

Mitigating Global Supply Chain Risks through Corporate Social Responsibility (CSR)

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Outline of Presentation

- *CSR - Definitions and Terminology*
- *Core CSR Issues*
- *Globalization and CSR*
- *CSR as Risk Management Tool*
- *CSR-Multi-S takeholder Global Supply Chain Model*
- *Results*
- *Managerial Insights*

CSR - Definitions and Terminology

- Business in the Community defines CSR as:
“a company’s positive impact on society and the environment, through its operations, products or services and through its interaction with key stakeholders such as employees, customers, investors, communities and suppliers.”
- Many terms used interchangeably
 - Corporate social responsibility
 - Corporate citizenship
 - Social programs / social investments
 - Community outreach / social outreach

CSR Stakeholders



Current drivers

- Consumers
- NGOs
- Trade unions
- Media
- Shareholders
- Risk reduction
- Brand
- Reputation

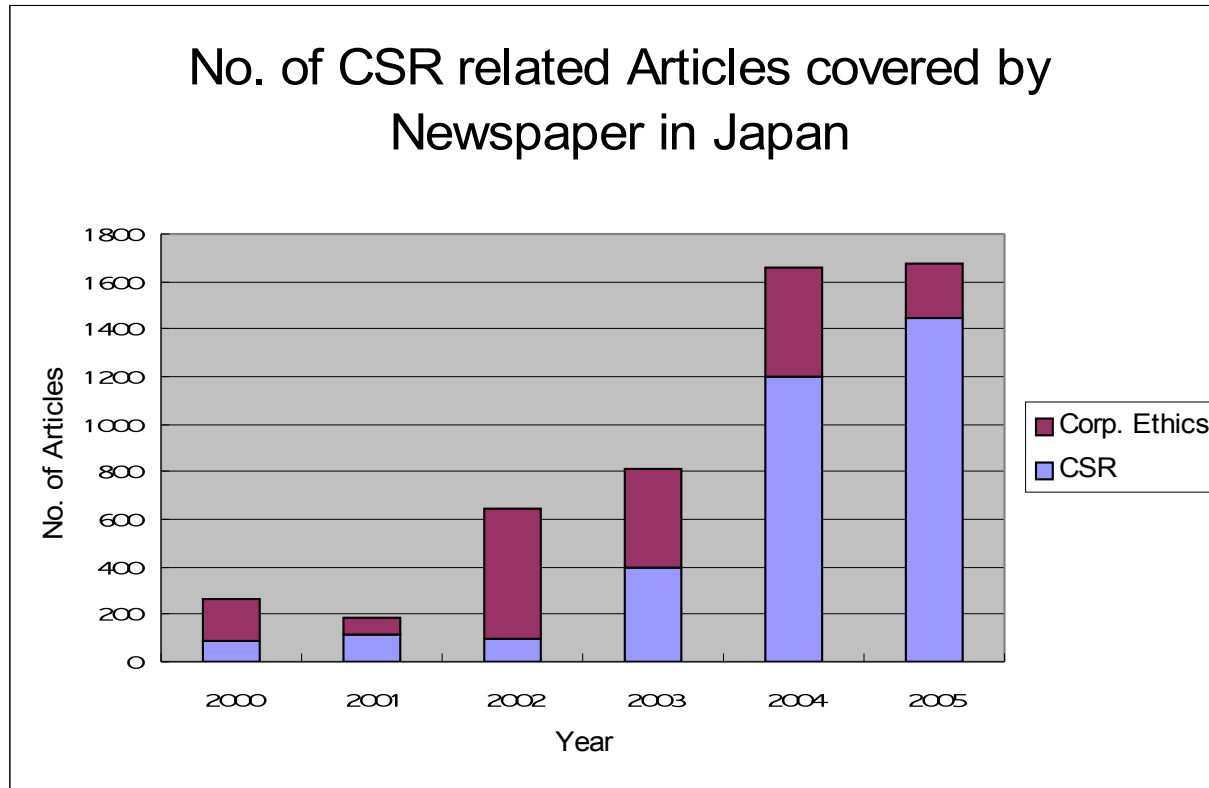
Core CSR Issues



Why is CSR Rising Globally?

