8-2007

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Recommended Citation
Cui, T., Raju, J. S., & Zhang, Z. (2007). Fairness and Channel Coordination. *Management Science, 53* (8), 1303-1314. http://dx.doi.org/10.1287/mnsc.1060.0697

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Keywords
distribution channels, fairness, channel coordination, behavioral economics, retailing and wholesaling, pricing

Disciplines
Advertising and Promotion Management | Business | Business Administration, Management, and Operations | Marketing | Operations and Supply Chain Management | Sales and Merchandising

Fairness and Channel Coordination*

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December 2006

Forthcoming, *Management Science, August 2007*

*We thank Lisa Bolton, Yuxin Chen, Mary Frances Luce, Maurice Schweitzer, and Christophe Van den Bulte for their constructive comments. We also thank the seminar participants at Wharton Applied Economics Summer 2004 Workshops, Berkeley (SICS 2004), University of California at Davis, CMU, Indiana University, NYU, Rutgers University, SUNY-Buffalo, University of Alberta, University of Minnesota, University of Mississippi, Yale University, Harvard Business School, and China International Forum on Marketing Science at Chengdu for their helpful comments.

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Abstract

In this paper, we incorporate the concept of fairness in a conventional dyadic channel to investigate how fairness may affect channel coordination. We show that when channel members are concerned about fairness, the manufacturer can use a simple wholesale price above its marginal cost to coordinate this channel both in terms of achieving the maximum channel profit and in terms of attaining the maximum channel utility. Thus, channel coordination may not require an elaborate pricing contract. A constant wholesale price will do.

(Keyword: Distribution Channels; Fairness; Channel Coordination; Behavioral Economics)

> "Even profit-maximizing firms will have an incentive to act in a manner that is perceived as fair if the individuals with whom they deal are willing to resist unfair transactions and punish unfair firms at some cost to themselves...willingness to enforce fairness is common."
>
> Daniel Kahneman, Jack L. Knetsch, and Richard H. Thaler (1986)

1 Introduction

Our objective in this paper is to examine how firms' concerns about fairness affect the nature of optimal contracts in a marketing channel. There are two main motivations for us to take this initial step. First, research in behavioral economics in the past two decades has shown that "there is a significant incidence of cases in which firms, like individuals, are motivated by concerns of fairness" in business relationships, including channel relationships (Kahneman, Knetsch, and Thaler 1986). Studies in economics and marketing have long documented many cases where fairness plays an important role in developing and maintaining channel relationships (Okun 1981; Frazier 1983; Heide and John 1988,1992; Kaufmann and Stern 1988; Anderson and Weitz 1992; Hackett 1994; Geyskens, Steenkamp, and Kumar 1998; Corsten and Kumar 2003,2005). For instance, through a large scale survey of car dealerships in the US and Netherlands, Kumar, Scheer, and Steenkamp (1995) show convincingly that fairness is a significant determinant of the quality of channel relationships. Subsequent research has also documented many cases where both manufacturers and retailers sacrifice their own margins for the benefit of their counterpart because of fairness concerns (Olmstead and Rhode 1985; Kumar 1996; Scheer, Kumar, and Steenkamp 2003). Indeed, some practitioners go as far as to say that maintaining fairness in a distribution channel "should be the supplier's first concern"(McCarthy 1985). Therefore, fairness concerns are a factor that analytical modelers in marketing may not want to ignore as they strive to develop good descriptive models of channel coordination. Analytical models on channel coordination in the past typically assume that all channel members care only about their monetary payoffs. This focus on monetary payoffs has produced many well-known conclusions. For instance, in a conventional dyadic channel consisting of one manufacturer selling a product to a single retailer at a constant wholesale price, using a price that does not vary with the quantity of purchase results in the well-known problem of "double marginalization" and the channel profit is always sub-optimal. A creative remedy for this problem is for the manufacturer to use quantity discounts (Jeuland and Shugan 1983). Moorthy (1987) shows carefully that other non-linear pricing contracts, such as a two-part tariff, can also coordinate the dyadic channel. However, it is not known if these managerial prescriptions apply to a channel where some or all channel members care about monetary payoffs as well as fairness. It is also unknown if new managerial prescriptions are required when the channel members are fair-minded.

Second, as noted some time ago by Holmstrom and Milgrom (1987), incentive contracts in the real world frequently take simpler forms than what theory often predicts. This can happen because, aside from the cost of writing and implementing an intricate contract, a simple contract may be the optimal one in "a richer real world environment." This can also happen because firms have little to lose using a simpler contract (Raju and Srinivasan 1996). In a channel context, we also observe in some cases that channel transactions are "governed by simple contracts defined only by a per unit wholesale price" (Lariviere and Porteus 2001). Of course, in some cases, channel contracts may only appear simple because the complexity is absorbed by trade promotions and various allowances. However, we believe intriguing to investigate whether the simplicity of the channel contract may also be due to "a richer real world environment" where channel members care about fairness in their transactions.

