Strategic Response to a Powerful Downstream Retailer: Difference-Setting Wholesale Pricing Contract and Partial Forward Integration

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Abstract. We study a supply chain consisted of a supplier and both retailers, and the supplier sells a single product through a dominant retailer and a weak retailer. The aggressive bargaining behavior of the dominant retailer brings the supplier much concern and two feasible strategies are presented to respond to that: difference-setting wholesale pricing contract and integration with the weak retailer. We investigate the decisions of supply chain members under each solution and find that, compared to the traditional form, the supplier always benefits from announcing the difference-setting wholesale pricing contract for it not only raises the marginal wholesale profits of both channels but also reduces the market share of the dominant retailer, thus potentially weakening its channel power. In addition, we show that combining with the weak retailer is not a wise choice for suppliers when the dominant retailer with relatively little bargaining power enjoys a large market share. Finally, by comparing the equilibria of these two solutions, we find that the optimal choice for suppliers depends not only on the difference in market share but also on the dominant retailer's bargaining power in the negotiation.

Keywords: Channel power, bargaining, wholesale-price contract, forward integration

1. Introduction

The problem of channel conflict is not new and widely exists in today's retailing industry, especially when retailers become powerful for them gaining additional market share and operation abilities, just like the example of Procter & Gamble and Wal-Mart's contention for control power around the commodity prices and shelf location in the 1980s (Liu et al. 2015), which has become a classic case of supply chain control. In recent years, the rapidly growing dominance of large retailers has shifted traditional channel incentives for manufacturers and a market oriented toward consumer demand provides the retailers with more authority, thereby increasing their bargaining power and voice in supply chain structures (Wang et al. 2019). For instance, in 2004, Gome, a pow-erful electric appliance store chain, established a so-called "no gross loss" role, which guaranteed that all losses from price cuts would be accepted by manufacturer and no loss would occur. This move goes against Gree's market positioning and leads to strong resistance from Gree. As a result, the two firms ended their collaboration (Pan et al. 2020). As for Wal-Mart, category killers commonly known but labeled with a notorious "hardball" for getting favorable wholesale terms via aggressive negotiating tactics with their suppliers (Facenda 2004, Munson et al. 1999). For example, *Business Week* reported that "One multinational supplier ··· says Wal-Mart buyers in Mexico were 'aggressive and abusive', pulling his product off shelves for several months when he objected to a deep price cut that would have wiped out

his profits" (Smith 2002). Similarly, *Fortune* reported that "[Wal-Mart's] suppliers are expected to offer their best price, period. 'It's not even negotiated anymore,' says ⋯ a consulting company that helps manufacturers sell to big retailers" (Useem et al. 2003).

Those powerful retailers not only take advantage of their channel power to gain an edge in product supply but also employ this competitive advantage to attack weak retailers. In the music industries, some powerful retailers, such as Best Buy, are able to extract an additional 10% discount vis-a-vis other weak purchasers from the major record companies, allowing them to sell new albums at lower prices and thereby grabbing massive amounts of business away from their competitors (Christman 2003). Moreover, the rapid development of e-commerce retail today gradually leads to the low profit margin of many products and some small firms are going out of business. In response, several countries have adopted resale-below-cost (RBC) laws to protect small retailers from excessive competition through below-cost pricing. And the results of Geylani et al. (2007) confirm that when faced with a dominant retailer, hard-pressed manufacturers and nondominant retailers have an incentive to mitigate the power of the dominant retailer.

In fact, the collaboration with the weak retailer is easily manageable and much more reliable compared to the alliance with the dominant one and so a good choice to consider. Besides, manufacturers always have an advantage in decision-making and profit-sharing in collaboration with weak retailers. For the example of Gree, after terminating the partnership with Gome, its performance does not change so much since Gree relies on its own distribution network as the main sales channel, which can maintain the long-term stable and unified price system of Gree air conditioners in the market. Haier also likes to ally with the weak retailers and transforms them into

community stores or franchised shops, in order to lessen the dependence on the dominant channel and establish controllable marketing channels. These weak retailers have little bargaining power and their gross margins are only about 3%-4%. To form the integrated marketing channels of sales & service, Haier provides many supports for the weak retailers, such as free training, wage subsidy, advertising support, and bears most of the work, such as logistics and after-sale services (Zhang et al. 2018).

In order to counter dominant retailers' oppression and exploitation, previous study has shown that manufacturers often provide the weak retailer with assistant such as trade credit or advertising (Wu et al. 2019, Fabbri and Klapper 2016, Geylani et al. 2007). Moreover, supply chain contracts are widely considered as useful and necessary tools to guide and restrict supply chain parties' behaviors (Lu et al. 2019), for example, Su an Mukhopadhyay (2012) design a wholesale-price contract to manage the asymmetric relationships in the distribution network. And the results of Cui et al. (2008) show that in a distribution channel characterized by a dominant retailer, a manufacturer has incentives to price discriminate between the dominant retailer and smaller independents. Therefore, in this paper, a difference-setting wholesale pricing contract designed, under which suppliers are able to set the difference between wholesale prices to protect the weak retailer from being at a huge disadvantage position on the supply side of products, is also expected to limit the negotiation behavior of the dominant retailer. Thereby, one of our main purpose of this article is to explore the effect of such a contract on behaviors and performance of supply chain members.

Based on the above, our distribution model characterizes two salient features of the dominant retailer in today's retailing markets. First, because of their ability to offer consumers effec-

tive promotional services and unprecedented shopping experience, which is unmatched by independents or mom-and-pop stores, dominant retailers command a large market share in nearly every retail industry (Epstein 1994, Zerrillo and Iacobucci 1995). Second, the decision of wholesale price offered to the dominant retailer is linked to the firm's bargaining power.[1] A study conducted by Shi et al. (2013) reveals that the greater the retailer's power is, the lower the corresponding wholesale price is. And other studies find that bargaining power significantly influences the firm's behavior in supply chains (Feng and Lu 2012, Guo and Iyer 2013). However, faced with asymmetric competing retailers, the previous studies always assume that the dominant retailer dictates its wholesale price or the wholesale price is exogenously given (Geylani et al. 2007, Zhang et al. 2018), which does not actually capture the feature of aggressive bargaining by powerful retailers.

In the presence of dominant retailers, to sum up, the supplier can design a beneficial wholesale-price contract or directly integrate with the weak retailer to response for the excessive bargaining behavior of the strong retailer. And the focus of this research is thus to explore the effect of these strategies on supply chain members' behaviors and to derive the optimal strategy for suppliers under different circumstances. Specifically, we pursue three research questions. First, we are going to find out the impact of carrying out a difference-setting wholesale pricing contract on the negotiation process. Under such wholesale contracts, suppliers no longer decide the wholesale terms offered to the weak retailer any more but only make decision about the wholesale-price difference between channels. We shall identify whether the bargaining process is affected by the change of wholesale terms and if happens, how the negotiated price varies and supplier chain members' profits change with

the wholesale contract. Second, we want to explore whether suppliers can always benefit from the integration with the weak retailer. It is commonly known that the merged entity avoids the double marginalization problem and so has a better performance. However, existing researches demonstrate that the choice of suppliers to play the supplier-only role or to encroach on the retailer's operation depends on channel profitability (Yang et al. 2018) and channel efficiency is relevant to the bargaining power (Qing et al. 2017). Therefore, in the face of asymmetric competing retailers, it is unclear whether the alliance with the weak retailer is always profitable, and if not, we wonder how the supplier's selection of distribution strategies changes with bargaining power and market share of the dominant retailer. Third, we want to know that which strategy could be more beneficial for suppliers. Suppliers can make a change in the wholesale terms or merge with the weak channel but he can't do both. There exists a trade-off before suppliers take a step to apply one of these measures and we are eager to know which strategy works better under different conditions.

