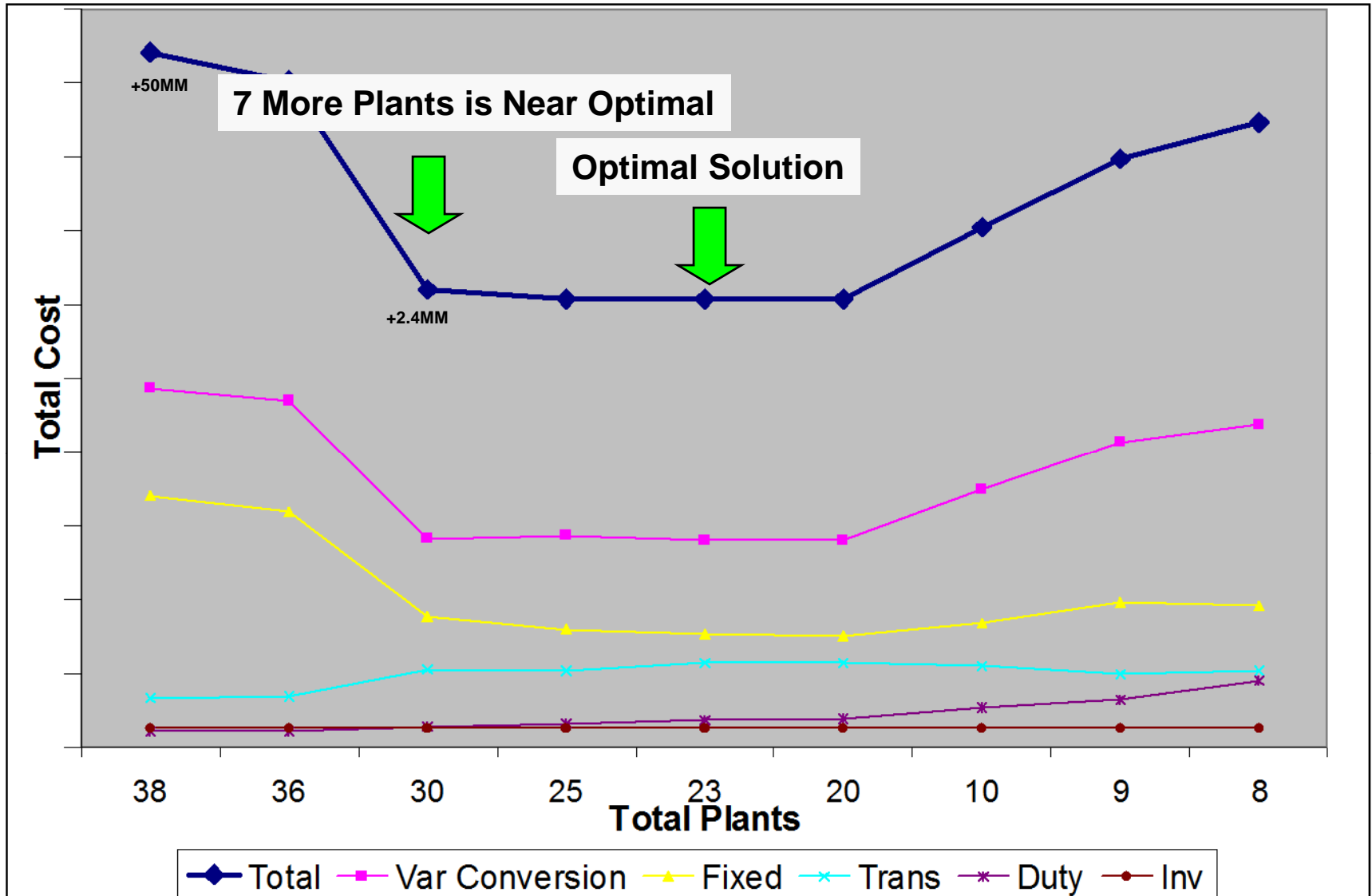
Below 8 plants there is not enough capacity