- Rapid globalization of businesses
 - Human right abuses, misconduct, ecological damages etc.
- Continued business scandals and misconduct on global basis
- Diversified stakeholders and growing concerns over corporate behavior and misconduct
- Proliferation of Internet and increase in media campaign have accelerated situations

CSR Globally



(Based on Nikkei Telecon21)

Newspapers: Nikkei, Nikkei Sangyou, Nikkei Ryuutsuu, Nikkei Kinyuu, Asahi, Yomiuri, Sankei, Nikkan Kogyou

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CSR Pressure...

SUPPORT
COMMUNITY
TRADE

AGAINST
ANIMAL
TESTING

profits with
principles

DEFEND
HUMAN
RIGHTS

PROTECT
OUR
PLANET



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Abuse is in style
at H&M



Leadership, Market Positioning or just more Greenwashing?



Striving to buy, sell and use environmentally friendly products.



Beyond Petroleum
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We understand that our responsibilities go beyond regulation. This is why we have a multi-functional approach to environmental issues throughout the company.

- From Chevron Canada Website

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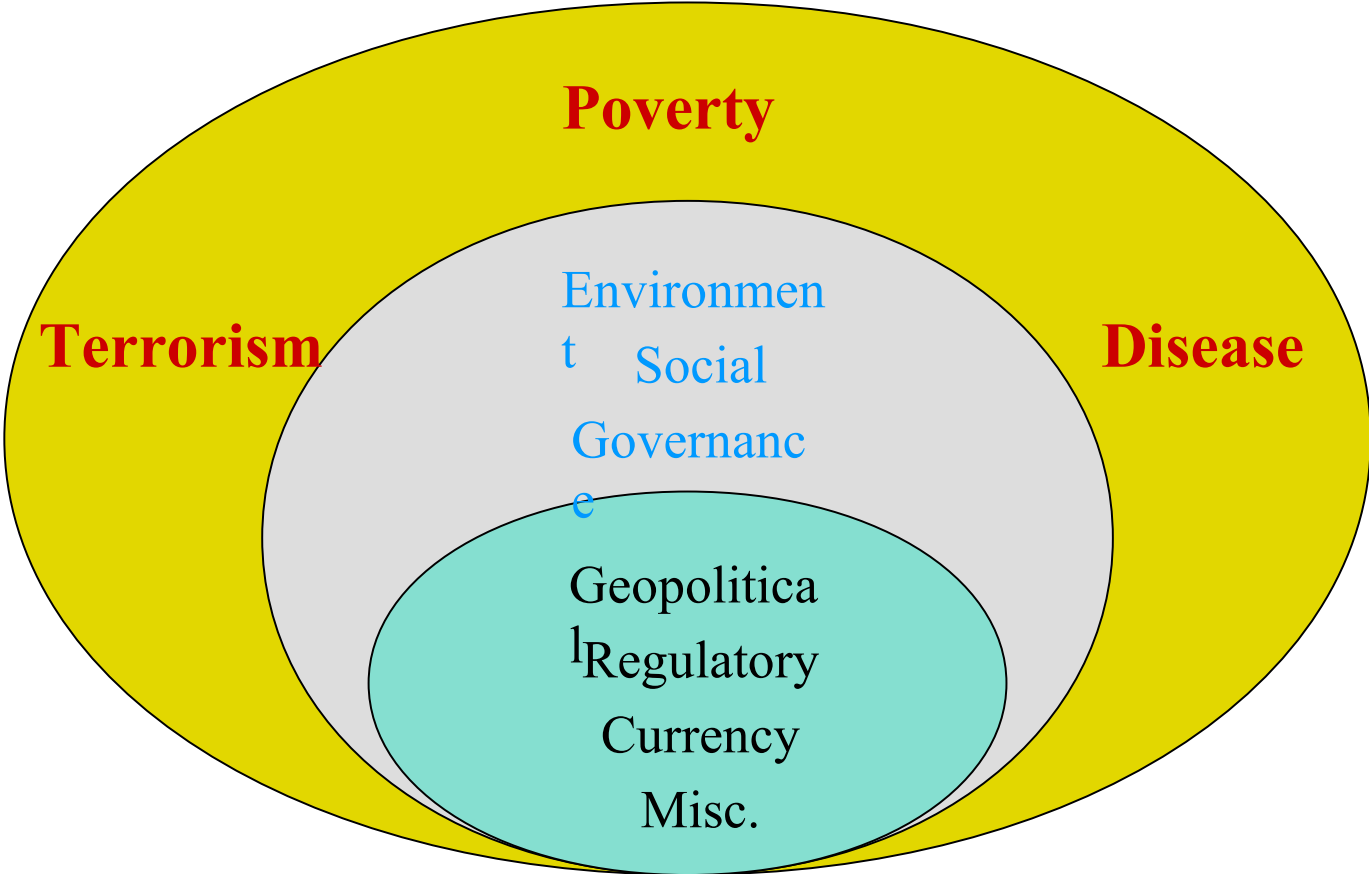
What are Impacts on Companies?