To examine these research questions, we model a supply chain with a supplier and two asymmetric competing retailers in the base case, where the two retailers sell the same product from a common supplier to compete in the downstream market. Later, in Section 7.1 we consider an extension where products are substitutable. In the aspect of transaction with upstream companies, the dominant retailer has a bargaining power over its offered wholesale price while the weak one doesn't. In response to the aggressive bargaining behavior of the dominant retailer, the supplier can take either way of announcing the difference-setting wholesale pricing contract or combining with the weak channel. The scenario in which suppliers announcing the difference-setting wholesale pricing contract is referred to

as the wholesale-price contract model, and the case in which suppliers opt to integrate with the weak retailer is called as the partial forward integration model. We seek to understand how the strategic moves affect each firm's operational decision and financial performance by analyzing and comparing the equilibriums of different models.

The main insights of our research are summarized as below. First, facing a dominant retailer with bargaining power, the implement of difference-setting wholesale pricing contract always benefits for suppliers. Under such contracts, the wholesale prices of both channels have an increase compared to that under traditional form. Intriguingly, the market share of the weak retailer gets a promotion while the market share of the dominant one gets a reduction, which to some extent, may weaken the voice of dominant retailers in the distribution system. Second, vertical integration with the weak retailer can generate huge revenue for suppliers, but it is not a wise choice when the dominant retailer with a little bargaining power enjoys a large market share. Nevertheless, integration does strengthen suppliers' capital bases, leading to an increase power in negotiation with hardline retailers. Finally, through comparison between different schemes, we find that the implement of wholesale-price contract satisfies a more vigorously competitive market and the effect of vertical integration is more significant in a moderate market.

The reminder of this paper is organized as follows. Section 2 reviews the relevant literature. Section 3 presents the baseline model of traditional distribution with a supplier and two asymmetric competing retailers and identifies the ensuing equilibrium. Section 4 presents the outcome with wholesale-price contract participating and compares the equilibrium between traditional model and wholesale-price contract model to explore the impact of wholesale-price contract on supply chain members' decisions and performance. Section 5 presents the outcome under partial forward integration and compares the results between traditional model and partial forward integration model to determine the consequences of integration. Section 6 discusses the optimal selection of strategies for suppliers. Section 7 extends the analysis to the case of partial substitutes and price competition, and examines their effect on the selection decision. Finally, we draw conclusions and provide suggestions for future studies in Section 8.

2. Literature Review

Our study draws on and reviews three primary streams of the literature: (a) research related to power retailers, (b) suppliers' strategic response to downstream asymmetric relationships and (c) partial forward integration. To be specific, we provide a more detailed review of these three streams in this following.

Ever since retail industries become more powerful and so gradually alter the traditional power structure of the supply chain, strong retailers have attracted plenty of attention from academics. A few studies focus on the issue of channel coordination when facing power retailers. Raju and Zhang (2005) show that such a channel can be coordinated to the benefit of the manufacturer through either quantity discounts or a menu of two-part tariffs. Chen et al. (2019) consider two coordination schedules, linear quantity discount schedule and Groves wholesale price schedule, to regulate the relationship among supply chain's members after demand disruption. Then, many papers are related with the dominance performance of these strong retailers. Jerath et al. (2007) investigate that among market dominance, channel dominance or dual dominance, which strategy the self-interested power retailer should pursue using a game-theoretic model. Lau et al. (2007) examine how a dominant retailer should

operate when his knowledge of the production cost is imperfect. Dukes et al. (2009) confirm that power retailers would strategically reduce its assortment by carrying only the popular variety while simultaneously inducing the rival retailer to carry both the specialty and popular varieties. Pan et al. (2009) construct a two-period model to discuss pricing and ordering problems for a dominant retailer with demand uncertainty in a declining price environment. Differ from the fore-mentioned articles, our point of focus is on the bargaining behavior of powerful retailers on deal with upstream suppliers and to explore what effect this behavior is in a competing environment.

The second stream of research related to our paper is the strategic response of suppliers to deal with downstream asymmetric relationships. Geylani et al. (2007) suggest that a strategic manufacturer can raise the wholesale price for the weak retailer first and then transfer demand to the weak retailer by engaging in joint promotions and advertising. Zhang et al. (2018) indicate that the weak channel always benefits from the alliance with suppliers because of the strengthened channel power and the dominant retailer can take advantage from the alliance when the marginal contribution of goodwill on market demand is relatively high. Wang et al. (2019) show that the supplier's alignment strategies depend on subtle considerations of multiple factors and supplier would rather align with the vulnerable incumbent when fluctuations in terminal market demand are severe, in other words, the supplier does not always benefit from information leakage. Wu et al. (2019) prove that trade credit can be used by the manufacturer as a strategic response to the bargaining power of its dominant retailer. Furthermore, as for supply chain contracts, Su an Mukhopadhyay (2012) propose a dynamic quantity discount contract or a revenue-sharing contract that the manufacturer can use to controlling

power retailer's gray activities and compare the performance under each contract to help the manufacturer make a judicious choice. Cui et al. (2008) show that the manufacturer can use trade promotions to price discriminate between the dominant retailer and smaller independents because trade promotions induce different inventory-ordering behaviors. So far, to the best of our knowledge, although price discrimination is proved efficient in dealing with problems arising in the competing relationship, no one has applied this measure into study about mitigating the dominant retailer's power, especially for bargaining power, which is important to point out since a convention in literature of power retailer is either to assume an exogenous wholesale price or to derive it endogenously using a Stackelberg framework. The negotiation process captures the fact that either firm may possess some power in transaction. Besides, the Nash bargaining framework has been extensively adopted in the field of supply chain management. Feng and Lu (2012) first model firm negotiations in a competitive setting and thereby provide insights into this important trade-off in competing manufacturers' outsourcing decisions. Chen et al. (2019) find that the optimal strategy for coopetition of two rival manufacturers is determined by not only the degree of product substitution but also the inter-firm power relationship in the negotiation of a cooperation contract. However, in this paper, bargaining is characterized to capture the dominant retailers' aggressive behavior due to their well-known store brands or high operational efficiency and we are going to find out strategic solutions for suppliers to mitigate this power.

Finally, our paper is also related to the literature on partial forward integration. Many extant papers focus on supply chain members' decisions under such a setting where the input supplier also plays the role of retail competitor. Arya et al. (2008) show that the vertically inte-

grated producer may set a higher price under Bertrand competition than that under Cournot competition. Yang et al. (2018) study the optimal distribution strategy of a supplier with limited capacity and find that all supply chain members may be beneficial for the supplier's limited capacity at the same time. Qing et al. (2017) consider a monopolistic supplier's capacity-allocation problem under bargaining and characterize the equilibrium decisions under different channel choices. The most related study to our paper is Arya and Mittendorf (2013). They explore how partial forward integration can affect competing firms' strategic investments and find that integration shifts the environment from being one in which firms invest to undercut retail rivals to one in which firms invest more in boosting demand, even that of their competitors. Nevertheless, our research considers the choice of distribution strategy of suppliers in the face of asymmetric competition.

We conduct the study based on the setting of Dukes et al. (2014) that the dominant party enjoys a relative advantage in the negotiation of wholesale terms. And then we try to provide feasible strategies for suppliers to mitigate the power of the dominant retailer. As we reviewed above, channel coordination could be a useful tool when cooperating with dominant retailers, but fail to practice when the dominant party owns too much power and thus becomes unmanageable. So, the point of our presented strategies is more involved in the collaboration with the weak retailer and we are going to figure out how these reactions affect the dominant party's behavior.

3. Traditional Distribution

3.1 The Model

We consider a supply chain consisting of one supplier and two competitive retailers R_i, $i = w, d$ referring to the weak retailer and the dominant retailer respectively. Both the retailers order the product from the supplier for reselling to the downstream market. We assume that the competing retailers engage in a Cournot-typed competition in the end-user market.

Particularly, in alignment with prior studies (e.g., Tang and Kouvelis 2011, Niu et al. 2019), we use the inverse demand function $p_w = a - bQ$ to represent the customer demand for the weak retailer, where p_w denotes the price for the weak retailer's goods, a is the market potential, b represents the quantity sensitivity and $Q = q_w + q_d$ is the total quantities available on the market. In order to capture the dominant retailer's competitive advantage in the downstream market, we assume that the demand for the dominant retailer is $p_d = a - bQ + m$ ($m \geq 0$ and $a \geq m$). As for the explanation of m, Niu et al. (2019) indicate that m could represent the premium perception of the dominant retailer's products from the consumers. Beyond that, m can be also regarded as the extra market demand of the dominant channel or the selling cost of the weak channel (in this case $a + m$ is considered as the original market size for both channel). Whatever the explanation, m characterizes the relative advantage of dominant retailers in channel distribution.