Past theoretical models have devoted considerable attention to channel issues. McGuire and Staelin (1983), Coughlan (1985), and Coughlan and Wernerfelt (1989), for instance, examine the manufacturers' choice of channel structure. Gerstner and Hess (1995) investigate the channel coordination role of pull promotions and Weng (1995) examines that of quantity discounts from an operations management perspective, all in the context of a dyadic channel. Chu and Desai (1995), Desai and Srinivasan (1995), and Desai (1997) study the mechanisms for channel coordination to achieve customer satisfaction and to align the interests of the franchisor and franchisees in the context of demand uncertainty and heterogeneity. Ingene and Parry (1995a; 1995b; 2000) and Iyer (1998) study channel coordination in a competitive context. More recently, Ho and Zhang (2004) use a reference-dependent approach to study double-marginalization problem in a dyadic channel. We attempt to contribute to this growing body of literature by examining the implications of fairness in a channel context.

As a first step, we shall start with the simplest channel structure—the dyadic channel, and introduce distributive fairness in a parsimonious, tractable way as inequity aversion. The history of the intellectual discourse on distributive fairness can be traced to Plato's *Republic* and Aristotle's *Nichomachean Ethics* (Cohen 1987). In modern times, Adams (1965) saw the relevance of distributive fairness in commercial relationships. Concerns of distributive fairness are not just limited to individuals as economic agents. Researchers in sociology, marketing, psychology, and other disciplines have found that distributive fairness can play an important role in firms' transactions with each other. This is because, as Macneil (1980) argues in advancing a long intellectual tradition (Adams 1963; Adams and Freedman 1976; and Blumstein and Weinstein 1969), the norm of mutuality between parties (*e.g.*, partnering firms) in contracts requires some kind of "evenness" that assures adequate returns to each instead of requiring strict equality when dividing the exchange surplus. This view of commercial relationships is apparently quite influential in marketing as well, as discussed previously.[1]

We first analyze a model where the retailer is fair-minded. Then, we extend our analysis to the case where, instead of merely reacting to the retailer's fairness concerns, the manufacturer also

[1] In more recent years, another intellectual tradition has also joined the force to highlight the importance of fairness in commercial relationships. The famous Ultimatum Game developed by Güth, Schmittberger, and Schwarze (1982) has been repeated in numerous experiments in various settings. Subjects in those experiments, including executive and full-time MBAs, have demonstrated a strong sense of fairness. In other lab experiments, researchers also find that subjects are averse to both disadvantageous and advantageous inequality between themselves and their partners (Loewenstein, Thompson and Bazerman 1989; Hackett 1994).

cares about fairness. For ease of exposition, we define a channel where one or more of its members cares about fairness as a "fair channel".

Our analysis shows that the manufacturer can use a constant wholesale price to align the retailer's interest with the channel's and coordinate the channel with a wholesale price higher than its marginal cost. Said differently, the double marginalization problem does not always arise when the manufacturer uses a simple pricing contract. Through careful analysis, we also identify the mechanism through which a simple wholesale price coordinates the channel. In this regard, we find that the intuition gained from studying a conventional channel where only monetary payoffs matter does not necessarily carry over to the case where channel members care about fairness and indeed, a simpler contract can be optimal in a richer channel environment.

2 Constant Wholesale Price and Channel Coordination

Consider the standard dyadic channel where a single manufacturer sells its product to consumers through a single retailer. For our basic model, we assume that the manufacturer moves first[2] and charges a constant wholesale price w. Then, taking the wholesale price w as given, the retailer sets its price p. For simplicity, we assume that only the manufacturer incurs a unit production cost $c > 0$ in this channel,[3] and the market demand is given by $D(p) = a - bp$, where $b > 0$. This demand specification abstracts away from the issues related to consumer fairness concerns about price *changes* motivated by "fair reasons" (cost factors) vs. "unfair reasons" (demand factors). We will come back to these issues in the conclusion section. The maximally achievable profit for the whole channel is given by $\Pi_c(p^*) = (p^* - c)D(p^*)$ at the channel coordinating retail price $p^* = arg\mathtt{max}\ \Pi_c(p) = \frac{a+bc}{2b}$. It is well-known that as long as all channel members care only about their own monetary payoffs, the manufacturer cannot achieve the maximum channel profit with only a constant wholesale price (Jeuland and Shugan 1983). In that case, as illustrated in Figure 1,

[2]This assumption is innocuous and we come to the same conclusions if we relax this assumption and allow the two channel members to bargain over the wholesale price. Please see Cui (2005).

[3]Here, c is known to the retailer. Although this assumption is limiting, there exist industries, as we will argue in the conclusion, where the cost information is transparent to the retailer.

the manufacturer will optimally choose to set its wholesale price at $\tilde{w} > c$, which will then induce the retailer to charge a price higher than p^* to maximize its own profit, leaving the channel profit suboptimal.