- Growing discussions, government actions, legislation and CSR standards/codes and etc.
- Expanding assessment and monitoring on CSR
 - Socially Responsible Investment (SRI) □
 - Growing stakeholder activism (NGOs as watchdogs for companies)



CSR has become a global business issue

CSR-Expanded Risk Management



CSR & Supply Chain

- Factors:
 - Legal requirements
 - Pressure from consumers
 - Changing consumer preferences
- Results:
 - Attempt to minimize their emissions
 - Produce more environmentally friendly products
 - Establish sound recycling network systems
 - Managing the corporate social responsibilities of their partners within the supply chain

CSR & Supply Chain

- Operational benefits realized by improving environmental and working conditions performance
 - Lower energy cost
 - Less waste
 - Increased productivity
 - Improved safety
 - Decreased turnover and training cost
 - Brand risk management

CSR Research Themes

- From 1953 to 1970:
 - Responsibility of the businessman (Bowen, 1953).
- From 1970 to 1980:
 - Characteristics of socially responsible behavior (Davis, 1973; Carroll, 1979)
- In the 1980s:
 - Stakeholder theory (Freeman, 1984)
 - Business ethics (Frederick, 1986)
 - Corporate social performance (Drucker, 1984)
- In the 1990s:
 - Empirical studies attempted to correlate CSR with financial performance (Clarkson, 1991; Waddock and Graves, 1997; Berman et al., 1999; Roman et al., 1999)
- Today CSR is:
 - A prominent research theme
 - Found in corporate missions and value statements (Svendsen et al., 2001)