We assume the retailers also differ with respect to the manufacturer's control over the wholesale price. Because the dominant retailer plays a crucial role in the channel distribution of products, he may possess some power in transaction.[2] Following the literature (e.g., nagarajan and Bassok 2008, Chen et al. 2019), we introduce parameter $\theta(0 \leq \theta \leq 1)$ to measure the negotiation power of the dominant retailer. Correspondingly, the negotiation power of the supplier is $1 - \theta$. With extreme negotiation powers, the bargaining over the wholesaling model is equivalent to the standard Stackelberg games. Most importantly, we should specify the profits of the supplier and the dominant retailer under the agreement (denoted as π_s

and π_d, respectively), and the firms' profits of disagreement (denoted as $\overline{\pi}_s$ and $\overline{\pi}_d$, respectively), meaning the negotiation breaks down. As discussed in this subsection, $\overline{\pi}_s$ is the supplier's profit with only weak retailer being the distributor and $\overline{\pi}_d = 0$ since no alternative supplier exists in this model. Therefore, the surplus generated by the cooperative game between the two firms is $(\pi_s + \pi_d) - \overline{\pi}_s$ and the negotiated wholesale price is the solution to the following Nash bargaining problem:

$$\max_{w_d} (\pi_s - \overline{\pi}_s)^{1-\theta} \pi_d^{\theta} \qquad (1)$$

In contrast, the supplier offers a take-it-or-leave-it wholesale price, w_w, to the weak retailer (e.g., Geylani et al. 2007). That is, the retailers are asymmetric in their power to dictate their wholesale costs and in their facing of channel distribution.

A schematic representation of the model is given in Figure 1.

Without loss of generality, we normalize the supplier's production cost to zero. The event sequence is described as follows: First, the supplier simultaneously announces the wholesale price, in which w_w is solely determined by the supplier and w_d is gained through Nash bargaining. Second, based on the wholesale prices provided, both the retail firms choose their product quantities and sell to the end market. Finally, retail demand and firm profits are realized. Given this basis setting, we are going to identify the equilibrium outcomes, profits for each firm, and implications for supplier chain members. The ensuring analysis employs backward induction to identify the (subgame perfect) equilibria.

3.2 Equilibrium

Given the wholesale prices w_w and w_d, respectively, the two retailers are engaged in the Cournot competition. In this model, the weak retailer and the dominant retailer independently and simultaneously determine their production quantities to maximize their profits. The profit functions are given as:

$$\pi_w(q_w) = (a - b(q_w + q_d) - w_w)q_w \qquad (2)$$

$$\pi_d(q_d) = (a - b(q_w + q_d) + m - w_d)q_d \qquad (3)$$

The supplier's profit is the sum of the payment from R_w and R_d. If the agreement with the dominant retailer is not reached, then only the weak retailer acts as the distributor and therefore the supplier's profit is $\overline{\pi}_s = a^2/(8b)$. Under the negotiation, the decision of w_d is related with the negotiation power of the dominant retailer, which is decided by Equation (1), and only the determination of w_w is solely relative to the profit of the supplier:

$$\pi_s(w_w) = w_w q_w + w_d q_d \qquad (4)$$

Using backward induction, the equilibrium solutions and the profits of supply chain members are summarized in Lemma 1. For simplicity of this study, we use superscripts n on the optimums to denote traditional distribution.

Lemma 1 *Under traditional distribution, the order quantities are* $q_w^n = \frac{a-m}{6b}$, $q_d^n = \frac{3a+6m+5(a+2m)\theta+\mu}{12b(3+\theta)}$, *the wholesale prices are* $w_w^n = \frac{6m(1-\theta)+3a(7+\theta)-\mu}{12(3+\theta)}$, $w_d^n = \frac{12a+3m(5-\theta)-\mu}{6(3+\theta)}$, *and the supply chain parties' profits are* $\pi_w^n = \frac{(a-m)^2}{36b}$, $\pi_d^n = \frac{(a(3+5\theta)+2m(3+5\theta)+\mu)^2}{144b(3+\theta)^2}$, $\pi_s^n = \frac{3a^2(5-\theta)(1+\theta)+a(1-\theta)(6m(1+3\theta)+\mu)+2m(1-\theta)(m(3+9\theta)+\mu)}{12b(3+\theta)^2}$, *where* $\mu = \sqrt{3}(a+2m)\sqrt{3+\theta(6+7\theta)}$.

We can obtain from Lemma 1 that q_w^n is irrelevant with θ and q_d^n is increasing with θ (i.e., $dq_d^n/d\theta > 0$), hence the total quantities available in the market arise as θ grows. This means the downstream market competition can be more intense with the dominant retailer becoming powerful, which is beneficial for end consumers because an intensified retail competition will cause a lower selling price. The consumer surplus can be calculated using Equation (5):

$$CS = \int_0^Q (Q - q)\, dq = \frac{Q^2}{2} \qquad (5)$$
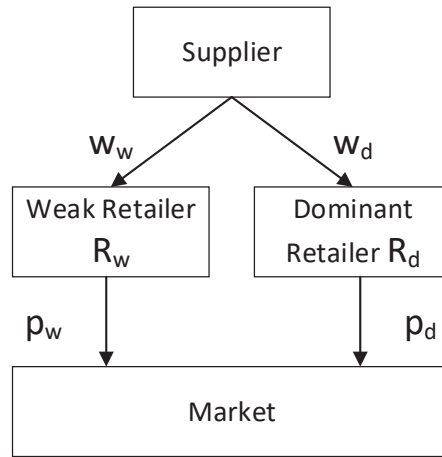
Figure 1 Model Structure with Asymmetric Retailer

The theory behind this phenomenon is that when the supplier owns full control of the source of supply, he maximizes his profit by charging a high wholesale price, which exacerbates the double marginalization effect and distorts the retailer's selling quantity, leading to a reduced total amount of goods in the market. As the negotiating power increases, the wholesale price offered to the dominant retailer is apparently lower than before, which enables the dominant retailer to order more and so raises the output of the supply chain.

Proposition 1 *Under traditional distribution,*

(1) w_w^n *and* w_d^n *are decreasing in* θ;[3]

(2) *the total surplus (i.e.,* $\pi_w^n + \pi_d^n + \pi_s^n + CS^n$*) is increasing in* θ.

Since w_d^n is decreasing in θ, the dominant retailer will order more than before. The supplier's response to the powerful retailer is to lower the wholesale price he offers to the weak retailer as well. The rationale behind is that, with a lower wholesale price, the supplier encourages the weak retailer to sell more products in the downstream market, which, in some extent, discourages the development of the dominant retailer in the marketplace. However, for the weak retailer, since Lemma 1 tells us that both the q_w^n and π_w^n do not change with θ, we know that the weak retailer doesn't in-

crease its order quantity at all and it is also easy to find out that the marginal profit in the weak retail channel doesn't change with θ either.[4] The reason behind this phenomenon is that the weak retailer is at a relative disadvantage in market competition and the marginal benefit of the weak channel has been maximized. Besides, to a certain degree, maintaining the original order volume has provided resistance against the dominance of the powerful retailer in the downstream market.

From Lemma 1 we can tell that π_d^n is increasing in θ (i.e., $d\pi_d^n/d\theta > 0$) and π_s^n is decreasing in θ (i.e., $d\pi_s^n/d\theta < 0$) because the bargaining over wholesale price is indeed a redistribution of the marginal revenue of suppliers. However, as Proposition 1(2) indicates, the total surplus of the supply chain is increasing in θ, which suggests that the total increase of the dominant retailer's profit and consumer surplus outweighs the corresponding loss that the supplier suffers (since π_w^n does not vary with θ). This observation, in some ways, exposes the detriment of letting the supplier enjoys the full wholesale pricing power. Without negotiation, the supplier has incentives to maneuver his operation decisions for its own benefit, which significantly discourages the follower from fully contributing to the supply chain; accordingly, the whole supply chain suffers. Therefore, the emergence of downstream

retail forces breaks the traditional monopoly pattern and brings out a higher supply chain welfare.

