FAIRNESS AND RETAILER-LED SUPPLY CHAIN COORDINATION UNDER TWO DIFFERENT DEGREES OF TRUST

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Abstract. Nowadays, customers are the decisive part in the market. The retailers who are closest to final consumers in a supply chain begin to show their power and thereby dominate the supply chain. Thus, the research about a retailer-led supply chain continues to be a burning question in the recent trade press and academic literature. Our research adds fresh fuel to the fire by studying how one channel member’s fairness concern affects the coordination of a two-stage supply chain with a dominant retailer and a supplier. We carry out our investigation in two cases which involve different degrees of trust between the channel members about the unit cost $c$ provided by the supplier. Our analysis shows that if the channel members have the same degree of trust on $c$-value, the dominant retailer can use a constant markup pricing contract to align the fair-minded supplier’s interest with the channel’s and coordinate the channel with a wholesale price higher than the supplier’s marginal cost; but the coordination fails if the dominant retailer is the only one who cares about fairness, and he obtains a lower profit than nobody cares about fairness. If the dominant retailer and the supplier have different degrees of trust on $c$-value, the retailer can not coordinate the channel with a markup pricing contract when only the supplier has fairness concerns.

1. Introduction. Today, customers become the core of the market which creates a customer-oriented market. The retailers’ position in the supply chain is getting more and more important because they are closest to final consumers. For instance, the powerful international retailer chains Wal-Mart, Carrefour and numerous owners of prestigious brand-names who now outsource their products are leaders in their supply chain. Thus, a dominant-retailer scenario becomes increasingly prevalent in the real world[20], and has recently gained big interest for academicians as well as

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professionals. For more details the interested reader is referred to e.g. [20, 3, 4, 11, 10, 25, 14, 21, 6, 25, 20, 7, 34, 18, 33, 10].

Despite the salience of the retailer-led supply chain in today’s economy, it has many potential problems. Wang and Liu [31] showed that in a retailer-led supply chain retailers control the channel, the manufacturers need to sacrifice some profit in exchange for market share. However, such cooperation is quite unstable. No enterprises can tolerate zero plus profit or even negative profit in the long run. For example, in summer 2004, Gree (the leading air conditioner manufacturer in China) argued that Gome’s (Gome is one of the top three home appliance retailers in China) demand of additional summer promotion fees was unfair and decided to withdraw all of its products from Gome stores [22]. Compared to Gome, the other Chinese firm, Sunning (one of the top three home appliance retailers in China) does a good job in cooperating the retailer-supplier relationships. Sunning adopts an option mechanism to realize a win-win situation. Now, Sunning has been the largest home appliance retailer in China.

Sometimes, even as a dominator in supply chain, the retailer may break up the partnership with his supplier for feeling unfairness. For instance, in 2008, Walmart Canada made a decision to terminate its business with Lego Group, because Lego Group refused to reduce its prices in the Canadian market to align with its pricing structure in the U.S. market. Walmart Canada considered such rejection to be unjust and perceived that Lego Group was unwilling to share the benefits they reaped from the appreciation of the Canadian dollar [18].

The above examples tell us that both the supplier and dominant retailer may have fairness concerns, and if someone thinks he is not treated fairly, the partnership will be influenced and even be terminated. Fairness plays an important role in managing the channel members’ cooperation relationships. Thus, it is necessary to pay attention to exploring how fairness concerns impact the operation of the retailer-led supply chains.

Researches in behavioral operation shows that people pay much attention to fairness in their daily life [24, 5, 12]. Kahneman, et al. [17] pointed out that firms, like individuals, are also motivated by the concern of fairness in business relationships. Supply chain relationship as a kind of business relationship also requires the partners to behave in a just manner. Narasimhan et al. [23] said that the concept of justice is important in a buyer-supplier relationship due to its economic and relational connotations. Several studies have suggested that justice practices in dealings with suppliers are important in enhancing buyer-supplier relationship performance [19, 8, 22], and unfairness can result in poor relationship performance due to potential supplier opportunism [29, 11].

Cui et al. [9] were the first to model fairness concerns in the context of channel coordination. In their paper, they formally model “fairness” based on the notion of “inequity aversion” proposed by Fehr and Schmidt [12] that the difference between the retailer’s payoff and the equitable payoff will produce disutility. They pointed out that no matter only the retailer concerns fairness, or both sides pay attention to fairness, a coordinating wholesale price contract can be designed with the linear demand. From then on, coordinating a supply chain with inequity aversion becomes an important issues in supply chain coordination management, and while it has attracted few researchers’ attention, studies on this topic have shown some interesting results [32]. For related work, see [2, 27, 36, 32, 30, 15].
The above literature about supply chain with fair-minded members is all established under the hypothesis that the supplier is the dominant player, but few researchers consider the situation that the retailer is the dominator. Given the important influence of the dominant retailer on the supply chain and the shortage of related studies, we are motivated to explore the impact of fairness on the channel with a dominant retailer. As the examples mentioned before, it is typically that only one channel member who cares about fairness. Thus, in this paper we focus on the scenario where only one channel member has fairness concern and investigate how it affects the supply chain.

We propose a two-stage supply chain with a supplier and a retailer, where the retailer is dominator in the channel. As a dominator, the retailer implements a “retailer-Stackelberg” game through a markup pricing contract. This means that the retailer is the leader in the Stackelberg game, and charges a retail margin over the wholesale price levied by the supplier to guarantee his financial prudence. Since, the supplier’s unit cost \( c \) is his private information, the dominant retailer can not have the same perfect knowledge of \( c \) as the supplier. We consider two sub-situations: (i) the dominant retailer trusts the supplier-reported \( c \)-value (complete-\( c \)-trust case); (ii) the dominant retailer dose not believe the supplier-reported \( c \)-value, and argues that the supplier’s unit cost is a random variable ranging over \([c_l, c_u]\) (uncomplete-\( c \)-trust case).

Our analysis shows that under complete-\( c \)-trust case the dominant retailer can use a constant markup pricing contract to align the fair-minded supplier’s interest with the channel’s and coordinate the channel with a wholesale price higher than the supplier’s marginal cost; the coordination will fail if the dominant retailer is the only one who cares about fairness, and he obtains a lower profit than he does not. Under the uncomplete-\( c \)-trust case, the retailer can not coordinate the channel with a markup pricing contract when only the supplier has fairness concerns.

The remainder of this paper is organized as follows. In Section 2, we will give a detailed description about our model and the benchmark supply chain model with a dominant retailer. The impact of channel member’s fairness concerns on the supply chain with a dominant retailer is considered under different degrees of trust on \( c \)-value in Section 3 and Section 4, respectively. Section 5 presents some computational results, including a number of numerical examples and sensitivity analysis. Finally, the paper concludes in Section 6.