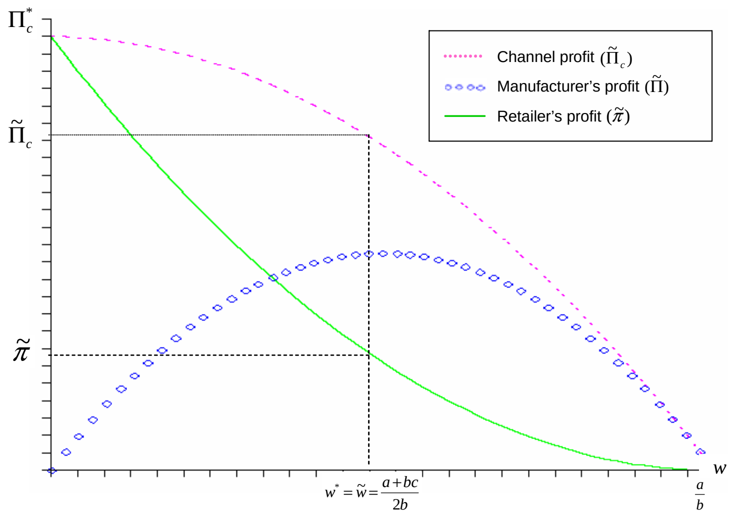

Figure 1: Profits in Conventional Channel

When the retailer also cares about fairness, besides its profitability, it will maximize a utility function $u(w,p)$ that accounts for the retailer's monetary payoff as well as its concern about fairness when setting its price. Later we shall analyze the case where both manufacturer and retailer care about fairness. In general, we can write

$$u(w,p) = \pi(w,p) + f_r(w,p), \tag{2.1}$$

i.e. that the monetary payoff $\pi(w,p) = (p-w)D(p)$ and the disutility due to inequity $f_r(w,p)$ enter the retailer's utility function in an additive form[4]. We can model fairness as inequity aversion *à la* Fehr and Schmidt (1999), such that the retailer is willing to "give up some monetary payoff to move in the direction of more equitable outcomes."

[4]To see that this expression is quite general, let player i's utility be given by $U_i(\mathbf{x}) = \varphi_i(\mathbf{x}, \Pi_i(\mathbf{x}))$, where $\mathbf{x}$ is the vector of all n players' decisions $\{x_1, ..., x_n\}$ and $\Pi_i(\mathbf{x})$ is player i's monetary payoff. This utility function is equivalent to $U_i(\mathbf{x}) = \Pi_i(\mathbf{x}) + \varphi_i(\mathbf{x}, \Pi_i(\mathbf{x})) - \Pi_i(\mathbf{x})$. If we denote $\varphi_i(\mathbf{x}, \Pi_i(\mathbf{x})) - \Pi_i(\mathbf{x})$ as $f_i(\mathbf{x})$, then we have $U_i(\mathbf{x}) = \Pi_i(\mathbf{x}) + f_i(\mathbf{x})$ as in the text.

We assume that the equitable outcome for the retailer is γ times the manufacturer's payoff, or $\gamma\Pi(w,p)$, where $\Pi(w,p) = (w-c)D(p)$. In other words, the retailer's equitable payoff is the payoff it deems deserving relative to the manufacturer's payoff. This specification of the retailer's equitable payoff is also consistent with the past literature on distributive fairness (see Macneil 1980 and Frazier 1983). Here, $\gamma > 0$ broadly captures the channel members' contributions and is exogenous to our model. Presumably, each channel member's equitable payoffs depend on the best outside option available to each. For instance, if the retailer's outside option improves relative to the manufacturer's, γ is expected to increase, and *vice versa*. In addition, anything that may affect a channel member's relative contribution in the channel, either due to demand-side factors or supply-side factors, should also affect γ. For instance, γ can increase if the retailer's marginal costs decrease or the retailer helps the manufacturer to lower its marginal costs.[5]

Thus, if the retailer's monetary payoff is lower than the equitable payoff, a disadvantageous inequality occurs, which will result in a disutility for the retailer in the amount of α per unit difference in the two payoffs. If its monetary payoff is higher than the equitable payoff, an advantageous inequality occurs in the amount of β per unit difference in the payoffs. Algebraically, we have

$$f_r(w,p) = -\alpha\ \texttt{max}\{\gamma\Pi(w,p) - \pi(w,p), 0\} - \beta\ \texttt{max}\{\pi(w,p) - \gamma\Pi(w,p), 0\}. \tag{2.2}$$

Such inequity aversion will motivate the retailer to reduce the disutility from inequity, whichever form it may take, even if the action reduces the retailer's monetary payoff. Past research has shown that "subjects suffer more from inequity that is to their monetary disadvantage than from inequity that is to their monetary advantage" (Fehr and Schmidt 1999). Accordingly, we further assume $\beta \leq \alpha$ and $0 < \beta < 1$. In Table 1, we summarize our model notations for the ease of reference.