Given the equilibrium outcomes and the ensuing analysis on the profits of supply chain members under traditional distribution, we next derive the consequences under wholesale-price contract and partial forward integration.

4. Difference-Setting Wholesale Pricing Contract

4.1 The Model

Under difference-setting wholesale pricing contract, the supplier announces the wholesale contract (w_d, λ) to retailers where w_d is the product wholesale price for the dominant retailer and λ is the price difference promised by the supplier, that is, $(w_d + \lambda)$ is the wholesale price offered to the weak retailer.[5] The original intention of suppliers is to protect the weak retailer from being at a huge disadvantage position in terms of product supply and another reason for this behavior is that with the dominant retailer's bargaining power increases, the supplier faces much more pressure in its business and operation. The wholesale price $(w_d + \lambda)$ set by suppliers to the weak retailer has the dominant retailer considered more in the procession of wholesale price bargaining because the benefit coming from the negotiation process will be good for its rival as well.

The decision-making process is basically the same as the traditional model. First, the supplier publishes the wholesale-price contract (w_d, λ), where w_d is the wholesale price offered to the dominant retailer and $(w_d + \lambda)$ is the wholesale price offered to the weak one; then observing wholesale prices, the two retailers simultaneously decide their selling quantities; finally, demands are realized and full payments from end customers are received by both retailers.

4.2 Equilibrium

As before, the game is solved backwards. Thus, at the retail competition stage, given wholesale prices, each firm chooses its product quantity to maximize its respective profit. The dominant retailer's profit function is same as in Equation (3) and the weak retailer's profit function is shown in Equation (6).

$$\pi_w\left(q_w\right) = \left(a - b\left(q_w + q_d\right) - w_d - \lambda\right)q_w \quad (6)$$

Now the supplier's decision variable is λ and his profit function thus becomes Equation (7) while w_d is still the equilibrium solution satisfying Equation (1) and the supplier's profit of failed agreement is equal to that under traditional model.

$$\pi_s\left(\lambda\right) = \left(w_d + \lambda\right)q_w + w_d q_d \quad (7)$$

Based on the above, we derive the equilibrium solutions and the profits of supply chain members with wholesale-price contract, which are presented in Lemma 2. To be clear, we use superscripts c to reflect the equilibrium under wholesale-price contract model.

Lemma 2 *Under difference-setting wholesale pricing contract, the order quantities are $q_w^c = \frac{a-m}{6b}$, $q_d^c = \frac{3a+6m+a\theta+2m\theta+\eta}{36b-12b\theta}$, the wholesale price difference is $\lambda = \frac{12m(-2+\theta)+3a(-1+\theta)+\eta}{12(3-\theta)}$, the wholesale prices are $w_w^c = w_d^c + \lambda = \frac{6m(-1+\theta)+3a(-7+3\theta)+\eta}{12(-3+\theta)}$, $w_d^c = \frac{6a(-2+\theta)+3m(-5+3\theta)+\eta}{6(-3+\theta)}$, and the supply chain parties' profits are $\pi_w^c = \frac{(a-m)^2}{36b}$, $\pi_d^c = \frac{(a(3+\theta)+2m(3+\theta)+\eta)^2}{144b(-3+\theta)^2}$, $\pi_s^c = \frac{a^2(15-9\theta)-2m(-1+\theta)(3m(1+\theta)+\eta)-a(-1+\theta)(6m(1+\theta)+\eta)}{12b(-3+\theta)^2}$, where $\eta = \sqrt{3}(a+2m)\sqrt{3+\theta^2}$.*

The change of wholesale contract doesn't affect the retailers' behaviors too much. From the outcome of Lemma 2 we can observe that the weak retailer's selling quantity is the same as that of the traditional model, and the selling quantity of the dominant retailer is still increasing with its bargaining power growing (i.e., $dq_d^c/d\theta > 0$), thus, the conclusion of consumer welfare persists.

Proposition 2 *Under difference-setting wholesale pricing contract,*

(1) w_w^c and w_d^c are decreasing in θ;

(2) λ and the total surplus (i.e., $\pi_w^c + \pi_d^c + \pi_s^c + CS^c$) is increasing in θ.

The reaction of suppliers to the dominant retailer is to lower down its competitor's input price as well as he does under traditional distribution. From λ increasing in θ we can infer that the rate at which w_w^c is decreasing is less than the rate at which w_d^c is decreasing. In other words, the bargaining power of the dominant retailer has a greater impact on its own channel. Besides, the performance of this supply chain is still getting better with a more power retailer. Next, what we should do is to compare the equilibrium between the traditional model and the wholesale-price contract model and to focus on the change of supply chain members' behaviors with the wholesale-price contract participating and the economic effect of contract (w_d, λ) on supply chain performance.

4.3 Comparison between Traditional Model and Wholesale-Price Contract Model

Comparing the results of Lemma 1 and Lemma 2, we get Lemma 3:

Proposition 3

(1) The wholesale prices offered to both retailers under wholesale-price contract is always greater than that under traditional distribution, that is, $w_w^c \geq w_w^n$ and $w_d^c \geq w_d^n$;

(2) the selling quantity of the dominant retail channel is lower under wholesale-price contract than that under traditional distribution, that is, $q_d^c \leq q_d^n$; thus, the total quantity is lower under wholesale-price contract than that under traditional distribution;

(3) the supplier is always better off under wholesale-price contract while the dominant retailer hurts from it, that is, $\pi_s^c \geq \pi_s^n$ and $\pi_d^c \leq \pi_d^n$.

Lemma 3(1) indicates that under the same power the dominant retailer possesses, the supplier could get a higher wholesale-price outcome if he offers the difference-setting wholesale pricing contract (w_d, λ), which is surprising because compared to the traditional wholesale-price contract (w_d, w_w), the former doesn't seem to change power structures or decision variables at all (since $w_w = w_d + \lambda$). As we can tell when $\theta = 0$, meaning that the supplier owns full control over the two channels' wholesale pricing, we have $w_w^c = w_w^n$ and $w_d^c = w_d^n$, which is in line with intuition. However, with the bargaining power participating (i.e., $0 < \theta < 1$), the comparison results become different.

The rationale behind this is, in fact, under traditional distribution, from the perspective of decision-making, the dominant retailer's bargaining power only plays a role in the wholesale-price decision of its own channel. However, with the participation of wholesale-price contract (w_d, λ), there is a positive relationship between the two channels' wholesale prices, which makes the dominant retailer get worried because if he gets some reduction on its wholesale price during the negotiation process, his rival in the downstream market could get a discount as well and that may offset his benefit from the product input. Therefore, in the end, through the comparison between the benefit from the reduced input price and the loss from the increased quantity sold by its competitor, the dominant retailer decides to slow down the decline in its own channel's wholesale price, which means that the supplier ultimately gets a higher wholesale-price equilibrium after bargaining than that under traditional distribution. And another explanation is that: since $w_w = (w_d + \lambda)$ is the wholesale price offered to the weak retailer, to some extent, the decision of w_d is relative to the decision of w_w

and the dominant retailer thereby gets some pricing power of the weak channel. In order to make more profits in the downstream competitive market, the dominant retailer deliberately raises its rival's marginal cost to cut down the selling quantity of the weak channel.

The higher wholesale prices are surely beneficial for the supplier. Although the wholesale price offered to the dominant retailer w_d^c is still decreasing, the implement of such wholesale-price contracts (w_d, λ) mitigates the influence of bargaining on pricing and in part weakens the channel power of the dominant retailer. In addition, as Lemma 3(2) specifies, the selling quantity of the dominant retailer is lower than that under traditional model while in both models the weak retailer's selling quantity does not change at all, demonstrating that the market share of the dominant retailer's products has a reduction while the market share of the weak retailer's products gets a promotion. This implies that, like the supplier, the weak retailer also prefers the wholesale-price contract model. Although the profit of the weak retailer is not affected, the increase in firm's market share will improve its product reputation and enhance the competitive advantage.