- Global Supply Risk Model

CSR as Risk Management Tool

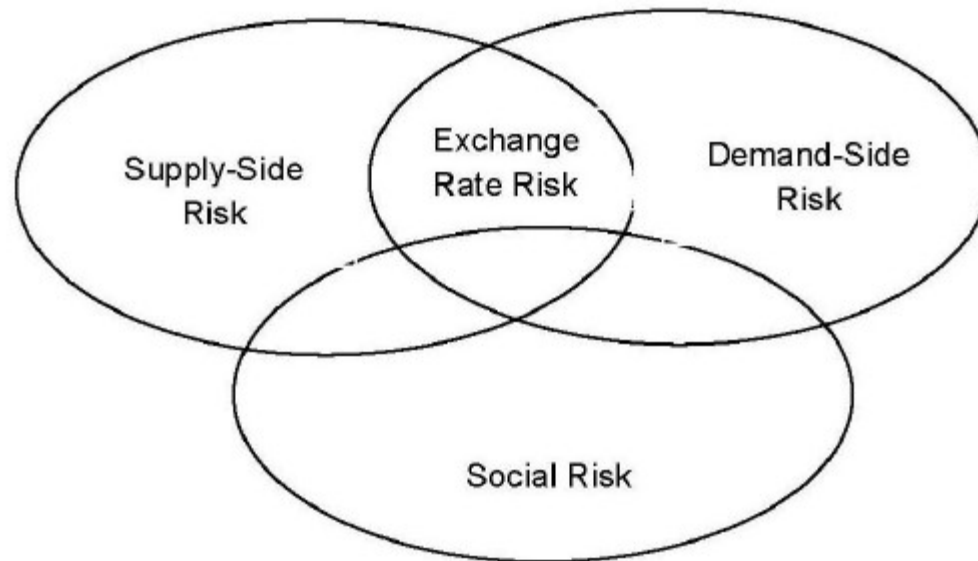


Figure 1: Global Supply Chain Risk Model

Global Supply Chain Network Model

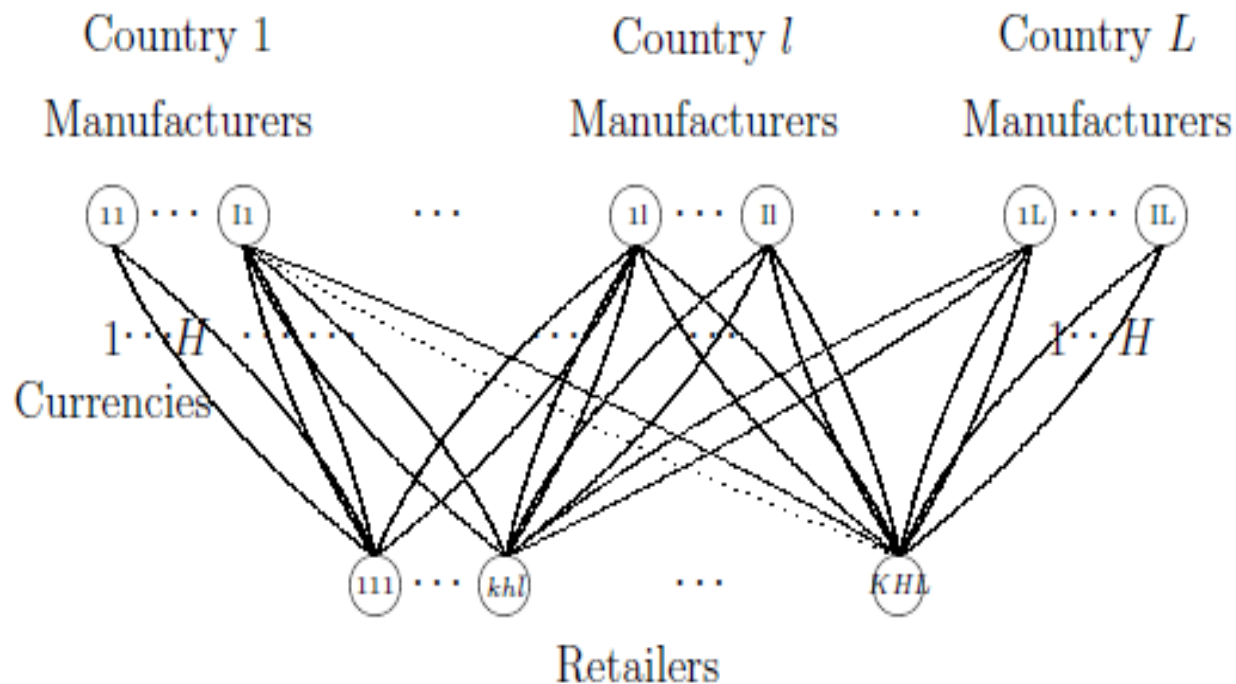


Figure 2: The Structure of the Global Supply Chain Network

Assumptions of the Model

- Establishing levels of social responsibility activities incurs some costs.
- Higher levels of social responsibility activities
 - Reduce transaction costs
 - Reduce demand side risk
 - Reduce supply side risk
 - Social Risk
- Multicriteria decision-makers
 - Manufacturers and retailers try to:
 - Maximize net revenue
 - Minimize risk

Features of the Model

- Captures multi-tiers
 - Manufacturers
 - Retailers
- Captures interactions among individual decision-makers
 - Competition at the same tier
 - Coordination among different tiers
- The model captures :
 - Supply-side risks
 - Demand side risks
 - Social risks
 - Exchange rate risks
- Determines
 - Production quantities, shipments, price levels of CSR activities

Manufacturer's Problem

The expected production cost function

$$\hat{F}^{il}(q^{il}, \eta^{il}) \equiv \int_{\xi^{il}} f^{il}(q^{il}, \eta^{il}, \xi^{il}) dF^{il}(\xi^{il}), \quad \forall i, l,$$

The expected social risk function

$$\hat{S}R^{il}(q^{il}, \eta^{il}) \equiv \int_{\xi^{il}} sr^{il}(q^{il}, \eta^{il}, \xi^{il}) dF^{il}(\xi^{il}), \quad \forall i, l,$$

The maximization Problem

$$\text{Maximize: } \sum_{k=1}^K \sum_{h=1}^H \sum_{\bar{l}=1}^L (\rho_{1kh\bar{l}}^{il*} \times e_h^*) q_{kh\bar{l}}^{il} - \hat{F}^{il}(q^{il}, \eta^{il}) - b^{il}(\eta^{il}) - \hat{S}R^{il}(q^{il}, \eta^{il}) - \omega^{il} [V_F^{il}(q^{il}, \eta^{il}) + V_{SR}^{il}(q^{il}, \eta^{il})]$$

subject to: $q_{kh\bar{l}}^{il} \geq 0$ and $0 \leq \eta^{il} \leq 1$ for all k, h, \bar{l} .