Trade-Off Curve

Current Number of Plants

Below 8 plants there is not enough capacity



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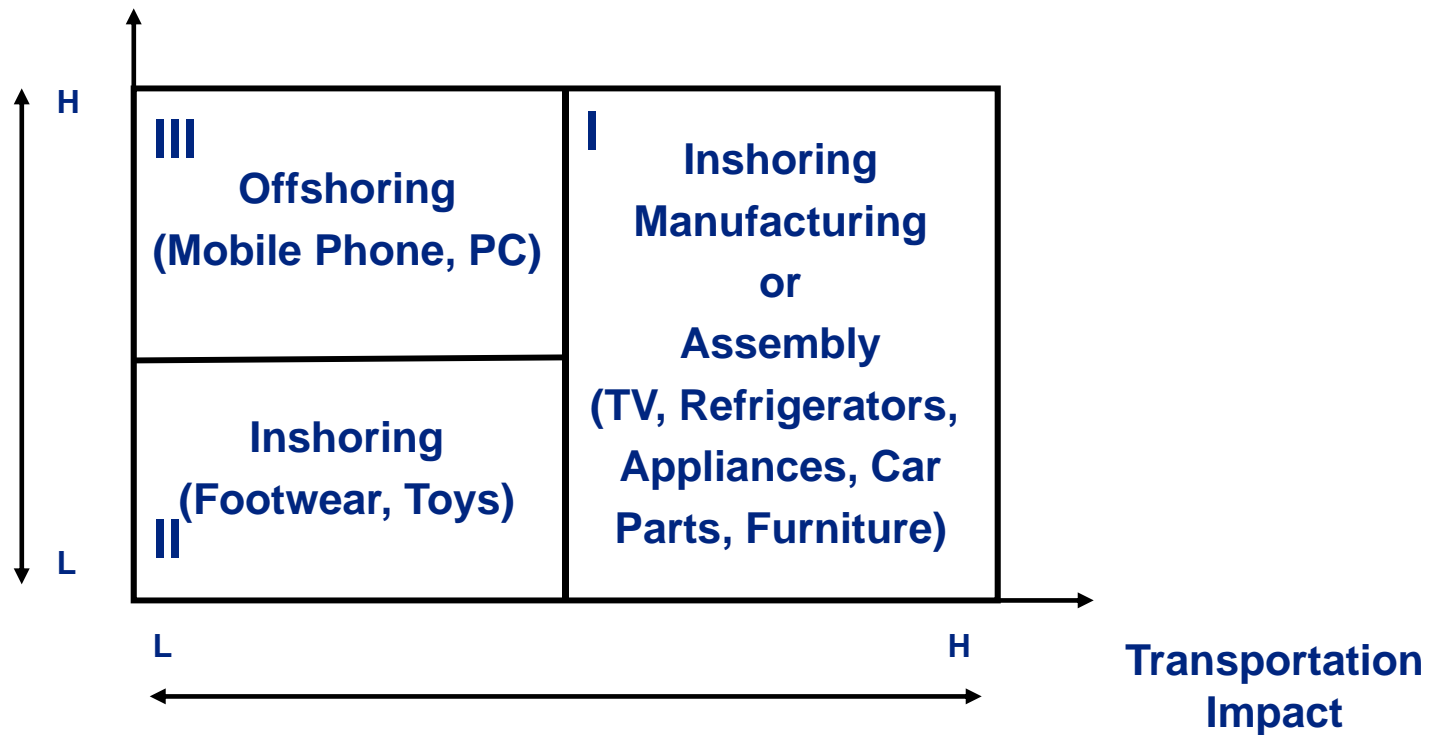
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Sharp moves from offshoring to nearshoring

- **TV manufacturer Sharp has recently started moving manufacturing facilities from Asia to Mexico to serve customers in North and South America.**
- **This is driven by the need to keep shipping costs low and time to market short.**
 - **Indeed, price of flat TV typically falls fast and thus reducing shipping time from about 40 days, when flat TVs were produced in Asia, to seven days makes a big impact on bottom line.**

When to Move from Offshoring to Inshoring? -- Product Characteristics

Cost of Moving Infrastructure



Toy manufacturer is moving plants near demand

- **Steiff, a privately owned German manufacturing company of toys was part of the global outsourcing trend when it moved around 20% of production to low cost countries.**
 - ♦ **The objective was to cut cost and compete on price.**
- **Recently, this toy manufacturer started moving production back to Germany, Portugal and Tunisia.**
 - ♦ **The reasons: quality problems together with high transportation costs associated with manufacturing far from the key markets**