Here, it is appropriate to note that the utility function specified in Equation (2.2), analogous to the common practice in the economics literature of specifying a utility function for a group of people or for a society, helps us to capture the retailer's concerns for fairness in a succinct way. The retailer

[5]We thank an anonymous reviewer and the AE for making these suggestions.

only behaves *as if* it has such a utility function. It is also worth noting that distributive fairness has much more substance than a simple mathematic representation here can capture. Nevertheless, we believe that this formulation strikes a reasonable balance between modeling tractability and behavioral complexity.

Table 1: **Variable Definitions**

Notation	Definition
c	manufacturer's marginal production cost
p, w, F	retail price, wholesale price, and manufacturer-charged flat fee
$D(p) = a - bp$	market demand, $b > 0$
π, Π, Π_c	profit functions respectively for retailer, manufacturer and channel
u, U	utility functions for retailer and manufacturer
f_r, f_m	disutility functions for retailer and manufacturer due to inequity
α, α_0	retailer's and manufacturer's disadvantageous inequality parameters
β, β_0	retailer's and manufacturer's advantageous inequality parameters
γ, μ	retailer's and manufacturer's equitable payoff parameters
p^*	channel-coordinating retail price, $p^* = \frac{a+bc}{2b}$

2.1 Retailer's Decisions

Given any wholesale price w, the retailer will choose a retail price p to maximize its utility given by equations (2.1) and (2.2). As the utility function is not differentiable everywhere, we derive the retailer's optimal decision in two steps. First, we derive the retailer's optimal decision conditional on the retailer's monetary payoff being either lower or higher than its equitable payoff. In the former case, *i.e.* $\pi(w,p) - \gamma\Pi(w,p) = (p-w)D(p) - \gamma(w-c)D(p) \leq 0$, the retailer experiences disadvantageous inequality. In the latter case, *i.e.* $\pi(w,p) - \gamma\Pi(w,p) = (p-w)D(p) - \gamma(w-c)D(p) \geq 0$, the retailer experiences advantageous inequality. Second, the optimal solutions from both cases are compared to determine the retailer's global optimal solution.

When the retailer effects disadvantageous inequality, $\pi(w,p) - \gamma\Pi(w,p) = (p-w)D(p) - \gamma(w-c)D(p) \leq 0$ or equivalently $p \leq (1+\gamma)w - \gamma c$, the retailer's optimization problem is given below

$$\max_p \quad (p-w)(a-bp) - \alpha[\gamma(w-c) - (p-w)](a-bp), \tag{2.3}$$

$$s.t. \quad p \le (1+\gamma)w - \gamma c. \tag{2.4}$$

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

$$p_1 = \begin{cases} \frac{(a+bw)(1+\alpha)+\alpha b\gamma(w-c)}{2b(1+\alpha)} & \text{if } w > w_1 \\ (1+\gamma)w - \gamma c & \text{if otherwise} \end{cases} \tag{2.5}$$

where $w_1 = \frac{a+a\alpha+b\alpha\gamma c+2b\gamma c}{b(1+\alpha+\alpha\gamma+2\gamma)}$. The retailer's utility is given by

$$u_1 = \begin{cases} \frac{[(a-bw)(1+\alpha)-\alpha b\gamma(w-c)]^2}{4b(1+\alpha)} & \text{if } w > w_1 \\ \gamma(w-c)[a-bw-b\gamma(w-c)] & \text{if otherwise.} \end{cases} \tag{2.6}$$

Similarly, if the retailer's pricing decision results in advantageous inequality, its monetary payoff is no lower than its equitable payoff, or $\pi(w,p) - \gamma\Pi(w,p) = (p-w)D(p) - \gamma(w-c)D(p) \ge 0$. The retailer's optimization problem becomes

$$\max_p \quad (p-w)(a-bp) - \beta[(p-w)-\gamma(w-c)](a-bp) \tag{2.7}$$

$$s.t. \quad p \ge (1+\gamma)w - \gamma c. \tag{2.8}$$

Define

$$\bar{p}_2 = \frac{(a+bw)(1-\beta)-\beta b\gamma(w-c)}{2b(1-\beta)}, \text{ and } w_2 = \frac{a-a\beta-\beta b\gamma c+2b\gamma c}{b(1-\beta-\beta\gamma+2\gamma)} \tag{2.9}$$

The retailer's optimal price and the maximum utility in the case of advantageous inequality are given by

$$p_2 = \begin{cases} \bar{p}_2 & \text{if } w \le w_2 \\ (1+\gamma)w-\gamma c & \text{if } w > w_2 \end{cases} \quad u_2 = \begin{cases} \frac{[(a-bw)(1-\beta)+\beta b\gamma(w-c)]^2}{4b(1-\beta)} & \text{if } w \le w_2 \\ \gamma(w-c)[a-bw-b\gamma(w-c)] & \text{if } w > w_2. \end{cases} \tag{2.10}$$

As the retailer is in a position to cause either advantageous or disadvantageous inequality, it will choose in a way to maximize its utility. The retailer's optimal decision will depend on whether u_1 in equation (2.6) is larger than u_2 in equation (2.10). It can be shown that $w_1 > w_2$ always holds and thus we have

$$\begin{cases} u_1 \le u_2 & \text{if } w \le w_2 \\ u_1 = u_2 & \text{if } w_2 < w \le w_1 \\ u_1 > u_2 & \text{if } w > w_1 \end{cases} \tag{2.11}$$