2. Model description and basic known results. The system considered in this paper consists of a supplier and a retailer. The supplier sells his product at a wholesale price \( w \) to the retailer. The retailer masters the distribution channel and is the dominator in the supply chain. The dominant retailer uses a markup price contract to implement a “retailer-Stackelberg” game. Under such contract, a retailer charges a mark \( m \) over the wholesale price levied by the supplier to guarantee his financial prudence, and sells the products to end customers at a retail price \( p = m + w \). The market demand is given by \( d(p) = a - bp = a - b(w + m) \), where \( a \) and \( b \), as market constants with \( a > 0 \) and \( b > 0 \), are common knowledge. We assume that only the supplier incurs a unit production cost \( c \) which is his private information.

The markup and the wholesale price are both endogenous, and are determined by the dominant retailer and the supplier, respectively. For the retailer-Stackelberg game, the sequence of events is follows.

(1) Before the sale period, the supplier reports his unit cost \( c \).
The dominant retailer sets his markup price.

In response to the dominant retailer’s decision, the supplier selects his wholesale price, which affects the market demand.

An equilibrium of this game is defined as an outcome from which neither player would want to unilaterally deviate.

Now, we consider the basic model where no channel member has fairness concerns in the complete-c-trust case. Firstly, in the centralized system, we assume only one risk-neutral decision maker who controls the channel makes decisions to optimize total system profits. The system’s profit function is

$$\pi_0(p) = (p - c)(a - bp).$$

We can see that the second-order derivative \(\pi''(p) = -2b < 0\), \(\pi(p)\) is concave in \(p\). Thus first-order condition works. It is known that the optimal unit retail price of the integrated supply chain should be

$$p_0^* = \frac{a + bc}{2b},$$

and

$$\pi_0^* = \frac{(a - bc)^2}{4b}.$$ 

Second, we consider the decentralized system with a dominant retailer. The dominant retailer first declares his markup \(m\) after he knows the supplier-reported \(c\). Then, for the given markup, the supplier sets his wholesale price \(w\), for whatever \(w\) he quotes, the unit retail price will be \(p = w + m\). Hence the supplier’s profit function is

$$\pi_s(w) = (w - c)(a - b(w + m)).$$

Solving \(\pi'_s(w) = 0\), we get the supplier’s optimal wholesale price \(w_0^* = \frac{a + bc}{2b} - \frac{m}{2}\). The dominant retailer’s profit function is

$$\pi_r(m) = m(a - b(w + m)).$$

Substituting \(w_0^*\) into the retailer’s profit function, and then solving \(\pi'_r(m) = 0\) gives:

$$m_0^* = \frac{a - bc}{2b}.$$ 

For the given \(m_0^*\), we obtain \(w_0^* = \frac{a + 3bc}{4b}; \pi_{bs}^* = \pi_s(w_0^*) = \frac{(a-bc)^2}{16b}; \pi_{br}^* = \pi_r(m_0^*) = \frac{(a-bc)^2}{8b}\). Note that the sale price under the decentralized system is \(p_0^* = w_0^* + m_0^* = \frac{a + 3bc}{4b} > \frac{a + bc}{2b} = p_0^*,\) which means that the retailer-led supply chain can not achieve channel coordination.

Next, we consider how does the dominant retailer set his markup when only the supplier or himself cares about fairness under two different c-trust cases with a markup pricing contract. We first derive the dominant retailer’s optimal markup pricing strategies under complete-c-trust case.

### 3. Complete-c-trust case

Under the complete-c-trust case, the dominant retailer trusts the supplier-reported unit cost \(c\)-value, they adopt the same \(c\) to make their decisions. Now, let’s consider the scenario where only the supplier cares about fairness.
3.1. **Only the supplier has fairness concerns.** When the supplier not only cares about profitability, but also has fairness concerns, his objective is to maximize a utility function $U_s(w)$ that accounts for his monetary payoff as well as his fairness concerns. We follow the framework introduced by Cui et al. [9], and define the supplier’s utility function as

$$U_s(w) = \pi_s(w) + f_s(w, m).$$  

(1)

Here, $f_s(w, m)$ is supplier’s disutility due to inequity. Note that fairness concerns implies that the supplier dislike outcomes which bring higher as well as lower profits than what they believe equitable. Following Cui et al. [9], we assume that the equitable outcome for the supplier is $\gamma_s$ times the retailer’s profit ($\gamma_s > 0$ is the equitable ratio for the supplier). If the supplier’s profit is lower than the equitable profit, a disadvantageous inequity occurs, which results in a disutility for the supplier with an amount of $\alpha_s$ per unit difference in the two profits. On the other hand, if her profit is higher than the equitable profit, there is also a disutility for the supplier with an amount of $\beta_s$ per unit difference in the profit. Mathematically, we have the disutility functions of the supplier as

$$f_s(w, m) = -\alpha_s(\gamma_s\pi_r(m) - \pi_s(w))^+ - \beta_s(\pi_s(w) - \gamma_s\pi_r(m))^+$$  

(2)

Denote $(\cdot)^+ = \max\{\cdot, 0\}$. Past research shows that “subjects suffer more from inequity that is to their monetary disadvantage than from inequity that is to their monetary advantage” [12]. Thus, we assume $\beta_s \leq \alpha_s$ and $0 < \beta_s < 1$.

3.1.1. **The supplier’s decision.** Given any markup $m$, the supplier will choose a wholesale price $w$ to maximize his utility given by Equations (1) and (2). As the utility function is not differentiable everywhere, we derive the supplier’s optimal decision in two steps. First, we give the supplier’s decisions under two cases, respectively.

**Case 1.** $\gamma_s\pi_r(m) \geq \pi_s(w)$.

If the supplier’s monetary payoff is lower than his equitable payoff, i.e., $\gamma_s\pi_r(m) - \pi_s(w) = (\gamma_s m - w + c)(a - b(w + m)) \geq 0$. Then, the supplier suffers disadvantageous inequality, and his optimization problem is given below

$$\max_{w>0}(w - c)(a - b(w + m)) - \alpha_s(\gamma_s m - w + c)(a - b(w + m))$$

$$\text{s.t. } w \leq \gamma_s m + c$$  

(3)

The optimal wholesale price and the maximum utility for the supplier, conditional on disadvantageous inequality, are given below

$$w_{\alpha_s} = \begin{cases} 
\frac{a + bc}{2b} - \left(1 - \frac{\gamma_s \alpha_s}{1 + \alpha_s}\right) \frac{m}{2} & \text{if } m > m_1 \\
\gamma_s m + c & \text{if otherwise,}
\end{cases}$$  

(4)

where $m_1 = \frac{(1 + \alpha_s)(a - bc)}{\pi(1 + \alpha_s) + \gamma_s (1 + \alpha_s)}$.