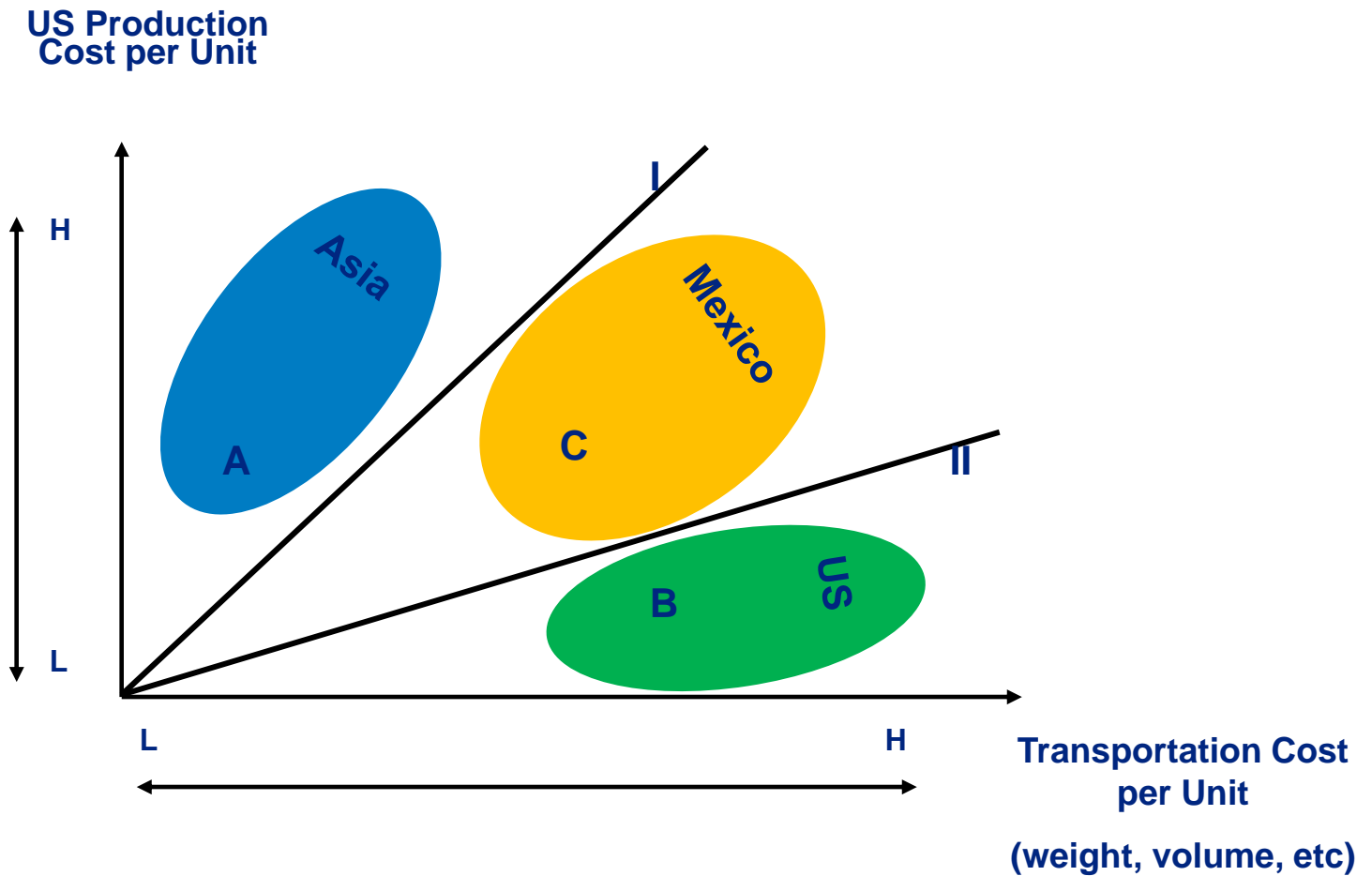
Drivers of Moving from Offshoring to Inshoring

- **Oil Price**
- **Labor Cost**
- **The value of the dollar**

**The Average Annual Wage Increase between 2003 and 2008
in different Countries**

Country	Brazil	China	Malaysia	Mexico	US
Average Annual Wage Increase	21%	19%	8%	5%	3%