The wholesale-price contract (w_d, λ) announced to the dominant retailer is more like a way of information disclosure because in the traditional distribution, only the supplier is aware of the wholesale-price setting of each channel[6]. It seems that information disclosure is a good stuff, while for the dominant retailer, there is unnecessary consideration arising during the process of negotiation. Therefore, the wholesale-price contract (w_d, λ) with potential protection can be an effective strategy for suppliers responding to the dominant retailer's bargaining.

As Figure 2 shows, the supplier's profit under wholesale-price contract is always higher than that under traditional model. Another point should be noted is that the difference of

profits is first increasing in θ and then decreasing in θ, which means that, at the beginning, the malicious behavior (that we call vicious competition later) from the dominant retailer is getting worse with his bargaining power increasing, which greatly benefits the supplier. And in the end, when the dominant retailer enjoys the full pricing power of its channel, the best policy for him is to set the wholesale price down to the supplier's base line just as he does under traditional model (the negotiation is going to break down). Accordingly, the effect of vicious competition on supply chain disappears as well.

5. Partial Forward Integration

5.1 The Model

We now consider a variation of the traditional model in which the supplier integrates with the weak retailer (i.e., based on a long-term contract or through acquisitions and mergers).[7] In such environments, the integrant of the supplier and the weak retailer can be both a (vertical) input provider to the dominant retailer while also competing in the (horizontal) market with the same retailer to reach end consumers. In terms of causes of integration, extant work has examined that partial forward integration has brought suppliers many benefits such as better reaching heterogeneous consumers and effectively monitoring independent distributors (e.g., Dutta et al. 1995, Vinhas and Anderson 2005).

For the sake of simplicity, we use subscript I to denote the integrant under partial forward integration, where, obviously, π_I represents the total profit of π_s and π_w, and q_I is the selling quantity of the integrant participating in the downstream competitive market. Individual profit should be specified under the integration case for the sake of comparative analysis later: since the monopoly supplier always has a dominated bargaining power and an absolute advantage over the weak retailer
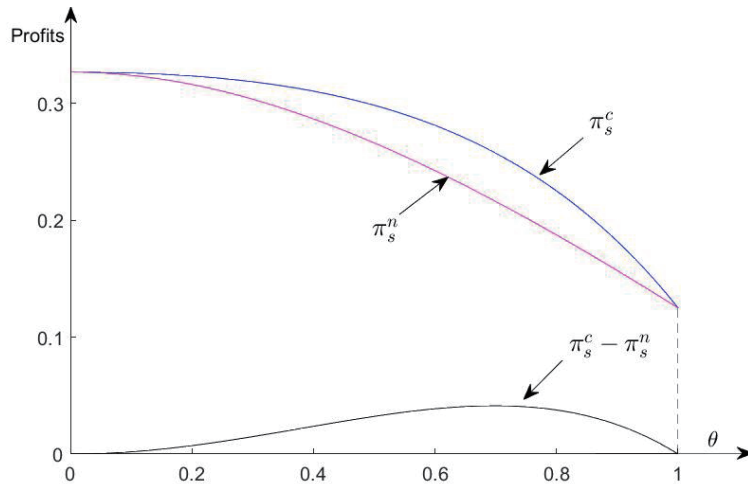
Figure 2 Supplier's Profits under Wholesale-Price Contract and Traditional Model ($a = 1, b = 1, m = 0.6$)

in allocating the allied profit (like the example of Haier mentioned in the introduction, the gross margins of weak retailers are only about 3%-4%), we assume that in this paper the supplier extracts all extra surplus under the integration case, this is to say, the weak retailer earn as much as it does of the traditional case.[8] The timeline is as follows: first the integrant publishes the wholesale price offered to the dominant retailer; then the integrated firm and the dominant retailer participate in the downstream market in the way of Cournot competition.

5.2 Equilibrium

Working backwards in the game, the dominant retailer's quantity choice is to solve its profit function as in Equation (3) as before. The integrated firm is about to make a quantity decision by using the profit function as in Equation (8) now.

$$\pi_I(q_I) = (a - b(q_I + q_d)) q_I + w_d q_d \quad (8)$$

The negotiated wholesale price under partial forward integration solves the following Nash bargaining problem as shown in Equation (9), where $\overline{\pi}_I = a^2/(4b)$ is the integrated firm's profit of failed agreement now. It is easy to tell that under partial forward integration, the firm's profit of no agreement is higher than

that under the previous models because integration does bring economic benefits, which may give the supplier some advantages in the bargaining.

$$\max_{w_d} (\pi_I - \overline{\pi}_I)^{1-\theta} \pi_d^\theta \quad (9)$$

As Equation (8) shows that the integrated firm's profit comes from the following two sources: product supply business and own channel sales. If the integrant deliberately raise the wholesale price to the dominant retailer in order to gain competitive edge in the downstream market, it may backfire on its optimal performance. Hence, the integrant and the dominant retailer have a coopetition relationship, under which the integrated firm need to balance its gains from these two sources. The equilibrium decisions and outcomes are summarized in Lemma 3, where we use superscripts p on the optimums under partial forward integration.

Lemma 3 *Under partial forward integration, the order quantities are* $q_I^p = \frac{5a - 2m(1+\theta)}{10b}$, $q_d^p = \frac{2m(1+\theta)}{5b}$, *the wholesale price is* $w_d^p = \frac{(5a + 4m - 6m\theta)}{10}$, *and the supply chain parties' profits are* $\pi_I^p = \frac{5a^2 - 4m^2(-1+\theta^2)}{20b}$, $\pi_d^p = \frac{4m^2(1+\theta)^2}{25b}$.

Clearly, the wholesale price is reducing with the increase of the dominant retailer's bargaining power, which is the same as that under

traditional distribution. It should be noted that the effect of bargaining power on wholesale price is closely related with m that represents the relative advantage of the strong channel. When $m = 0$, implying that both channels have the same profitability, the integrated firm has no incentives to supply to the dominant one and it is more profitable for him to be the solo seller in the market. Only when $m > 0$ would the firm adopt the dual-channel strategy and the dominant retailer could bargain with the integrated firm over the wholesale price. This partially explains the setting in this model that only the retailer who is in a distinct advantage in the marketplace is able to bargain with the upstream supplier.

The reduction in wholesale price certainly leads to an increase in selling quantity of the dominant retailer under partial forward integration. In consequence, the sales of the integration get down. However, the total amount available in the market is greater as θ grows (i.e., $d(q_I^p + q_d^p)/d\theta > 0$), demonstrating that the amount of products increased in the dominant retail channel exceeds the amount of products reduced in the weak one. Apparently, the rise of dominant retail forces in the downstream market always benefits the consumer in different distribution channel structure.

Proposition 4 *Under partial forward integration, the total surplus (i.e., $\pi_I^p + \pi_d^p + CS^p$) is increasing in θ.*

From Lemma 3 we can easily verify that the dominant retailer's profit is increasing in θ while the integrated firm suffers a loss from the increased negotiation power on the retail side, which is in line with intuition because, under partial forward integration, the integrant plays the both roles of supplying inputs and distributing products. In either role, the company's performance is adversely affected by the strong side. Nevertheless, Proposition 4 demonstrates that the total surplus in supply chain is increasing in θ, the same as π_d^p and

CS^p, suggesting that the sum of increments of the dominant retailer's profit and the welfare the consumer enjoys is outweigh the corresponding reduction in the performance of the integrated firm. These findings imply that standard welfare conclusions continue to be reserved (as they are in the previous models) in the setting of partial forward integration. With the equilibrium outcomes in Lemma 1 and Lemma 3 in tow, we are now in a position to contrast the two regimes and explore the broader strategic and economic effects of partial forward integration for suppliers.