The supplier’s utility is given by

$$U_{\alpha_s} = \begin{cases} 
\frac{[(1 + \alpha_s)(a - bc) - (1 + \alpha_s + \alpha_s \gamma_s)bm]^2}{4b(1 + \alpha_s)} & \text{if } m > m_1 \\
\gamma_s m[a - bc - (1 + \gamma_s)bm] & \text{if otherwise.}
\end{cases}$$  

(5)
Case 2. $\gamma_s \pi_r(m) \leq \pi_s(w)$.

If the supplier’s monetary payoff is higher than his equitable payoff, i.e., $\gamma_s \pi_r(m) - \pi_s(w) = (\gamma_s m - w + c)(a - b(w + m)) \leq 0$. Then, the supplier’s optimization problem can be written as

$$\max_{w > 0} (w - c)(a - b(w + m)) - \beta(w - c - \gamma_s m)(a - b(w + m))$$

s.t. $w \geq \gamma_s m + c$ \hspace{1cm} (6)

The supplier’s best response, $w_{\beta_s}$, and maximum utility in the case of advantageous inequality are given by the following:

$$w_{\beta_s} = \begin{cases} \frac{a + bc}{2b} - \frac{(1 + \frac{\gamma_s \beta_s}{1 - \beta_s}) m}{2} & \text{if } m \leq m_2 \\ \gamma_s m + c & \text{if } m > m_2, \end{cases}$$

(7)

where $m_2 = \frac{(1 - \beta_s)(a - bc)}{m - \gamma_s \beta_s + \gamma_s \beta_s}$.

The supplier’s utility is given by

$$U_{\beta_s} = \begin{cases} \frac{(1 - \beta_s)(a - bc) - (1 - \beta_s - \beta_s \gamma_s) bm}{4b_1 - \beta_s} & \text{if } m \leq m_2 \\ \gamma_s m[a - bc - (1 + \gamma_s) bm] & \text{if } m > m_2. \end{cases}$$

(8)

The second step is to give the supplier’s global optimal wholesale price through comparing Case 1 and Case 2. It can be shown that $m_1 > m_2$ always holds and thus we have

$$\begin{cases} U_{\alpha_s} \leq U_{\beta_s} & \text{if } m \leq m_2 \\ U_{\alpha_s} = U_{\beta_s} & \text{if } m_2 < m \leq m_1 \\ U_{\alpha_s} \geq U_{\beta_s} & \text{if } m > m_1. \end{cases}$$

(9)

By this conclusion, the supplier’s optimal wholesale price can be given by

$$w(m) = \begin{cases} \frac{a + bc}{2b} - \frac{(1 + \frac{\gamma_s \beta_s}{1 - \beta_s}) m}{2} & \text{if } m \leq m_2 \\ \gamma_s m + c & \text{if } m_2 < m \leq m_1 \\ \frac{a + bc}{2b} - \frac{(1 - \frac{\gamma_s \alpha_s}{1 + \alpha_s}) m}{2} & \text{if } m > m_1. \end{cases}$$

(10)

3.1.2. The retailer’s decision. Anticipating the supplier’s best response, the dominant retailer will incorporate it into her profit function and sets a markup to maximize his profit. Then, his problem is

$$\max_m \pi_r(m) = m(a - b(w(m) + m)),$$

where $w(m)$ is given in the Equation (10). The analysis of the dominant retailer’s decisions is similar to that for the supplier. First, we determine the most profitable markup for the dominant retailer corresponding to the three wholesale price ranges indicated in Equation (10). Second, we compare the resulting payoffs to determine the global optimal payoff for the dominant retailer. Then, we can obtain the following theorem.

**Theorem 3.1.** Under the complete-trust case, the dominant retailer can coordinate the fair channel, both in terms of achieving the maximum channel profitability and in terms of attaining the maximum channel utility, with a constant markup $m$ if the supplier is sufficiently inequity averse

$$\alpha_s \geq \max\{\frac{\gamma_s - 1}{1 + \gamma_s}, \beta_s\} \text{ and } \frac{1}{1 + \gamma_s} \leq \beta_s \leq 1.$$
The optimal markup and profit are given below

\[ m_t = \begin{cases} 
    m_I & \text{if } 0 < \beta_s < \frac{1 - 2 \gamma_s}{1 + \gamma_s} \text{ and } \\
    m_2 & \text{otherwise} 
\end{cases} \]

\[ \pi_{tr} = \begin{cases} 
    \frac{(a - bc)^2 (1 - \beta_s)}{8(1 - \gamma_s - \gamma_s \beta_s)} & \text{if } 0 < \beta_s < \frac{1 - 2 \gamma_s}{1 + \gamma_s} \\
    \frac{(a - bc)^2 (1 - \gamma_s)}{4(1 - \gamma_s)} & \text{otherwise} 
\end{cases} \]

where \( m_I = (a - bc) (1 - \beta_s) / [2b(1 - \gamma_s)] \).

If the dominant retailer chooses a markup from range \( m_2 < m < m_1 \), then his optimization problem is given by

\[ \max_m m(a - b(w + m)) \]

\[ \text{s.t.} \quad \begin{cases} 
    w = \frac{a + bc}{2b} - (1 + \frac{\gamma \beta_s}{1 - \beta_s}) \frac{m}{2} \\
    m \leq m_2 
\end{cases} \]

The optimal markup price and the dominant retailer’s profit are given below

\[ m_t = \begin{cases} 
    m_2 & \text{if } 0 < \beta_s \leq \frac{1}{1 + \gamma_s} \text{ and } \\
    m_{II} & \text{otherwise} 
\end{cases} \]

\[ \pi_{tr} = \begin{cases} 
    \frac{(a - bc)^2 (1 - \beta_s)}{8(1 - \beta_s - \gamma_s \beta_s)} \frac{\gamma_s}{(1 - \gamma_s)} & \text{if } 0 < \beta_s \leq \frac{1}{1 + \gamma_s} \\
    \frac{(a - bc)^2 (1 - \gamma_s)}{4(1 - \gamma_s)} & \text{otherwise} \end{cases} \]

where \( m_{II} = (a - bc) / [2b(1 + \gamma_s)] \).