When to Move from Offshoring to Inshoring



Case Study 3: Sourcing Strategies

A large floor covering manufacturer

Hardwood, Ceramic Tile,

Carpet, Laminate



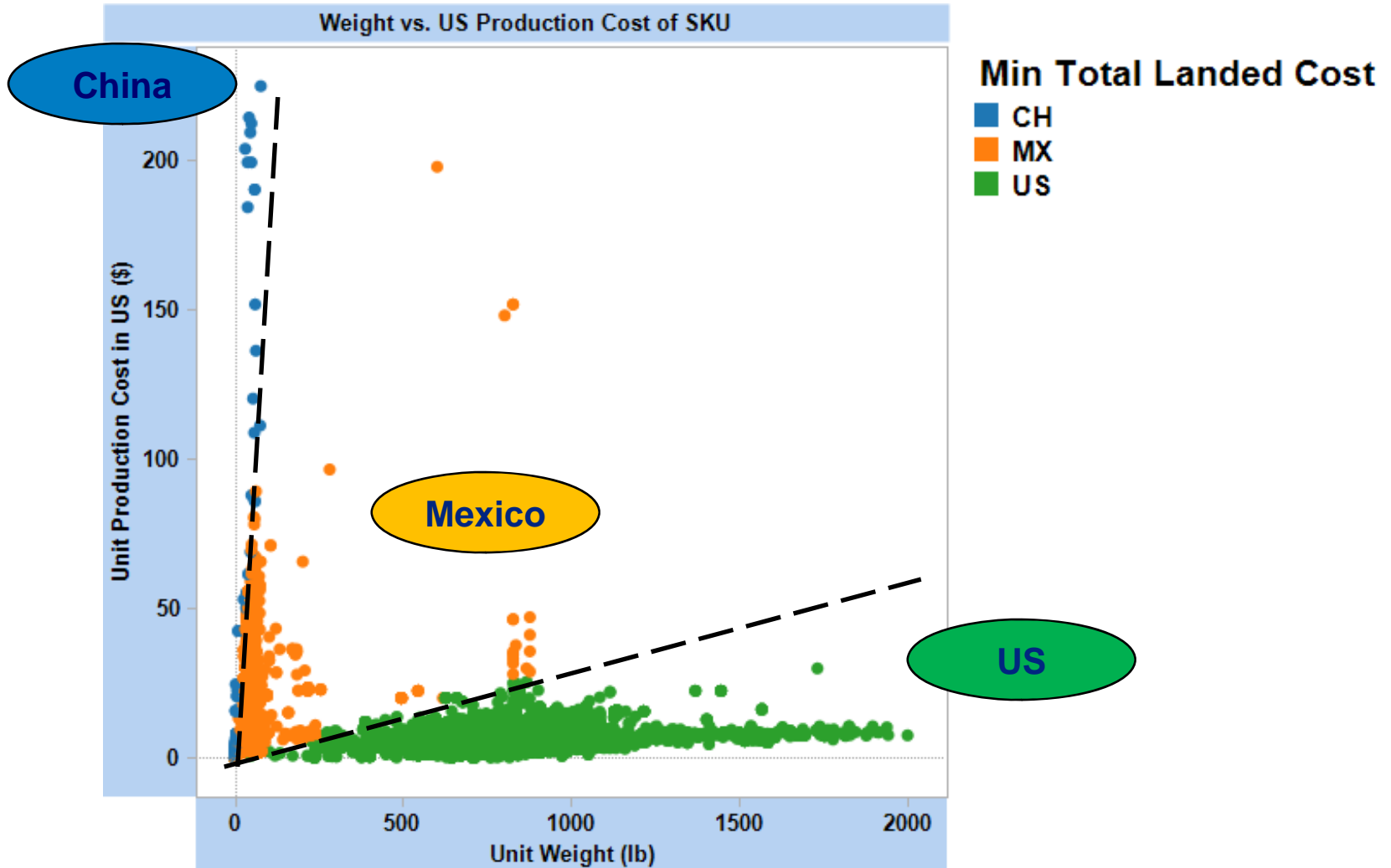
Challenge

- Understand how *increasing labor and transportation costs* across the globe are causing previous sourcing decisions to be altered

Sourcing Parameters

- ◆ **37,000 SKUs**
- ◆ **Large range of Production Costs**
 - ▶ **\$0.01 to \$300 per unit if production is in the US**
- ◆ **Large Range of Weights**
 - ▶ **0.01 to 5,000 pounds per unit**
- ◆ **Manufacturing options**
 - ▶ **US –Atlanta; Mexico – Monterey; China- Shanghai**
- ◆ **Combination of transport modes**
 - ▶ **Ocean; Rail; Truck Load**