Retailer's Problem

• Random demand with Probability distribution

$$F_{kh\bar{i}}(x, \rho_{3kh\bar{i}}) = P_{kh\bar{i}}(\hat{d}_{kh\bar{i}} \leq x) = \int_0^x f_{kh\bar{i}}(x, \rho_{3kh\bar{i}}) dx.$$

News vendor

model:

Excess supply
(inventory)

$$\Delta_{kh\bar{i}}^+ \equiv \max\{0, s_{kh\bar{i}} - \hat{d}_{kh\bar{i}}\}$$

Excess demand
(shortage)

$$\Delta_{kh\bar{i}}^- \equiv \max\{0, \hat{d}_{kh\bar{i}} - s_{kh\bar{i}}\},$$

Expected

Value

$$\pi_{kh\bar{i}}^+(s_{kh\bar{i}}, \rho_{3kh\bar{i}}) \equiv E(\Delta_{kh\bar{i}}^+) = \int_0^{s_{kh\bar{i}}} (s_{kh\bar{i}} - x) f_{kh\bar{i}}(x, \rho_{3kh\bar{i}}) dx,$$

$$\pi_{kh\bar{i}}^-(s_{kh\bar{i}}, \rho_{3kh\bar{i}}) \equiv E(\Delta_{kh\bar{i}}^-) = \int_{s_{kh\bar{i}}}^{\infty} (x - s_{kh\bar{i}}) f_{kh\bar{i}}(x, \rho_{3kh\bar{i}}) dx.$$

Total expected

penalty

$$E(\lambda_{kh\bar{i}}^+ \Delta_{kh\bar{i}}^+ + \lambda_{kh\bar{i}}^- \Delta_{kh\bar{i}}^-) = \lambda_{kh\bar{i}}^+ \pi_{kh\bar{i}}^+(s_{kh\bar{i}}, \rho_{3kh\bar{i}}) + \lambda_{kh\bar{i}}^- \pi_{kh\bar{i}}^-(s_{kh\bar{i}}, \rho_{3kh\bar{i}}).$$

Retailer's Problem

- The expected social risk function

$$\hat{S}r_{kh\bar{l}}(s_{kh\bar{l}}, \eta_{kh\bar{l}}) \equiv \int_{\xi_{kh\bar{l}}} sr_{kh\bar{l}}(s_{kh\bar{l}}, \eta_{kh\bar{l}}, \xi_{kh\bar{l}}) dF_{kh\bar{l}}(\xi_{kh\bar{l}}), \quad \forall i, l.$$

- The maximization problem

$$\begin{aligned} & \text{Maximize} \quad E(\rho_{3kh\bar{l}}^* \cdot \min\{s_{kh\bar{l}}, \hat{d}_{kh\bar{l}}\}) - E(\lambda_{kh\bar{l}}^- \Delta_{kh\bar{l}}^+ + \lambda_{kh\bar{l}}^- \Delta_{kh\bar{l}}^-) \\ & - b_{kh\bar{l}}(\eta_{kh\bar{l}}) - \sum_{i=1}^I \sum_{l=1}^L (\rho_{1kh\bar{l}}^{il*} \times e_h^*) q_{kh\bar{l}}^{il} - \hat{S}r_{kh\bar{l}}(s_{kh\bar{l}}, \eta_{kh\bar{l}}) - \omega_{kh\bar{l}} V S r_{kh\bar{l}}(s_{kh\bar{l}}, \eta_{kh\bar{l}}), \end{aligned}$$

$$\text{subject to: } q_{kh\bar{l}}^{il} \geq 0, \quad 0 \leq \eta_{kh\bar{l}} \leq 1, \quad \text{for all } i, l.$$

The Market Stochastic Economic Equilibrium Conditions

$$\hat{d}_{kh\bar{l}}(\rho_{3kh\bar{l}}^*) \left\{ \begin{array}{l} = \sum_{i=1}^I \sum_{l=1}^L q_{kh\bar{l}}^{il*} \quad \text{a.e.} \quad \text{if } \rho_{3kh\bar{l}}^* > 0 \\ \leq \sum_{i=1}^I \sum_{l=1}^L q_{kh\bar{l}}^{il*} \quad \text{a.e.} \quad \text{if } \rho_{3kh\bar{l}}^* = 0, \end{array} \right.$$

The Equilibrium State

- Definition: The equilibrium state of the network is one where the flows between the tiers of the network coincide and the product transactions, levels of social responsibility activities, and prices satisfy the sum of the optimality conditions and the equilibrium conditions.