If the dominant retailer chooses a markup from range \( m > m_1 \), then his optimization problem is given by

\[ \max_m m(a - b(w + m)) \]

\[ \text{s.t.} \quad \begin{cases} 
    w = \frac{a + bc}{2b} - (1 - \frac{\gamma_s \alpha_s}{1 + \alpha_s}) \frac{m}{2} \\
    m > m_1 
\end{cases} \]

The optimal markup price and the dominant retailer’s profit are given below

\[ m_t = \begin{cases} 
    m_{III} & \text{if } 0 < \alpha_s \leq \frac{2 \gamma_s - 1}{1 + \gamma_s} \text{ and } \\
    m_1 & \text{otherwise} 
\end{cases} \]

\[ \pi_{tr} = \begin{cases} 
    \frac{(a - bc)^2 (1 + \alpha_s)}{8(1 + \alpha_s + \gamma_s \alpha_s)} \frac{\gamma_s}{(1 - \gamma_s)} & \text{if } 0 < \alpha_s \leq \frac{2 \gamma_s - 1}{1 + \gamma_s} \\
    \frac{(a - bc)^2 (1 + \alpha_s)}{4(1 + \gamma_s)} & \text{otherwise} \end{cases} \]

where \( m_{III} = (a - bc) (1 + \alpha_s) / [2b(1 + \alpha_s + \gamma_s \alpha_s)] \).
Therefore, the dominant retailer will compare the resulting payoffs to determine the global optimal payoff. The global optimal markup and profits are given by

\[
\begin{align*}
    m_1^* &= m_{II}, & \pi_{tr}^* &= \frac{(a-b)c(1-\beta_s)}{8\alpha s + \gamma_s}, & \text{if } 0 < \beta_s \leq \frac{1-2\gamma_s}{1+\gamma_s} \text{ and } \alpha_s \geq \beta_s \\
    m_2^* &= m_{II}, & \pi_{tr}^* &= \frac{(a-b)c(1-\beta_s)}{8\alpha s + \gamma_s}, & \text{if } \frac{1-2\gamma_s}{1+\gamma_s} < \beta_s < \frac{1}{1+\gamma_s} \text{ and } \beta_s \leq \alpha_s \leq \tilde{\alpha}_s \\
    m_3^* &= m_{II}, & \pi_{tr}^* &= \frac{(a-b)c(1-\beta_s)}{8\alpha s + \gamma_s}, & \text{if } \frac{1-2\gamma_s}{1+\gamma_s} < \beta_s < \frac{1}{1+\gamma_s} \text{ and } \\
    m_4^* &= m_{II}, & \pi_{tr}^* &= \frac{(a-b)c(1-\beta_s)}{8\alpha s + \gamma_s}, & \text{if } \frac{1-2\gamma_s}{1+\gamma_s} < \beta_s < \frac{1}{1+\gamma_s} \text{ and } \alpha_s \geq \max\{\beta_s, \tilde{\alpha}_s\} \\
    \beta_s &\leq \alpha_s \leq \tilde{\alpha}_s, \\
    \alpha_s &\geq \max\{\beta_s, \tilde{\alpha}_s\} \\
    \tilde{\alpha}_s &= \frac{1-\beta_s-\alpha_s-2\gamma_s}{\beta_s+\gamma_s}, & \text{if } 0 < \beta_s \leq \frac{1-2\gamma_s}{1+\gamma_s} \text{ and } \alpha_s \geq \beta_s \\
    \tilde{\alpha}_s &= \frac{1-\beta_s-\alpha_s-2\gamma_s}{\beta_s+\gamma_s}, & \text{if } \frac{1-2\gamma_s}{1+\gamma_s} < \beta_s < \frac{1}{1+\gamma_s} \text{ and } \beta_s \leq \alpha_s \leq \tilde{\alpha}_s \\
    \tilde{\alpha}_s &= \frac{1-\beta_s-\alpha_s-2\gamma_s}{\beta_s+\gamma_s}, & \text{if } \frac{1-2\gamma_s}{1+\gamma_s} < \beta_s < \frac{1}{1+\gamma_s} \text{ and } \alpha_s \geq \max\{\beta_s, \frac{1}{1+\gamma_s}\} \\
    \tilde{\alpha}_s &= \frac{1-\beta_s-\alpha_s-2\gamma_s}{\beta_s+\gamma_s}, & \text{if } \frac{1-2\gamma_s}{1+\gamma_s} < \beta_s < \frac{1}{1+\gamma_s} \text{ and } \alpha_s \geq \max\{\beta_s, \frac{1}{1+\gamma_s}\} \\
\end{align*}
\]

where $\tilde{\alpha}_s = \frac{1-\beta_s-\alpha_s-2\gamma_s}{\beta_s+\gamma_s}$.

Notice that when $m_1^* = m_{II}$ or $m_2^* = m_{II}$ (if $\beta_s = \frac{1}{1+\gamma_s}$, $m_{II} = m_{II}$), by the Equation (10), we can calculate the supplier’s optimal wholesales price $w_t^* = \gamma_s m_{II} + c$. Then, the retail price

\[p_t = w_t^* + m_t^* = (1 + \gamma_s)m_{II} + c = \frac{a + bc}{2b}\]

equals the channel-profit maximizing retail price $p_t^*$. Therefore, the dominant retailer can select his markup $m_t^* = (a-b)/[2b(1 + \gamma_s)]$ to coordinate the fair supply chain when $\frac{1}{1+\gamma_s} \leq \beta_s < 1$ and $\alpha_s \geq \max\{\beta_s, \frac{1}{1+\gamma_s}\}$. It follows that the supplier’s utility and profit are given by

\[U_{ts}^* = \pi_{tr}^* = \gamma_s (a - bc)^2/(4b(1 + \gamma_s))\]

The dominant retailer is solely profit-maximizing, hence his utility is equivalent to his profit, while the supplier’s utility is less than or equal to his profit due to nonpositive disutility from inequity. Consequently, the centralized channel’s optimal profit is an upper bound on the fair supply chain’s optimal channel utility. When the channel profit is maximized with $m_t^* = m_2$ for $\beta_s = \frac{1}{1+\gamma_s}$ and $\alpha_s \geq \max\{\beta_s, \frac{1}{1+\gamma_s}\}$ and $m_t^* = m_{II}$ for $\frac{1}{1+\gamma_s} \leq \beta_s \leq 1$ and $\alpha_s \geq \max\{\beta_s, \frac{1}{1+\gamma_s}\}$, the supplier will select wholesales price $w_t^* = \gamma_s m_t^* + c$ which provides him the same utility and profit. Then, the supply chain utility, $U_{s}^* = \pi_{tr}^* + U_{ts}^* = \pi_{tr}^* + \pi_{ts}^*$, is also equal to supply chain profit. This means that the channel utility is therefore also maximized when $\frac{1}{1+\gamma_s} \leq \beta_s < 1$ and $\alpha_s \geq \max\{\beta_s, \frac{1}{1+\gamma_s}\}$. □

3.2. Only the dominant retailer has fairness concerns. Just as the fair-minded supplier, when only the dominant retailer cares about fairness, he will maximize a utility function

\[U_{r}(m) = \pi_{r}(m) + f_{r}(m, w),\]

where $f_{r}(m, w) = -\alpha_r(\gamma_r \pi_r(w) - \pi_r(m))^+ - \beta_r(\pi_r(m) - \gamma_r \pi_r(w))^+$ is retailer’s disutility due to inequity, the equitable outcome for the retailer is $\gamma_r$ times the supplier’s profit ($\gamma_r > 0$), $\alpha_r$ and $\beta_r$ are the retailer’s inequity aversion coefficients, satisfying that $\beta_r \leq \alpha_r$ and $0 < \beta_r < 1$.