Sourcing Analysis - 2008



Costs increase between 2003 & 2008

- **Labor Costs**

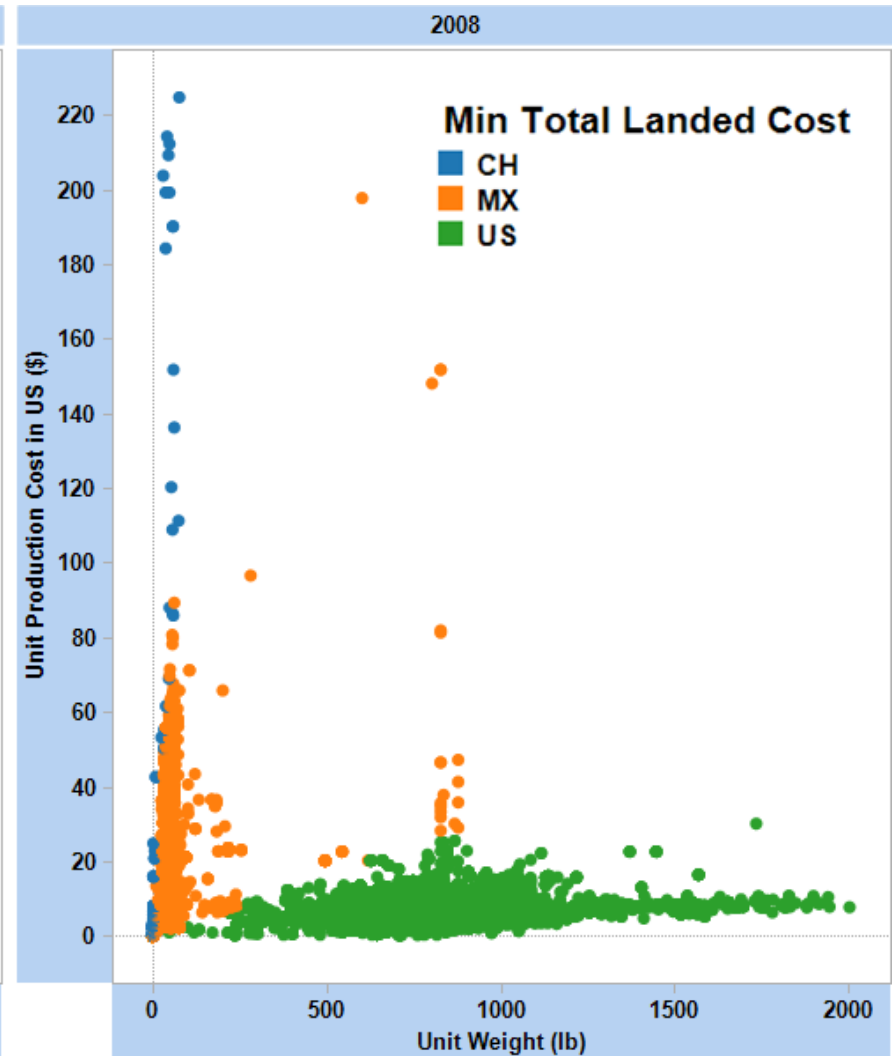
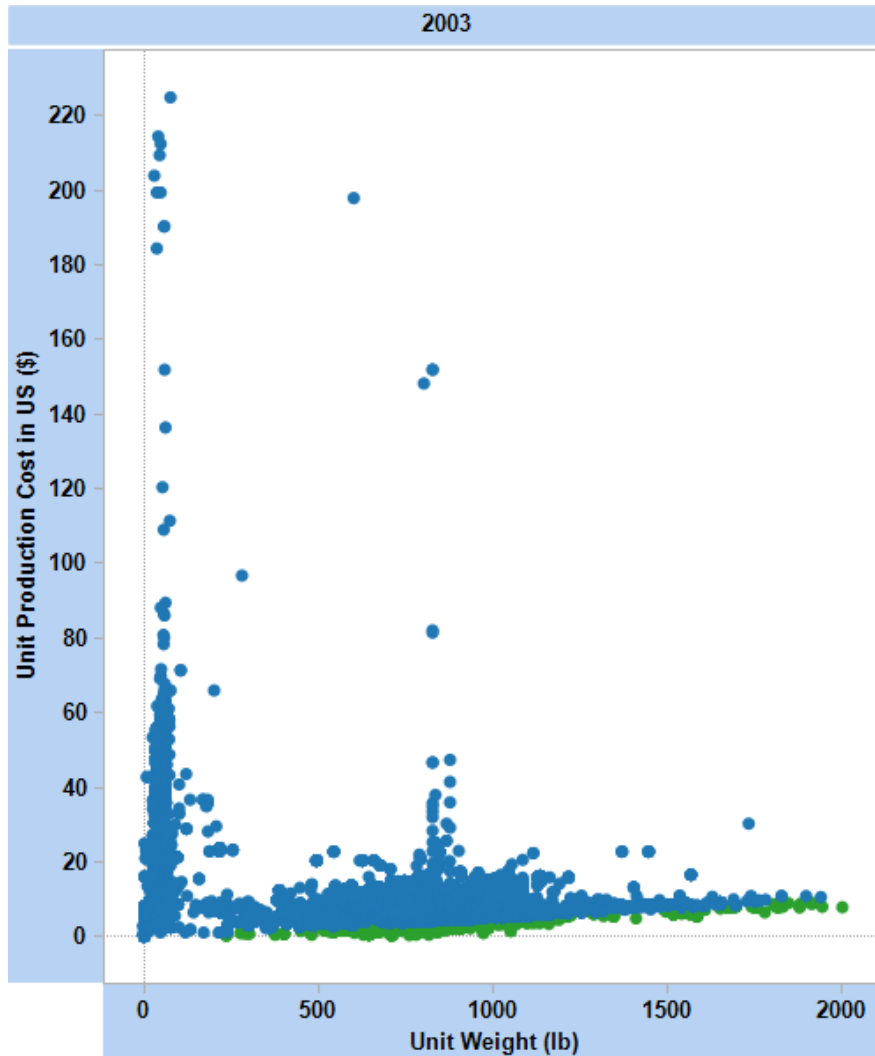
- **US** ↑ **15 %**
- **Mexico** ↑ **23 %**
- **China** ↑ **144 %**