This means that for any given w, the retailer's optimal price is given by

$$p(w) = \begin{cases} \frac{a+bw}{2b} - \frac{\beta\gamma(w-c)}{2(1-\beta)} & \text{if } w \leq w_2 \\ w + \gamma(w-c) & \text{if } w_2 < w \leq w_1 \\ \frac{a+bw}{2b} + \frac{\alpha\gamma(w-c)}{2(1+\alpha)} & \text{if } w > w_1 \end{cases} . \tag{2.12}$$

Equation (2.12) reveals something interesting about how the fair-minded retailer makes its pricing decision. At any given w, the price that maximizes the retailer's monetary payoff is given by $\tilde{p} = \frac{a+bw}{2b}$, which is also the optimal price for the retailer if it does not care about fairness. However, because of its fairness concern, the retailer will set a price below $\tilde{p}$ in response to the manufacturer setting a very low wholesale price ($w \leq w_2$). In this case, the prospect of advantageous inequality prompts the retailer to sacrifice its own monetary payoff to reward the manufacturer. In contrast, when the manufacturer charges a very high wholesale price ($w > w_1$), the retailer faces the prospect of disadvantageous inequality if it were to set a price for profit maximization. In this case, the retailer charges a price higher than $\tilde{p}$ and sacrifices its own monetary payoff to punish the manufacturer. When the manufacturer sets an intermediate wholesale price, the retailer will respond by setting a price that achieves the equitable outcome: neither advantageous nor disadvantageous inequality will occur.

2.2 Manufacturer's Decisions

For now we assume that the manufacturer sets its wholesale price w only to maximize its profit $\Pi(w) = (w-c)[a - bp(w)]$ in anticipation of the retailer's reactions through $p(w)$ given in equation (2.12). This assumption allows us to develop some intuition about how fairness shapes channel interactions in a parsimonious manner. We will extend our analysis in Section 3 to the case where the manufacturer also cares about fairness. We simply note here that this extension will not alter our main conclusions, but will yield some additional insights.

Our analysis of the manufacturer's decisions is similar to that for the retailer, proceeding in two steps. First, we determine the most profitable wholesale price for the manufacturer in each

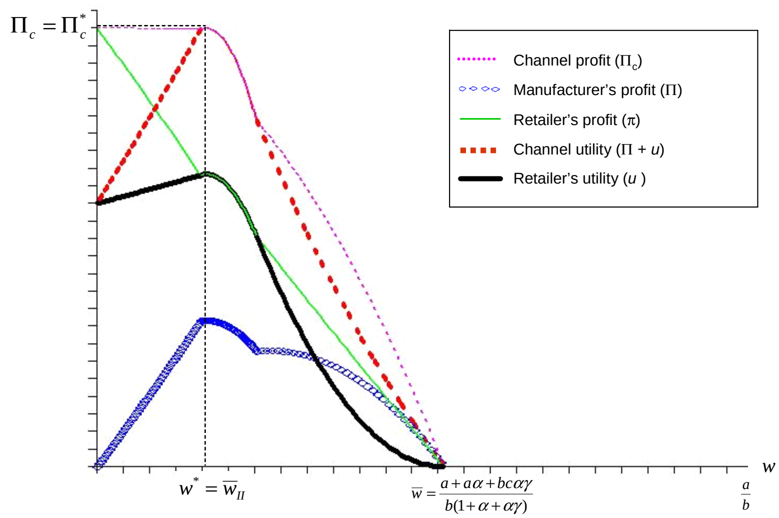

Figure 2: Equilibrium for Fair Channel

of the three price ranges indicated in equation (2.12). Second, we compare the resulting payoffs to determine the globally optimal payoff for the manufacturer. For brevity, we leave the detailed derivations in Technical Appendix A and summarize our results in the following proposition.

Proposition 1 *The manufacturer 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 wholesale price w if the retailer is sufficiently inequity averse ($\alpha \geq$ max $\{\frac{\gamma-1}{1+\gamma}, \beta\}$ and $\beta \geq \frac{1}{1+\gamma}$). The manufacturer achieves channel coordination by setting a wholesale price higher than its marginal cost ($w^* = \frac{a+bc+2b\gamma c}{2b(1+\gamma)}$) and obtains a payoff of $\Pi^* = \frac{(a-bc)^2}{4b(1+\gamma)}$. The retailer sets, in response, its price at p^* and gets a payoff of $\pi^* = u^* = \frac{(a-bc)^2\gamma}{4b(1+\gamma)}$.*

Proposition 1 is illustrated in Figure 2. From Figure 2, we see that fairness concerns on the part of the retailer has introduced considerable nonlinearity in each channel member's payoff function and hence into the payoff function for the whole channel, as compared to the payoff functions for the conventional channel (Figure 1) where fairness concerns are absent. Yet, in equilibrium, the manufacturer's one stone–its wholesale price–kills three "birds."[6] The wholesale price that the

[6]In Figure 2, the channel coordinating conditions $\alpha \geq \texttt{max}\,\{\frac{\gamma-1}{1+\gamma}, \beta\}$ and $\beta \geq \frac{1}{1+\gamma}$ are satisfied.

manufacturer chooses to maximize its own profitability also maximizes the retailer's utility, the channel's profitability, and the channel's total utility defined as the sum of the retailer's utility and manufacturer's profits. In other words, the manufacturer's wholesale price can align all channel members' incentives to the benefit of the channel as a whole such that the double marginalization problem does not occur.