Since the supplier does not care fairness, his problem is to maximize his profit

\[\pi_s(w) = (w - c)(a - b(w + m)).\]
The dominant retailer’s utility is given by
\[ w^*_b = \frac{a + bc}{2b} - \frac{m}{2}. \]

Substituting \( w^*_b \) into the retailer’s utility function \( \pi_r \). As the utility function is not differentiable everywhere, similar to the above subsection, we derive the retailer’s optimal decision in two steps.

**Case 1.** \( \gamma_r \pi_s(w^*_b) \geq \pi_r(m) \).

If the retailer’s monetary payoff is lower than his equitable payoff, i.e., \( \gamma_r \pi_s(w^*_b) - \pi_r(m) = (\gamma_r(w^*_b - c) - m)(a - b(m + w^*_b)) \geq 0 \), then, the retailer suffers disadvantageous inequality, and his optimization problem is given below
\[
\begin{align*}
\max_{m > 0} & \quad m(a - bc - bm)(1 + \alpha_r) - \frac{\alpha_r \gamma_r(a - bc - bm)^2}{4b} \\
\text{s.t.} & \quad m \leq \frac{\gamma_r(a - bc)}{b(2 + \gamma_r)}
\end{align*}
\]

The optimal markup and the maximum utility for the retailer are given below
\[
m_{\alpha_r} = \begin{cases} 
\frac{(1 + \alpha_r + \alpha_r \gamma_r)(a - bc)}{b(2 + 2\alpha_r + \alpha_r \gamma_r)} & \text{if } \alpha_r \leq \frac{\gamma_r - 2}{\gamma_r + 2} \\
\frac{\gamma_r(a - bc)^2}{3b(2 + \gamma_r)^2} & \text{if otherwise.}
\end{cases}
\]

The dominant retailer’s utility is given by
\[
U_{\alpha_r} = \begin{cases} 
\frac{(1 + \alpha_r)^2(a - bc)^2}{4b(2 + 2\alpha_r + \alpha_r \gamma_r)} & \text{if } \alpha_r \leq \frac{\gamma_r - 2}{\gamma_r + 2} \\
\frac{\gamma_r(a - bc)^2}{3b(2 + \gamma_r)^2} & \text{if otherwise.}
\end{cases}
\]

**Case 2.** \( \gamma_r \pi_s(w^*_b) \leq \pi_r(m) \).

If the retailer’s monetary payoff is higher than his equitable payoff, i.e., \( \gamma_r \pi_s(w^*_b) - \pi_r(m) = (\gamma_r(w^*_b - c) - m)(a - b(m + w^*_b)) \leq 0 \), then, the retailer suffers advantageous inequality, and his optimization problem is given below
\[
\begin{align*}
\max_{m > 0} & \quad m(a - bc - bm)(1 - \beta_r) + \frac{\beta_r \gamma_r(a - bc - bm)^2}{4b} \\
\text{s.t.} & \quad m \geq \frac{\gamma_r(a - bc)}{b(2 + \gamma_r)}
\end{align*}
\]

The optimal markup and the maximum utility for the retailer are given below
\[
m_{\beta_r} = \begin{cases} 
\frac{(1 - \beta_r - \beta_r \gamma_r)(a - bc)}{b(2 - 2\beta_r - \beta_r \gamma_r)} & \text{if } \beta_r \leq \frac{2 - \gamma_r}{\gamma_r + 2} \\
\frac{\gamma_r(a - bc)^2}{b(2 + \gamma_r)^2} & \text{if otherwise.}
\end{cases}
\]

The dominant retailer’s utility is given by
\[
U_{\beta_r} = \begin{cases} 
\frac{(1 - \beta_r)^2(a - bc)^2}{4b(2 - 2\beta_r - \beta_r \gamma_r)} & \text{if } \beta_r \leq \frac{2 - \gamma_r}{\gamma_r + 2} \\
\frac{\gamma_r(a - bc)^2}{b(2 + \gamma_r)^2} & \text{if otherwise.}
\end{cases}
\]

By comparing Case 1 and Case 2, we can give the retailer’s globally optimal markup and utility as follows.
Similarly, if stable suppliers in the long run. But the dominant retailer’s fairness concerns maybe brings him a maximum channel utility, with a constant markup terms of achieving the maximum channel profitability nor in terms of attaining the fairness, then he not only can not coordinate the fair channel, neither in $\gamma_r \geq 2$

Theorem 3.2. Under the complete-c-trust case, if only the dominant retailer cares about fairness, then he not only can not coordinate the fair channel, neither in terms of achieving the maximum channel profitability nor in terms of attaining the maximum channel utility, with a constant markup $m$, but also gets a lower profit than he does not have fairness concerns.

Proof. No matter what markup $m^*_r$ the fair-minded dominant retailer chooses from the Equation (13), the supplier’s optimal wholesale price is given by $w^*_b = \frac{a + bc}{2b} - m^*_r$. If $m^*_r = \frac{(1 - \beta - \bar{\beta} - \gamma_r)(a - bc)}{2(2 - 2\beta - \bar{\beta} - \gamma_r)}$, we can obtain that $w^*_b = \frac{a(1 - \beta) + bc(3 - 3\beta - \bar{\beta} - \gamma_r)}{2b(2 - 2\beta - \bar{\beta} - \gamma_r)}$.

Then, the retail price is $p_r = m^*_r + w^*_b = \frac{a + bc}{2b} + \frac{a(1 - \beta) + \beta \gamma_r}{2b(2 - 2\beta - \bar{\beta} - \gamma_r)} > \frac{a + bc}{2b} = p^*_b$. Similarly, if $m^*_r = \frac{(1 + \alpha_r + \alpha_r \gamma_r)(a - bc)}{2(2 + 2\alpha_r + \alpha_r \gamma_r)}$, the retail price is $p_r = \frac{a + bc}{2b} + \frac{a(1 + \alpha_r) + \alpha_r \gamma_r}{2b(2 + 2\alpha_r + \alpha_r \gamma_r)} > \frac{a + bc}{2b} = p^*_b$; if $m^*_r = \frac{\gamma_r(a - bc)}{2(2 + \gamma_r)}$, the retail price is $p_r = \frac{(1 + \gamma_r) a + bc}{2(2 + \gamma_r)} > \frac{a + bc}{2b} = p^*_b$. Thus, the supply chain cannot achieve coordination.

When the retailer does not care about fairness, his profit is $\pi^*_b = \frac{(a - bc)^2}{8b}$. By the Equation (13), we can verify that $\frac{\gamma_r(a - bc)}{2(2 + \gamma_r)} - \frac{(a - bc)^2}{8b} = \frac{-(2 - \gamma_r)^2(a - bc)^2}{8b(2 + \gamma_r)^2} < 0$. Since $\alpha_r \leq \frac{\gamma_r - 2}{\gamma_r + 2}$, $\gamma_r > 2$, we have $2 + 2\alpha_r - \gamma_r \leq \frac{(1 + \alpha_r)^2(a - bc)}{2(2 + 2\alpha_r + \alpha_r \gamma_r)} < \frac{a - bc}{8b}$. Thus, the dominant retailer gets a lower profit than he does not have fairness concerns.