The equilibrium state is equivalent to a VI of the form:

determine $X^* \in \mathcal{K}$ satisfying

$$\langle F(X^*), X - X^* \rangle \geq 0, \quad \forall X \in \mathcal{K},$$

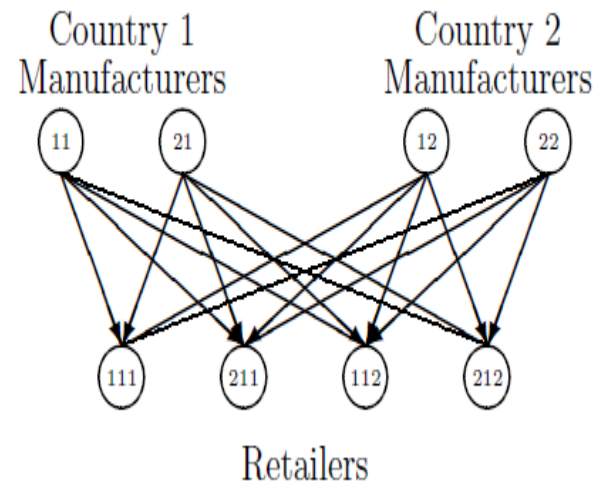
Qualitative Properties

I have established

- Existence of a solution to the VI
- Uniqueness of a solution to the VI

Computational Studies

- The effects of CSR cost on levels of CSR
- The effects of levels of CSR on:
 - transaction costs
 - supply side risks
 - demand side risks
 - social risks
- The effects of levels of CSR
 - product prices
 - product transactions



Results

Variables	Example 1	Example 2	Example 3	Example 4
Equilibrium Flows from Manufacturers to Retailers				
q_{111}^{11*}	97.50	0.78	0	0
q_{211}^{11*}	97.50	0.78	0	0
q_{112}^{11*}	97.50	0.78	0	0
q_{212}^{11*}	97.50	0.78	0	0
q_{111}^{21*}	97.50	128.92	0	0
q_{211}^{21*}	97.50	128.92	130.00	0
q_{112}^{21*}	97.50	128.92	130.00	0
q_{212}^{21*}	97.50	128.92	130.00	0
q_{111}^{12*}	97.50	128.92	0.00	0
q_{211}^{12*}	97.50	128.92	130.00	0
q_{112}^{12*}	97.50	128.92	130.00	0
q_{212}^{12*}	97.50	128.92	130.00	0
q_{111}^{22*}	97.50	128.92	0	0
q_{211}^{22*}	97.50	128.92	130.00	0
q_{112}^{22*}	97.50	128.92	130.00	0
q_{212}^{22*}	97.50	128.92	130.00	0
Manufacturers' Equilibrium CSR Level				
η^{11*}	1	0.045	0	0
η^{21*}	1	1	1	0
η^{12*}	1	1	1	0
η^{22*}	1	1	1	0
Retailers' Equilibrium CSR Level				
η_{111}^*	1	1	0	0
η_{211}^*	1	1	1	0
η_{112}^*	1	1	1	0
η_{212}^*	1	1	1	0
Retailers' Equilibrium Prices				
ρ_{3111}^*	5.01	\$6.39	\$200.00	\$200.00
ρ_{3211}^*	\$5.01	\$6.39	\$4.98	\$200.00
ρ_{3112}^*	\$5.01	\$6.39	\$4.98	\$200.00
ρ_{3212}^*	\$5.01	\$6.39	\$4.98	\$200.00

The Perceived Benefits of Good CSR

- Risk management
- Staff recruitment and retention
- Cost reductions
- Enhanced reputation and image
- Market access
- Relationships with government, other businesses, stakeholders



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Managerial Insights

- CSR in supply chain should be viewed holistically.
- CSR improvements can lead to economic benefits for companies.
- CSR can potentially reduce production inefficiencies, reduce cost and risk and at the same time allow companies to increase sales, increase access to capital, new markets, and brand recognition.
- Managing CSR in a global market is more demanding and requires that it is adapted to and contextualized for specific individual country.

Thank You!

Questions?