Intuitively, the retailer's concern with fairness introduces two unexpected opportunities for channel coordination. First, inequity aversion on the part of the retailer can exacerbate the problem of double-marginalization, as the retailer may mark-up its price excessively to punish the manufacturer for setting an "unfairly" high wholesale price. However, it can also alleviate the problem when the retailer sacrifices its own margin to reward the manufacturer for a "generous" wholesale price. Under the right condition (*e.g.*, $\beta = \frac{1}{1+\gamma}$), the manufacturer can be motivated by the reward to charge a wholesale price that is sufficiently low, but still above its marginal cost ($w = w_2 = w^*$) to coordinate the channel. Second, when the manufacturer charges some intermediate wholesale price ($w_2 < w \leq w_1$), the fair-minded retailer is better off effecting an equitable outcome where neither advantageous nor disadvantageous inequality occurs and achieving a payoff of $\gamma\Pi$. As a result, the fair-minded retailer voluntarily aligns its interest with the manufacturer's. In this case, as the manufacturer sets its wholesale price at w^* to maximize its profit Π, it also maximizes the retailer's utility and payoff $\gamma\Pi$ as well as the channel profit and utility $(1+\gamma)\Pi$.

Note that when the channel is coordinated, the manufacturer's wholesale price is above its marginal cost. Furthermore, relative to the optimal wholesale price in the corresponding decentralized channel absent of any fairness concerns, *i.e.* $w = \frac{a}{2b} + \frac{c}{2}$, the manufacturer's wholesale price in this fair channel is lower, weighing less heavily on the demand factors ($\frac{a}{b}$), but more on marginal cost (c). Thus, Proposition 1 also suggests that the retailer's fairness concerns have a tendency to depress a channel's wholesale price while encouraging more cost-based pricing.

The main significance of Proposition 1 lies, however, in the observation that channel coordination may not require a very elaborate pricing contract. A constant wholesale price will do, as long as the retailer is fair-minded. This implies that when one observes a constant wholesale price in a channel, it is not an indication that the manufacturer lacks interest in channel coordination or that it may be using some other complex but undisclosed pricing contract. Indeed, a manufacturer may even have a good reason to prefer this simple pricing mechanism, as stated in the following proposition.

Proposition 2 *When a fair channel is coordinated through a constant wholesale price, the retailer perceives no inequity. Therefore, a constant wholesale price as a channel coordination mechanism can help to foster an equitable channel relationship.*

Proposition 2 thus uncovers the lure of a constant wholesale price as a possible pricing in distribution channels. It also highlights the importance of an equitable distribution of channel profits in channel management.

3 Fair-Minded Manufacturer and Retailer

The analysis we have conducted so far is in the spirit of examining whether "profit maximizing-firms will have an incentive to act in a manner that is perceived as fair if the individuals with whom they deal are willing to resist unfair transactions and punish unfair firms at some cost to themselves" (Kahneman, Knetsch, and Thaler 1986). What happens if the manufacturer is also fair-minded? We address that question in this section.

When the manufacturer is also fair-minded, we assume that the manufacturer considers a payoff of $\mu\pi$ as the fair payoff to itself, where $\mu > 0$ is a positive, exogenous parameter analogous to γ in our basic model and π is the retailer's monetary payoff. With its fairness concerns, the manufacturer no longer strives to maximize only its monetary payoff. Its objective is to maximize its utility defined as

$$U(X, p) = \Pi(X, p) + f_m(X, p), \tag{3.1}$$

where X is the manufacturer's decision variable(s) and

$$f_m(X, p) = -\alpha_0 \ \texttt{max}\{\mu\pi(X, p) - \Pi(X, p), 0\} - \beta_0 \ \texttt{max}\{\Pi(X, p) - \mu\pi(X, p), 0\}.$$

For the same reason as in our basic model, we assume $\beta_0 \leq \alpha_0$ and $0 \leq \beta_0 < 1$. Note that our basic model is a special case of the extended model with $\alpha_0 = 0$ and $\beta_0 = 0$.