In the previous literature, researchers did not consider the scenario where only the leader in the Stackelberg game cares about fairness. We fill the gap by considering the dominant retailer has fairness concerns, and find that caring about fairness brings the dominant retailer neither much more monetary benefits nor a coordinated supply chain. But the dominant retailer’s fairness concerns maybe brings him a stable suppliers in the long run.
4. Uncomplete-c-trust case. In this section, we consider the uncomplete-c-trust scenario when only the supplier has fairness concerns.

For the supplier-reported c-value, the retailer may believe the value is inaccurate and does not trust it. We suppose that the dominant retailer perceives the supplier’s real cost is a random variable $x$ uniformly distributed over $[c_l, c_u]$ with c.d.f $F(x)$ and mean $\mu_c$. Here $c \in [c_l, c_u]$. The fair-minded supplier obtains the retailer’s idea, while he still believes his reported $c$ is correct and make his wholesale price based the reported $c$-value. The retailer knows the supplier’s idea too.

Since, the retailer is the dominator in the channel, we assume that the profit function of the centralized system under uncomplete-c-trust case is

$$\pi_{0u}(p) = E_c[(p - c)(a - bp)].$$

Then, we have the optimal selling price of the centralized system is

$$p^*_0 = \frac{a + b\mu_c}{2b}.$$

For the decentralized system, the retailer thinks the market demand is

$$d_c = E_c[a - b(w + m)] = a - b(\int_{c_l}^{c_u} wdF(x) + m).$$

then, his expected profit is

$$\pi_{ur}(m) = m[a - b(\int_{c_l}^{c_u} wdF(x) + m)];$$

the supplier’s profit is

$$\pi_{us}(w) = (w - c)[a - b(\int_{c_l}^{c_u} wdF(x) + m)].$$

We say that the supply chain is coordinated if the selling price under decentralized system equals to $p^*_0$.

Now, we explore the impact of the supplier’s fairness concerns on the channel. The fair-minded supplier’s problem is

$$\max_w U_{us}(w) = \pi_{us}(w) - \alpha_s(\gamma_s\pi_{ur}(m) - \pi_{us}(w))^+ - \beta_s(\pi_{us}(w) - \gamma_s\pi_{ur}(m))^+.$$  

Similar to the complete-c-trust case, we get the supplier’s optimal wholesales price as follows

$$w(m) = \begin{cases} 
\frac{a}{2b} + \frac{2c - \mu}{2} - \left(1 + \frac{\gamma_s}{1 - \beta_s}\right)\frac{m}{2} & \text{if } m \leq m_2 \\
\gamma_s m + c & \text{if } m_2 < m \leq m_1 \\
\frac{a}{2b} + \frac{2c - \mu}{2} - \left(1 - \frac{\gamma_s}{1 + \alpha_s}\right)\frac{m}{2} & \text{if } m > m_1. 
\end{cases}$$

The retailer anticipates the supplier’s best response and incorporates it into her optimization problem, which is given by

$$\pi^*_{ur} = \max_m E_c[\pi_{ur}(m)] = E_c[m(a - b(w(m) + m))].$$

Then, we can obtain the following theorem.

**Theorem 4.1.** Under the uncomplete-c-trust case, if only the supplier cares about fairness, the dominant retailer can not coordinate the fair channel, neither in terms of achieving the maximum channel profitability nor in terms of attaining the maximum channel utility, with a constant markup price $m$. 

Proof. Similar to the proof of the Theorem 3.1, we can derive the dominant retailer’s global optimal payoff as

\[
\begin{align*}
    m^*_u = \tilde{m}_I, & \quad \pi_*^u = \frac{(a-b)c_\alpha^2(1-\bar{\beta})}{8b(1-\bar{\beta}_s-\gamma_\alpha \bar{\beta}_s)} \quad \text{if } 0 < \bar{\beta}_s \leq \frac{1-2\beta_s}{1+\gamma_s} \text{ and } \alpha_s \geq \bar{\beta}_s \\
    m^*_u = \tilde{m}_{II}, & \quad \pi_*^u = \frac{(a-b)c_\alpha^2(1+\alpha_s)}{8b(1+\alpha_s+\gamma_\alpha \alpha_s)} \quad \text{if } \frac{1-2\gamma_s}{1+\gamma_s} < \bar{\beta}_s < \frac{1}{1+\gamma_s} \text{ and } \beta_s \leq \alpha_s \leq \alpha_s \\
    m^*_u = \tilde{m}_2, & \quad \pi_*^u = \frac{(a-b)c_\alpha^2(1-\bar{\beta})\gamma_s}{6b(1-\bar{\beta}_s-\gamma_\alpha \bar{\beta}_s+2\gamma_\alpha \alpha_s)^2} \quad \text{if } \frac{1-2\gamma_s}{1+\gamma_s} < \bar{\beta}_s < \frac{1}{1+\gamma_s} \text{ and } \alpha_s \geq \frac{1}{1+\gamma_s} \\
    m^*_u = \tilde{m}_{III}, & \quad \pi_*^u = \frac{(a-b)c_\alpha^2(1+\alpha_s)}{4b(1+\alpha_s+\gamma_\alpha \alpha_s)} \quad \text{if } \bar{\beta}_s = \frac{1}{1+\gamma_s} \text{ and } \beta_s \leq \alpha_s < \frac{\gamma_s-1}{1+\gamma_s} \\
    m^*_u = \tilde{m}_{III}, & \quad \pi_*^u = \frac{(a-b)c_\alpha^2(1+\alpha_s)}{4b(1+\alpha_s+\gamma_\alpha \alpha_s)} \quad \text{if } \frac{1}{1+\gamma_s} < \bar{\beta}_s < 1 \text{ and } \beta_s \leq \alpha_s < \frac{\gamma_s-1}{1+\gamma_s} \\
    m^*_u = \tilde{m}_2, & \quad \pi_*^u = \frac{(a-b)c_\alpha^2(1+\alpha_s)}{4b(1+\alpha_s+\gamma_\alpha \alpha_s)} \quad \text{if } \frac{1}{1+\gamma_s} < \bar{\beta}_s < 1 \text{ and } \alpha_s \geq \max\{\beta_s, \frac{\gamma_s-1}{1+\gamma_s}\}
\end{align*}
\]  

where \( \tilde{m}_I = (a-b)c_\alpha(1-\bar{\beta}_s)[2b(1-\bar{\beta}_s-\gamma_\alpha \bar{\beta}_s)], \tilde{m}_{II} = (a-b)c_\alpha(1+\alpha_s)[2b(1+\gamma_\alpha \alpha_s)] \) and \( \tilde{m}_2 = \frac{4b(1-\bar{\beta}_s-\gamma_\alpha \bar{\beta}_s+2\gamma_\alpha \alpha_s)}{8b(1-\bar{\beta}_s-\gamma_\alpha \bar{\beta}_s+2\gamma_\alpha \alpha_s)}\).