5.3 Comparison between Traditional Model and Partial Forward Integration

Comparing the optimal decisions and profits of supply chain members from Lemma 1 and Lemma 3, we present the results in Lemma 5.

Proposition 5

(1) *There exists a threshold point $\dot{\theta}$, such that, if $0 \leq \theta \leq \dot{\theta}$, the wholesale price offered to the dominant retailer is lower under partial forward integration than that under traditional model, that is, $w_d^p \leq w_d^n$; otherwise, $w_d^p > w_d^n$;*

(2) *the dominant retail channel sales are lower under partial forward integration than that under traditional model, that is, $q_d^p < q_d^n$; the weak retail channel sales are higher under partial forward integration than that under traditional model, that is, $q_I^p > q_w^n$;*

(3) *when $0 \leq m \leq \widetilde{m}$, the supplier always prefers partial forward integration; when $\widetilde{m} < m \leq a$, there exists another threshold point θ^0, such that, if $0 \leq \theta \leq \theta^0$, the supplier prefers traditional model; if $\theta^0 < \theta \leq 1$, the supplier prefers partial forward integration.*

(4) *the dominant retailer always hurts from partial forward integration, that is, $\pi_d^p < \pi_d^n$.*

As Proposition 5(1) indicates, when the bargaining power of the dominant retailer is

small (i.e., $0 \leq \theta \leq \dot{\theta}$), which means the influence of bargaining on pricing is not obvious, the wholesale price offered to the dominant retailer is lower than that under traditional model. This may be confusing since the supply terms are now controlled by its rival and the merger probably charges the dominant retailer a particularly high price for the input in order to limit its competitive strength. However, as our study finds out, it is not the best policy when faced with relatively advantageous distributors in the market. The decrease of wholesale price leads to an increase in strong channel sales and thereby increases the merging party's wholesale profit, which outweighs the loss from the decrease of its retail profit. And what's more surprising is that the decline of wholesale price doesn't bring about an increase of the dominant retail sales because, just as Proposition 5(2) demonstrates, the merging party has a huge increase in the selling quantity because of its distinct advantage over the input cost of products and so the selling quantity of the dominant retailer gets a significant reduction. Therefore, to sum up, the fall in wholesale price offered to the dominant retailer, to some extent, is more likely to partially offset the advantage the retail division of the integrant secures from obtaining the input at cost. But as the bargaining power grows (i.e., $\dot{\theta} < \theta \leq 1$), the dominant retailer gets a higher wholesale price than that of the traditional model, which happens largely because, just as we mentioned before, under partial forward integration, the upstream firm has a stronger financial base (i.e., $\overline{\pi}_I > \overline{\pi}_s$) and this brings the merger more confident in the bargaining process, causing the decrease in w_d^p going slower than the decrease in w_d^n. For instance, when $\theta = 1$, meaning the agreement is going to break down, the wholesaler's final offer under integration is greater than that under traditional model (i.e., $w_d^p|_{\theta=1} > w_d^n|_{\theta=1}$), which proves our point.

As for the effect of integration on the supplier's profit, it becomes a little complicated. As Figure 3 depicts, when m is comparatively small (i.e., $0 \leq m \leq \widetilde{m}$), which means that the profitability of the strong channel is not sufficiently large, partial forward integration brings about a higher performance on suppliers. Interestingly, when the profitability of the dominant channel is high (i.e., $\widetilde{m} < m \leq a$), the suppler prefers the traditional distribution rather than integration in the case of low bargaining power (i.e., $0 \leq \theta \leq \theta^0$). This occurs because, as Proposition 5(1) reveals, with a low bargaining power, the wholesaler would offer the dominant retailer a smaller wholesale price under partial forward integration, which could be viewed as a loss from integration realizing. And when the dominant channel can't earn too much revenue for the supplier, the benefit from integration is much more attractive and outstanding. However, as m grows, the loss from distributing goods through the dominant channel is increasing and eventually overwhelms the benefit that the integration brings about. In the end, the supplier would rather play the supplier-only role. This finding is partially the same like the results of previous study (i.e., Yang et al. 2018, Qing et al. 2017) that facing a highly profitable retail channel, it is better for the supplier to adopt the supplier-only role rather than encroach on the retailer's operation. However, in this paper, we find the conclusion still exists when supplying to asymmetric distributors.

The dominant retailer always hurts from partial forward integration. Although the wholesale price may be lower than that under traditional model, the selling quantity still gets down since his competitor in the downstream market becomes more powerful after integration. Overall, partial forward integration can also be a strategic response to the dominant retailer. However, the supplier should be more prudent because the integration may hurt him-
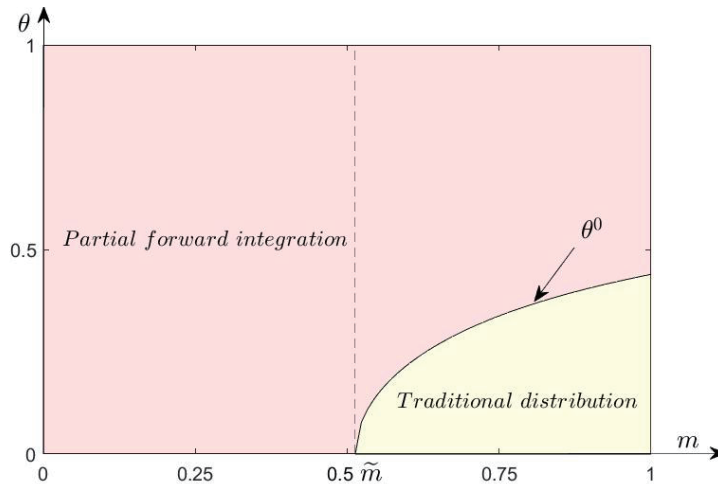
Figure 3 Supplier's Preference between Partial Forward Integration and Traditional Model ($a = 1, b = 1$)

self as well.

6. Optimal Strategy for Suppliers

We have analyzed the effect of wholesale-price contract (w_d, λ) and partial forward integration on the supply chain members' behavior and performance. Either of strategies can be beneficial for suppliers and harmful to the dominant retailer. We are now in a position to choose the better strategy from the perspective of the supplier's profit. Proposition 6 shows the comparative results.

Proposition 6

(1) When $0 \leq m \leq \widetilde{m}$, the supplier always prefers partial forward integration; when $\widetilde{m} < m \leq a$, there exists another threshold point θ^1, such that, if $0 \leq \theta \leq \theta^1$, the supplier prefers wholesale-price contract (w_d, λ); if $\theta^1 < \theta \leq 1$, the supplier prefers partial forward integration;

(2) $\theta^1 \geq \theta^0$.

As Figure 4 illustrates, partial forward integration is always the best policy for suppliers when facing a dominant retailer with comparatively low reputation (i.e., $0 \leq m \leq \widetilde{m}$). When the dominant retailer has a distinct advantage in the downstream market, the supplier's optimal choice varies with the negotiation power

of the dominant retailer. Specifically speaking, if bargaining power is relatively low (i.e., $0 \leq \theta \leq \theta^1$), the wholesale-price contract outperforms partial forward integration; and if bargaining power is large (i.e., $\theta^1 \leq \theta \leq 1$), partial forward integration is more beneficial for suppliers. In fact, the supplier makes a trade-off between the benefit from vicious competition under contract (w_d, λ) and the extra profits made by being a competitive distributor through integration. Then, through the comparison between Figure 3 and 4, we can easily find out that the region of $\theta^0 < \theta \leq \theta^1$ is where the effect of vicious competition is more significant compared to the profits brought by partial forward integration.