When both channel members care about fairness, channel interactions become more complex and interesting.[7] In this case, what they each consider as fair is an important barometer for gauging the outcome of channel interactions. On the one hand, the retailer considers a payoff of $\gamma\Pi$ as equitable. This means that the retailer considers $\frac{\gamma}{1+\gamma}\Pi_c$ to be the equitable share of the channel profit for its participation in the channel. On the other hand, the manufacturer considers its own equitable share to be $\frac{\mu}{1+\mu}\Pi_c$. The sum of these two equitable shares is the minimum profit that the channel has to produce in order to satisfy both channel members' desire for an equitable outcome. We refer to this minimum channel profit as the Equity-Capable Channel Payoff (*ECCP*). We have

$$ECCP = \frac{\gamma}{1+\gamma}\Pi_c + \frac{\mu}{1+\mu}\Pi_c = \frac{\mu\gamma + \mu + \gamma + \mu\gamma}{\mu\gamma + \mu + \gamma + 1}\Pi_c. \tag{3.2}$$

In the case where $ECCP > \Pi_c$ for a channel, or $\mu\gamma > 1$, we shall refer to this channel as the *acrimonious channel*. In this channel, the two channel members jointly desire more monetary payoffs than what the channel is capable of producing and hence either upstream or downstream inequity will result regardless of whether the channel is coordinated or how it is coordinated. In the case where $ECCP \leq \Pi_c$ or $\mu\gamma \leq 1$, we shall refer to this channel as the *harmonious channel*. For this channel, an equitable division of channel profits is feasible. We summarize our analysis of the case where the manufacturer only uses a constant wholesale price in the following proposition.

[7] If the manufacturer is the only fair-minded channel member, the resulting channel is closer to the case of the conventional channel. As shown in Cui (2005), if only the manufacturer is fair-minded, the channel can never be coordinated with a constant wholesale price as the double marginalization problem can never be removed. In fact, depending on the magnitude of μ, or what the manufacturer considers to be its equitable payoff, the double marginalization problem may become less or more severe because of the manufacturer's fairness concerns. In other words, the fair-minded manufacturer may not be a blessing to the channel if the manufacturer deems a very high payoff as equitable($\mu > 2$).

Proposition 3 *The manufacturer can use the wholesale price derived in Proposition 1 to coordinate an acrimonious channel, both in terms of maximizing the channel profit and in terms of attaining the maximum channel utility, as long as it is not too averse to its own disadvantageous inequality or* $\alpha_0 \leq \frac{1}{\mu\gamma - 1}$*. It can do the same to coordinate a harmonious channel as long as it is not sufficiently averse to its own advantageous inequality, or* $\beta_0 \leq \frac{1}{1+\mu}$ *if* $\beta = \frac{1}{1+\gamma}$ *and* $\alpha \geq \max\{\frac{\gamma-1}{1+\gamma}, \beta\}$ *and* $\beta_0 < 1$ *if* $\beta > \frac{1}{1+\gamma}$ *and* $\alpha \geq \max\{\frac{\gamma-1}{1+\gamma}, \beta\}$*.*

The detailed analysis and proofs are contained in Technical Appendix B.

Intuitively, when charging a constant wholesale price to coordinate the channel, the manufacturer must rely, as we have discussed before, on the retailer's desire to effect an equitable outcome to align the retailer's interest with the channel's. In turn, this means that the manufacturer must be willing to make some sacrifice and bear any disadvantageous (advantageous) inequity when dealing with the acrimonious (harmonious) channel, since the retailer must not bear any. That is why α_0 (β_0) must be sufficiently small when facing the acrimonious (harmonious) channel.

Propositions 3 suggests that an equitable channel relationship is harder to come by when all channel members are averse to inequity. This outcome may seem counter-intuitive at first, but it is quite plausible upon some reflection. It captures the fact that it is harder to achieve equity when each channel member views equity from their own parochial perspective. In effect, fairness concerns can become a source of friction in channel relationships.

4 Conclusions

In this paper, we take an initial step to incorporate fairness concerns on the part of channel members into analytical methods of channel coordination. Past studies in behavioral economics and in marketing have shown that fairness is an important norm that often motivates and regulates channel relationships, and that fairness concerns on the part of managers from time to time shape and govern their on-going channel interactions. Therefore, it is useful to investigate fairness concerns and to explore their implications for channel coordination.

Our analysis shows that because of fairness concerns, the retailer has an incentive to effect an equitable outcome in channel interactions, and channel coordination can be achieved using a constant wholesale price. Said differently, in a fair channel, the problem of double marginalization need not always be present and maximum channel profit as well as the maximum channel utility can be achieved by a self-interested manufacturer using a constant wholesale price.

Our analysis also shows that an equitable channel relationship may be an exception rather than a norm, especially when all channel members are fair-minded (The range of parameters where the channel is coordinated is smaller). In that case, conflicting fairness standards can be a source of frictions in channel interactions and an inequitable division of channel profits can occur even when the channel is coordinated achieving the maximum channel profits and utility. Thus, our normative analysis puts in perspective the frictions and conflicts commonly observed in the channel context—perhaps they are all the necessary evil associated with pursuing channel coordination!