When the dominant retailer sets his markup as \( m^*_u = \tilde{m}_2 \) for \( \bar{\beta}_s = \frac{1}{1+\gamma_s} \) and \( \alpha_s \geq \max\{\beta_s, \frac{\gamma_s-1}{1+\gamma_s}\} \) or \( m^*_u = \tilde{m}_{III} \) for \( \frac{1}{1+\gamma_s} \leq \bar{\beta}_s \leq 1 \) and \( \alpha_s \geq \max\{\beta_s, \frac{\gamma_s-1}{1+\gamma_s}\} \), the supplier will select wholesales price \( w^*_u = \gamma_s m^*_u + c = (a-b)c_\alpha \gamma_s/[2b(1+\gamma_\alpha \alpha_s)] + c \). Then, the retail price is

\[
p^*_u = w^*_u + m^*_u = \frac{a + bc - b(c - \mu_c)}{2b}.
\]

Since, the supplier-reported \( c \) may not equal to the dominant retailer’s adopted \( \mu_c \), \( p^*_u \) may not equal to \( p^*_I \). This means that the dominant retailer can not coordinate the fair channel with a constant markup \( m \) under uncomplete-c-trust case.

Similarly, we can also verify that the retailer does not coordinate the fair channel when the retailer set \( m^*_u = \tilde{m}_I \) or \( m^*_u = \tilde{m}_{III} \). \( \square \)

The Theorem 3.1 and Theorem 4.1 display that establishing mutual trust between supply chain participants is important. Based on mutual trust, the dominant retailer can use a simple markup pricing contract to coordinate the supply chain with a fair-minded supplier. Once mistrust surfaces in the channel, supply chain coordination based on markup pricing contract no longer exists.

5. Numerical experiments. In this section, numerical experiments are conducted to study the impact of the fairness parameters \( \gamma_i, \alpha_i \) and \( \beta_i, i \in \{s, r\} \) on the retailer’s, the supplier’s and the supply chain’s decision, profit and (or) utility, respectively. We first conduct under the complete-c-trust case and then the uncomplete-c-trust case. We select the base parameters \( a = 500, b = 15 \) and \( c = 10 \). For simplicity, we use DS and CS to represent the decentralized system and centralized system, respectively.

5.1. Complete-c-trust case.

5.1.1. Only the supplier cares about fairness. When only the supplier cares about fairness, let \( \alpha_s = 3 \) and \( \beta_s = 0.8 \), we check the impact of the parameter \( \gamma_s \) on the supply chain.

From the Figure 1 and Figure 2, we find that the supply chain can be coordinated by the retailer through a markup pricing contract under complete-c-trust when only
the supplier has fairness concerns. With the supplier’s equitable ratio $\gamma_s$ increasing, the retailer’s markup and profit decrease, while the supplier’s wholesale price and utility increase. This means that the larger the supplier’s equitable ratio, the higher the supplier’s wholesale price. Facing the supplier’s fairness concerns, the retailer should set a smaller markup, or he may earn a smaller profit if he ignores the supplier’s fairness concerns which can be seen from the Figure 2. The management inspiration of these results is that even if your are the dominator of the channel once your partner has fairness concerns you should pay enough attention, or it will hurt your own profit; in your dealing with partner’s fairness concerns, you should surrender part of your profits in order to pay your partner to avoid suffering further losses due to the partner’s unfairness feel.

Now we let $\gamma_s = 0.8$, and consider the impact of the parameters $\alpha_s$ and $\beta_s$. The Figure 3 and Figure 4 show that once the equitable ratio is given, the change of the parameters $\alpha_s$ has no impact on the players’ decision. The Figure 5 and Figure 6 imply that even if $\beta_s$ is small, facing the retailer’s high required profit margin, the fair-minded supplier will set a higher wholesale price to achieve the outcome fairness $(\gamma_s \pi_r(m) - \pi_s(w) = 0)$. Then the supply chain can be coordinated. These results tell us that because of the unfairness parameters $\alpha > \beta$, the dominated
supplier in order to avoid suffering worst disutility $-\alpha_s(\gamma_s \pi_r(m) - \pi_s(w))$, he will ask a high wholesale, then only the unfairness parameters $\beta$ works. So, in this case the dominant retailer can through set forth his high cost, intense competition et al. to persuade the supplier to become less conservative and give up the high wholesale price strategy.

5.1.2. Only the dominant retailer cares about fairness. When only the retailer cares about fairness, let $\alpha_r = 3$ and $\beta_r = 0.8$, we check the impact of the parameter $\gamma_r$ on the supply chain. From the Figures 7 and 8, we can see that the fair-minded retailer can not coordinate the supply chain through a markup pricing contract, his markup and utility are increasing in his equatable ratio $\gamma_r$. On the contrary, the supplier’s wholesale is decreasing in $\gamma_r$. The Figure 8 also implies that if the retailer does not care about fairness he may earn more profit.

Now we let $\gamma_r = 0.8$, and consider the impact of the parameters $\alpha_r$ and $\beta_r$. Figures 9-12 display that once the equitable ratio is given, the change of the parameters $\alpha_r$ and $\beta_r$ has no impact on the players’ decision. This is because the fair-minded player always tries to avoid unfairness which might results in disutility.
Then, there is no unfairness \( (\gamma_r \pi_s(w) - \pi_r(m) = 0) \), so the parameters \( \alpha_i \) and \( \beta_i \), \( i \in \{s,r\} \), have no impact on the players’ decision. Although the retailer as the dominant of the channel can avoid the unfairness with his power, he also suffers losses. If retailer’s profit losses can help the upstream get much more development space and chance, bring a strong partnership, and promote common development between channel partners, it would still be worth doing.

5.2. Uncomplete-c-trust case. Now, we consider the retailer incompletely trusts the supplier-reported \( c \)-value case. We let \( \mu - c \) represents the retailer’s degree of distrust on supplier-reported \( c \)-value, and explore the impact of degree of distrust on the players’ decision and profit (utility). Let \( \gamma_s = 0.8, \alpha_s = 3 \) and \( \beta_s = 0.8 \).

By the Figure 13, we can see that the retailer can coordinate the supply chain when he trusts supplier’s \( c \)-value, or the coordination fails for the retailer’s distrust on the supplier’s \( c \)-value. The Figure 14 shows that the bigger the distrust, the bigger the gap between the preference of DS and CS. So, this result tell us that it is
not enough to just share information between the channel partners, and they should enhance mutual trust. Trust between the retailer and the supplier is important.