- **Transportation Costs**

- **Ocean Freight** ↑ **100 %**
- **TL/Rail** ↑ **25 %**

- **Good estimate of the increase in rail and TL costs**
- **Conservative estimate of the increase in ocean costs**

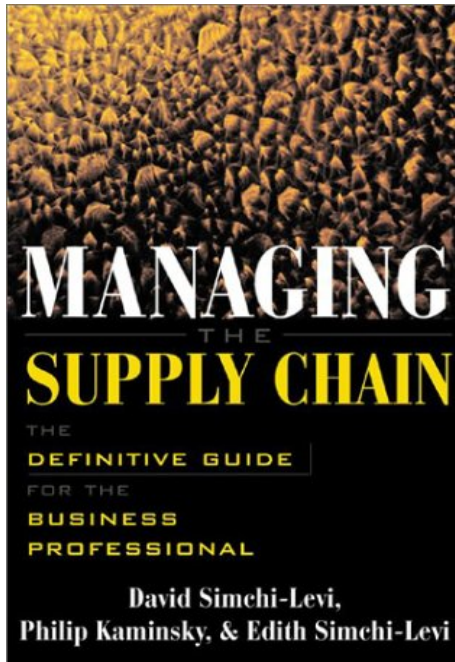
Sourcing Strategies: 2003 and 2008



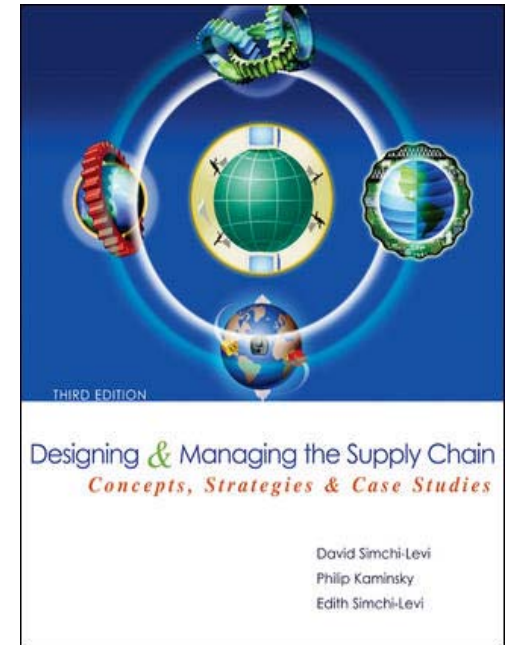
Key Points to Take Home

- **Unprecedented volatility has significant impact**
 - Business, consumers, environment, technology
- **Need to consider the entire supply chain**
 - Replace static by dynamic supply chain strategies
- **Flexibility generates real value**
 - Partial flexibility may be more than enough
- **Managing risk is the number one concern of CEO and COO**
 - Redundancy, Risk Sharing, Risk Pooling,

Your Turn!



Finish



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