Another point that should be noted is when the dominant retailer owns too much negotiation power, partial forward integration is always more profitable for suppliers. The reason behind is too much power over transaction results in the dominant retailer squeezing excessive surplus of suppliers and the main source of suppliers' profit making comes from the weak channel. Since the integrated firm has a better operating efficiency and realizes more revenue, wholesale-contract (w_d, λ) falls behind.
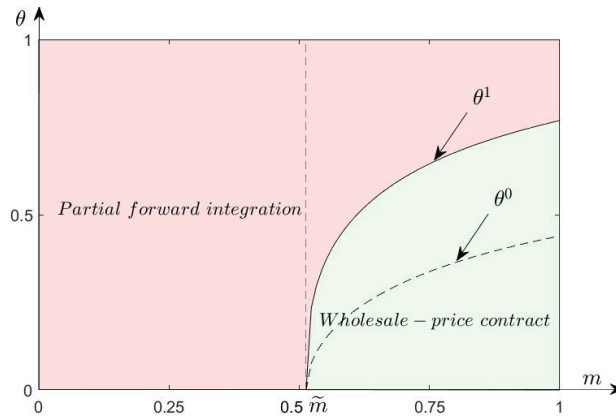
7. Extensions

Figure 4 Supplier's Optimal Choice ($a = 1, b = 1$)

7.1 Imperfect Substitutes

In the previous sections, we assume that both retailers sell the same products. In this subsection, we study the case when products are partially substitutable and then explore the influence of substitutability on supply chain members' behavior and suppliers' optimal strategy selection. For simplicity, we use the demand functions $p_w = 1 - q_w - \beta q_d$ and $p_d = a - q_d - \beta q_w$, where the basic market potential for the weak retailer is set to 1 and $a \in [1, 2]$ represents the dominant retailer having a larger market share than the weak one. $\beta \in [0, 1]$ denotes the product substitutability. If $\beta = 0$, it corresponds to the case of independent products. In contrast, a high value of β corresponds to the case of high degree of substitution, which often leads to more intense market competition (e.g., Wang et al. 2013, Qing et al. 2017). Based on this demand function, the optimal solutions for the three models are provided in Appendix B. The majority of our results in the base case continues to hold and in order to demonstrate on the effect of substitution on suppliers' strategy selection, a numerical example is provided here.

Figure 5 illustrates the supplier's best strategy choice under different setting of β. When $\beta = 1$, as Figure 5a shows, products of both channels are perfectly substitutable and in fact, Figure 5a is exactly the same as Figure 4 since

$a = 1 + m \in [1, 2]$. With β decreasing, the region of partial forward integration apparently expands and the area of wholesale-price contract shrinks. This happens because β describes the intensity of product competition, and the fiercer the competition in product market is, the greater the correlation between channels' wholesale prices. As a result, the effect of wholesale-price contract (w_d, λ) is much more pronounced and the benefit from partial forward integration is largely offset. Consider the case of $\beta = 0$, meaning the two products are completely independent. Since no connection exists between two channels, the announcement of wholesale-price contract (w_d, λ) makes no sense to the supplier, in contrast, the advantage of partial forward integration is maximized. Therefore, to sum up, the implementation of wholesale-price contract satisfies a much more intense market while for products that are not highly substitutable, partial forward integration is more beneficial, nevertheless, when facing retailers owning strong bargaining power, partial forward integration is always a reliable choice.

7.2 Price Competition

Now suppose the two retailers set prices rather than quantities. Following the classical study of Singh and Vives (1984), we adopt the de-

(a) $\beta = 1$ (b) $\beta = 0.8$ (c) $\beta = 0.6$
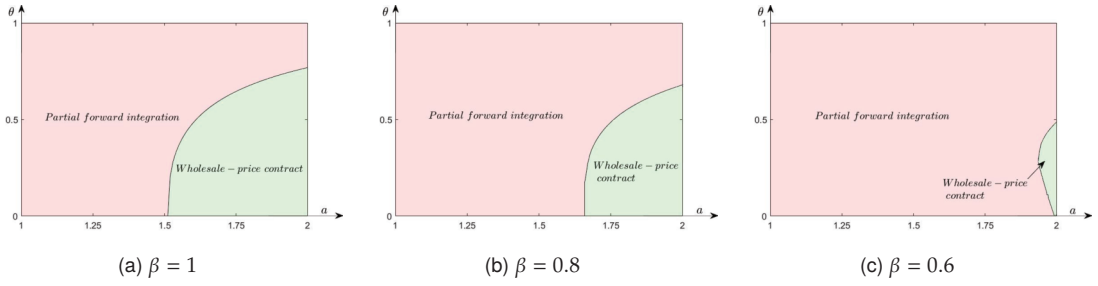
Figure 5 Supplier's Strategy Selection under Different Values of β

mand functions:

$$q_w = \frac{1 - a\beta}{1 - \beta^2} - \frac{1}{1 - \beta^2} p_w + \frac{\beta}{1 - \beta^2} p_w \quad (10)$$

$$q_d = \frac{a - \beta}{1 - \beta^2} - \frac{1}{1 - \beta^2} p_d + \frac{\beta}{1 - \beta^2} p_w \quad (11)$$

Based on the demand function above, the equilibrium decisions and optimal profits of supply chain members can be obtained in Appendix C. Particularly, we illustrate the optimal strategy choice and channel distribution selection of suppliers under price competition in the following proposition.

Proposition 7

(1) If $a > a^0(\beta)$ (or $\beta > \beta^0(a)$), the supplier chooses partial forward integration, but plays the supplier-only role;

(2) if $a^1(\beta, \theta) < a \leq a^0(\beta)$, the supplier makes a trade-off between partial forward integration and wholesale-price contract, but if the supplier chooses integration, he will play the supplier-only role;

(3) if $a \leq a^1(\beta, \theta)$, the supplier's strategic choice is the same as he does under retail quantity competition;

(4) $a^1(\beta, \theta)$ is increasing in θ.

The theory behind Proposition 7(1) is that, facing a dominant retailer commanding a large market share, only when the retail products of the enterprise are more heterogeneous can the weaker retailer gain profits when he participates in the market. Therefore, in the case of

$\beta > \beta^0(a)$ (or $a > a^0(\beta)$ in Figure 6 for a given β), only the dominant retailer acts as a distributor and so the change of wholesale-price contract makes no sense. However, the reason of suppliers still being beneficial from partial forward integration is that the integration raises the earnings of failed agreement of the supplier and therefore provides suppliers with more voice in the negotiation with the dominant retailer. Another point should be noted is that after vertical integration, the supplier can choose not to encroach on the retailer's operations (i.e., $a > a^1(\beta, \theta)$) but he needs to pay the weak retailer the revenue as much as the latter makes under traditional distribution. As depicted in Figure 6, B outlines the decision region in which the supplier prefers vertical integration but chooses to close the weak channel because the elimination of the weak channel increases the retail sales of the dominant channel and so increases the dominant retailer's purchase of the input from the supplier, which outweighs the profits of encroachment. Furthermore, Proposition 7(4) tells us that under vertical integration, whether the supplier encroaches on the retailer's operation partially depends on the dominant retailer's bargaining power. For example, as Figure 6 shows that in the case of $a = 1.5$, the suppliers benefit more from no encroachment when the bargaining power is low, nevertheless, as the bargaining power grows, the supplier chooses to be a competitor of the strong retailer. The reason for this change is that, although the high profitability of the strong channel brings huge revenue to
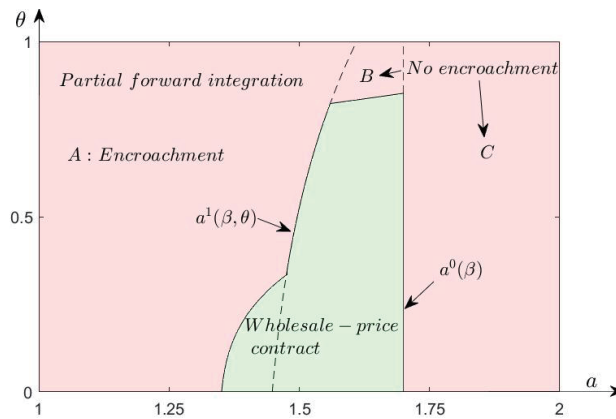
Figure 6 Supplier's Strategy Choice and Channel Distribution Selection under Retail Price Competition ($\beta = 0.8$)

the supplier, the aggressive bargaining behavior of the dominant retailer extracts increasing profits from the products wholesale and finally enforces the supplier to adopt the dual-channel strategy.