Figure 13. The effect of $\mu$ on prices

Figure 14. The effect of $\mu$ on profit (utility)

6. Conclusions. In this paper, we study supply chain coordination in the presence of fairness concerns assuming a linear demand model under different degrees of trust when only one channel member cares about fairness. Different from many studies assuming a dominant supplier implementing the “supplier-Stackelberg” game, this paper proposes a dominant retailer implementing the “retailer-Stackelberg” game and supposes that there exists different degrees of trust between the channel members. We examine how a dominant retailer should make up his decisions to coordinate the fair channel and maximize his profit or utility. The results show that it is possible for the dominant retailer to design a markup pricing contract to coordinate the channel when only the supplier is concerned about fairness under complete-$c$-trust case; and if only the retailer has fairness concerns, he no longer coordinates the supply chain and obtains a lower profit than without fairness concerns. Under uncomplete-$c$-trust case, the retailer can not coordinates the supply chain even only the supplier cares about fairness.

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REFERENCES
[1] E. Anderson and S. D. Jap, The dark side of close relationships, MIT Sloan Management Review, 46 (2005), 75–82.
[2] Ö. Caliskan-Demirag, Y. F. Chen and J. Li, Channel coordination under fairness concerns and nonlinear demand, European Journal of Operational Research, 207 (2010), 1321–1326.
[3] S. C. Choi, Price competition in a channel structure with a common retailer, Marketing Science, 10 (1991), 271–296.
[4] P. N. Bloom and V. G. Perry, Retailer power and supplier welfare: The case of Wal-Mart, Journal of Retailing, 77 (2001), 379–396.
[5] M. C. Campbell, Perceptions of price unfairness: Antecedents and consequences, Journal of Marketing Research, 36 (1999), 187–199.
[6] K. Chen and T. Xiao, Demand disruption and coordination of the supply chain with a dominant retailer, European Journal of Operational Research, 197 (2009), 225–234.

[7] K. Chen and P. Zhuang, Disruption management for a dominant retailer with constant demand-stimulating service cost, Computers & Industrial Engineering, 61 (2011), 936–946.

[8] T. Y. Choi and Z. Wu, Triads in supply networks: Theorizing buyer-supplier-supplier relationships, Journal of Supply Chain Management, 45 (2009), 8–25.

[9] T. H. Cui, J. S. Raju and Z. J. Zhang, Fairness and channel coordination, Management Science, 53 (2007), 1303–1314.

[10] A. Dukes, T. Geylani and Y. Liu, Dominant retailers’ incentives for product quality in asymmetric distribution channels, Marketing Letters, 25 (2014), 93–107.

[11] G. Ertek and P. M. Griffin, Supplier-and buyer-driven channels in a two-stage supply chain, IIE Transactions, 34 (2002), 691–700.

[12] E. Fehr and K. M. Schmidt, A theory of fairness, competition, and cooperation, The quarterly journal of economics, 114 (1999), 817–868.

[13] A. Georgiades, Wal-Mart Canada, Lego pull apart over price tiff, Wall Street Journal (eastern edition), 2008.

[14] T. Geylani, A. J. Dukes and K. Srinivasan, Strategic manufacturer response to a dominant retailer, Marketing Science, 26 (2007), 164–178.

[15] T. H. Ho, X, Su and Y. Wu, Distributional and peer-induced fairness in supply chain contract design, Production and Operations Management, 23 (2014), 161–175.

[16] G. Iyer and J. M. Villas-Boas, A bargaining theory of distribution channels, Journal of Marketing Research, 40 (2003), 80–100.

[17] D. Kahneman, J. L. Knetsch and R. Thaler, Fairness as a constraint on profit seeking: Entitlements in the marke, The American Economic Review, (1986), 728–741.

[18] S. Kolay and G. Shaffer, Contract design with a dominant retailer and a competitive fringe, Management Science, 59 (2013), 2111–2116.

[19] N. Kumar, L. K. Scheer and J. B. E. M. Steenkamp, The effects of supplier fairness on vulnerable resellers, Journal of Marketing Research, 32 (1995), 54–65.

[20] A. Lau, H. Lau and J. Wang, Pricing and volume discounting for a dominant retailer with uncertain manufacturing cost information, European Journal of Operational Research, 183 (2007), 848–870.

[21] A. Lau, H. Lau and J. Wang, How a dominant retailer might design a purchase contract for a newsvendor-type product with price-sensitive demand, European Journal of Operational Research, 190 (2008), 443–458.

[22] Y. Liu, Y. Huang, Y. Luo and Y. Zhao, How does justice matter in achieving buyer-supplier relationship performance? Journal of Operations Management, 30 (2012), 355–367.

[23] R. Narasimhan, S. Narayanan and R. Srinivasan, An Investigation of Justice in supply chain relationships and their performance impact, Journal of Operations Management, 31 (2013), 236–247.

[24] R. L. Oliver and J. E. Swan, Equity and disconfirmation perceptions as influences on merchant and product satisfaction, Journal of Consumer Research, 16 (1989), 372–383.

[25] K. Pan, K. K. Lai, L. Liang and S. C. H. Leung, Two-period pricing and ordering policy for the dominant retailer in a two-echelon supply chain with demand uncertainty, Omega, 37 (2009), 919–929.

[26] K. Pan, K. K. Lai, S. C. H. Leung and D. Xiao, Revenue-sharing versus wholesale price mechanisms under different channel power structures, European Journal of Operational Research, 203 (2010), 532–538.

[27] V. Pavlov and E. Katok, Fairness and Coordination Failures in Supply Chain Contracts, working paper, 2009.

[28] J. Raju and Z. J. Zhang, Channel coordination in the presence of a dominant retailer, Marketing Science, 24 (2005), 254–262.

[29] C. Rossetti and T. Y. Choi, On the dark side of strategic sourcing: Experiences from the aerospace industry, The Academy of Management Executive, 19 (2005), 46–60.

[30] Y. Shi and J. Zhu, Game-theoretic analysisi for a supply chain with distributional and peer-induced fairness concerned retailers, Management Science and Engineering, 8 (2014), 78–84.

[31] X. Wang and L. Liu, Coordination in a retailer-led supply chain through option contract International Journal of Production Economics, 110 (2007), 115–127.
[32] K. Wang, J. Sun, L. Liang and X. Li, Optimal contracts and the manufacturer’s pricing strategies in a supply chain with an inequity-averse retailer, *Central European Journal of Operations Research*, 24 (2016), 107–125.

[33] J. C. Wang, A. M. Wang and Y. Y. Wang, Markup pricing strategies between a dominant retailer and competitive manufacturers, *Computers & Industrial Engineering*, 64 (2013), 235–246.

[34] R. Yan, C. A. Myers and J. Wang, Price strategy, information sharing, and firm performance in a market channel with a dominant retailer, *Journal of Product & Brand Management*, 21 (2012), 475–485.

[35] J. Yang, J. Xie, X. Deng and H Xiong, Cooperative advertising in a distribution channel with fairness concerns, *European Journal of Operational Research*, 227 (2013), 401–407.

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