In conclusion, under price competition, the supplier decides not only the strategic selection but also the distribution problem and the decisions thus become more delicate and complicated. In fact, when both channels are in operation (i.e., $a \leq a^0(\beta)$), price competition puts more constraints on vertical integration and therefore expands the region of wholesale-price contract outperforming (i.e., $a^1(\beta, \theta) < a \leq a^0(\beta)$). And except for that, the strategic conclusions under price competition are the same as that of quantity competition.

8. Conclusions

Conflicts between retailers and suppliers intensify as retailers gain additional market scales and operation capabilities (Pan et al. 2020). Unexpected concerns have been caused by the dominance of retailers and recently the e-commerce phenomenon, for example, further provokes this question again. This study considers a supply chain with one supplier and two asymmetric retailers. The dominant retailer has additional market share and bargaining power while the weak retailer does not. We provide suppliers to response the domi-

nant retailer with two feasible solutions that are difference-setting wholesale pricing and partial forward integration from the perspective of decision-making and channel control. Each of strategies could be beneficial for suppliers and we further identify the better choice in different situations.

As for wholesale-price contract (w_d, λ), which seems like a way of information disclosure but in fact brings about unnecessary concerns for the dominant retailer, it can be regarded as a valid strategy to weaken the influence of bargaining power of the dominant retailer on wholesale pricing. And moreover, with contract (w_d, λ) publishing, although the performance of the weak retailer does not change, it gains certain advantages to some extent due to the increased market share. In terms of partial forward integration, intuitively, integration is always profitable for suppliers since it eliminates the double marginalization of the weak channel, nevertheless, when facing the dominant retailer with relatively little bargaining power but huge advantages in the competitive market, it is more beneficial for suppliers to adopt the supplier-only role.

Through the comparison between wholesale-price contract (w_d, λ) and partial forward integration, we conclude that suppliers actually make a balance between the

benefits caused by vicious competition under (w_d, λ) contract and the extra profits made by being a competitive distributor through channel integration. When the profitability of the strong channel is relatively low, the effect of channel integration stands out; and in the case of high profitability of the strong channel, the influence from vicious competition is more pronounced. But for the retailers owning too much negotiation power, it is always optimal for suppliers to choose partial forward integration. Furthermore, we extend our model with substitute products and the outcome indicates that the strategy equilibrium of partial forward integration enlarges as the products become independent. This finding reveals that the implement of wholesale-price contract satisfies a much more intense market while the effect of channel integration is significant when product competition is moderate.

This paper is conducted on a monopoly supplier and no other spot market exists, which means that the supplier could charge monopolistic prices to the downstream firms. The powerful supplier leaves the retailer with no choice but only to passively receive the price offer. Vendors like that are more commonly found in the electronic industry in which the upstream owns a full control over a unique and essential product component.[9] As the bargaining behavior of the dominant distributor breaks the balance of revenue allocation between channels, we try to provide feasible strategies for monopoly supplier to maintain his status.

A few concerns may exist about our assumptions that suppliers would extract all extra surplus from integration and suppliers set different prices to retailers. We stress, therefore, that the intent of our research is to provide management insights for supply chain members rather than to advocate legally questionable behavior.

Still, other important questions remain. For example, we suppose that the asymmetric re-

tailers engage in the downstream market, but do not consider that the strong retailer may project its pricing or channel power over other channel members. It would be intriguing to find out the effect of such behaviors on decisions of suppliers and whether the comparative results of this paper still hold. Additionally, products with limited supplier capacity can also be one value future extension.

Acknowledgments

Endnotes

[1] Strong retailers always press the supplier into a very hard position in the process of negotiation due to their unmatchable market share, which is consistently growing by constant acquisitions and mergers, and unique brand values putting their final products into a reliable and prevailing position, although probably more expensive. Despite regulations like Fair Trade Management for Retailers and Suppliers published in China in 2006 aiming to forbid any slotting fee or sales rebate without conditions claimed by retailers, things do not go well owing to ambiguous provisions and unclear enforcement agencies. Furthermore, the point of this assumption is to capture the relative advantage of the dominant retailer, which is consistent with previous literature (Chen 2003) that assumes dominant retailer has more influence over the manufacturer through negotiations, while other retailers get take-it-or leave-it offers.

[2] In this paper, we attribute such power of dominant retailers to their additional market share or brand values. In fact, there are more potential benefits arising for suppliers when they work with dominant retailers. For example, the sheer size of dominant retailers and the velocity at which they sell their inventory allow them to sell large volumes, which helps their suppliers to benefit from scale economies in transaction costs. In addition, sophisticated information technologies of retailers help reach at a better sales prediction and so largely avoid the problem of product restocking or return.

[3] In fact, in a scenario with different market shares, it is the weak retailer who obtains a lower wholesale price in the case of $\theta = 0$. This outcome could be viewed as the original additional assistance to the weak retailer from the supplier, as we demonstrated in the introduction that

suppliers do be willing to give their weak retailers extra help for their operation. There could exist confidentiality agreements between suppliers and retailers to protect their collaboration. And the dominant retailer gets the possibility to know nothing about its rival's terms as long as its offered product price is most favorable comparing to that from other alternative vendors. If we deliberately set $m = 0$ to make $w_w^n > w_d^n$ consistently establish, the supplier will foreclose the dominant channel when integrating with the weak retailer because it is meaningless to keep the strong channel alive. In this sense, the existing of m is the reason why only dominant retailer could bargain with the upstream. Besides, the reader should not interpret our model as a one-for-one match with the Walmart case where strong retailers always get lower wholesale offer and so could charge lower market price. The upstream supplier still holds the status of Steinberg leader. So, the lower or higher wholesale price is the result of the joint action of channel profitability and bargaining process. In fact, this model is more suitable for the electronic industry where the upstream supplier like Samsung offers an essential input and simultaneously faces asymmetric distributors like Apple and other small brands. We are trying to provide feasible strategies for powerful suppliers to mitigate the bargaining power of the dominant distributor.

[4] Since market-dominance behaviors (Jerath et al. 2007) are not considered in this paper, the dominant retailer has not done something like "Always low prices" to attack the weak retailer. Therefore, with only bargaining existing, the conclusion of the weak retailer's performance is tenable.

[5] It should be pointed out that either wholesale contract (w_d, w_w) or (w_d, λ) sets different wholesale prices. Indeed, different wholesale prices are increasingly used in theoretical works to capture the asymmetry among retailers (Wu et al. 2019). While assuming (potentially) different wholesale prices is against the Robinson-Patman act of 1936 in the USA (known as the anti-price discrimination act), this and similar acts in other countries are very hard to obey or to enforce in practice, and some theoretical works (e.g., Jain et al. 2011, Yang et al. 2015) prove that comparing to unified pricing, offering differentiated prices works better for end consumers and the supply chain.

[6] Surely there is no information asymmetry in this paper. The so-called information disclosure policy implemented by the supplier takes place in the negotiation process with the dominant retailer. Under traditional model, the dominant retailer has no information about the value of w_w. While under (w_d, λ) contract model, the dominant retailer gets the correlation of channels' wholesale price, which is exactly disclosed by the supplier's contract implementation. And that's the meaning of disclosure policy involved here.

[7] The acquisition may cause some fixed costs and we normalize the acquisition cost to zero in this paper. The standard conclusion persists with a positive fixed cost.

[8] This assumption is more of the consideration of simplifying our calculation. Since the main research problem of this paper is to compare the supplier's profits of different schemes, a small split of the joint profit to the weak retailer does not really affect our derived conclusions, which could be certainly testable. The game between the supplier and small independent stores under integration can also be played under the bargaining framework, though under which, both the output quantity and the split of the product profit are negotiated. This assumption allows us to conduct equilibrium analysis without assuming any specific contract form, which precludes the associated inefficiency issues (Feng and Lu 2012). And our paper can be viewed as the case in which the supplier has complete bargaining power over vulnerable retailers.

[9] Especially in the past decade, mergers and acquisitions among upstream suppliers have been active in various industries ranging from electronics and semiconductor to personal care products, creating gigantic manufacturing powerhouses focusing on providing production services to downstream enterprises (Feng and Lu 2013).

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