At this point, curious readers may wonder whether nonlinear contracts such as a two-part tariff or a quantity discount schedule can also coordinate the fair channel. Our analysis in Cui (2005) suggests that they can. However, the manufacturer cannot use either mechanism to take away all of the channel profit. Indeed, the manufacturer may not be able to claim the largest share of the channel profit when the channel is so coordinated. In addition, such nonlinear pricing contracts may not foster channel harmony as inequity inevitably occurs when they are used as channel-coordinating mechanisms.

While we believe that our analysis has generated some useful new insights, it is important to point out some important limitations of our model that future research can investigate further. First, we take for granted that the concerns with fairness displayed by a firm's managers are an "automated," non-strategic behavior. Recent research in neuroeconomics has provided some initial support for this view through functional magnetic resonance imaging (fMRI). Results suggest that "when people feel they're been treated unfairly, a small area called the anterior insula lights up, engendering the same disgust that people get from, say, smelling a skunk," while the prefrontal cortex lights up when "people rationally weigh pros and cons" (BusinessWeek, 2005; and Camerer, *et al*, 2005). However, it can be quite fruitful to look into the process through which such fairness concerns may be formed and manifested in a channel context. Presumably, repeated interactions, which we do not model here, may be conducive to their formation, through punishing any opportunistic behavior.

Second, we do not examine how imperfect information may affect channel interactions in the presence of fairness concerns. For instance, a retailer may not know a manufacturer's costs to know whether it has attained its equitable payoffs.[8] Future research can investigate how robust our conclusions are if such information related assumptions are relaxed. However, it is important to note that in some industries, the retailer can get the manufacturer's cost information. Such is the case, for instance, when the manufacturer supplies a standardized product or a commodity. In that case, competitive offers from manufacturers will reveal to a retailer much cost information. Such is also the case when the retailer engages in the private label business and therefore knows quite a bit about manufacturers' cost structure. Furthermore, we venture to suggest that had the information asymmetry in the channel been introduced, our conclusion would not have been affected in any separating equilibrium where a high (low) cost is represented and believed to be a high (low) cost. What this means is that information asymmetry may further restrict the parameter space but should not qualitatively alter our conclusions.

Third, we analyzed a simple dyadic channel. More research is required to explore the implications of fairness in different channel structures. Finally, our analysis focuses on the implications of fairness concerns by channel players on channel coordination. For that reason, we do not model consumer fairness concerns about *price changes* motivated by either "fair reasons" (cost factors) or "unfair reasons" (Bolton, Warlop and Alba 2003). Future research can incorporate consumer

[8]We thank an anonymous reviewer and the AE for raising this issue.

fairness concerns to explore their implications for channel coordination.[9] We suspect that since the cost to the retailer is the wholesale price from the manufacturer, the double marginalization problem could become worse, once incorporating consumer fairness concerns, as the retailer would have a greater flexibility in marking up on the wholesale price due to the consumer fairness concerns. However, our conclusion should not be qualitatively affected. As we have shown, within a certain wholesale price range, the retailer always wants to achieve the equitable outcome and it does so by setting $p(w) = w + \gamma(w - c)$. What this means is that the retailer's price will only depend on the retailer's cost—the manufacturer's wholesale price. Therefore, the introduction of consumer fairness concerns may not affect our conclusions qualitatively.

Notwithstanding these limitations, we hope that this initial step we have taken will sparkle more interest in pursuing this exciting line of research in the future and motivate researchers to investigate many other aspects of channels and issues that are affected by fairness concerns that we were unable to address here.

[9] We thank an anonymous reviewer for raising this issue.

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Technical Appendix A

Proof of Manufacturer's Decisions for Constant Wholesale Price. When the manufacturer sets a wholesale price w, the retailer will choose $p(w)$ as in equation (2.12). If the manufacturer chooses a wholesale price from range $w \leq w_2$, then the manufacturer's optimization problem is given by

$$\max_w \quad (w-c)(a-bp), \tag{A1}$$

$$s.t. \quad \begin{cases} p = \frac{a+bw}{2b} - \frac{\beta\gamma(w-c)}{2(1-\beta)} \\ w \leq w_2 \end{cases} \tag{A2}$$

The optimal wholesale price and the manufacturer's profit are given below[1]

$$w = \begin{cases} \bar{w}_I & \text{if } 0 < \beta \leq \frac{1-2\gamma}{1+\gamma} \\ w_2 & \text{otherwise} \end{cases} \quad \text{and} \quad \Pi = \begin{cases} \frac{(a-bc)^2(1-\beta)}{8b(1-\beta-\beta\gamma)} & \text{if } 0 < \beta \leq \frac{1-2\gamma}{1+\gamma} \\ \frac{(a-bc)^2(1-\beta)\gamma}{b(1-\beta-\beta\gamma+2\gamma)^2} & \text{otherwise} \end{cases} \tag{A3}$$

where $\bar{w}_I = \frac{(a+bc)(1-\beta)-2\beta b\gamma c}{2b(1-\beta-\beta\gamma)}$.

If the manufacturer chooses a wholesale price from range $w_2 < w \leq w_1$, then the manufacturer's optimization problem is given by

$$\max_w \quad (w-c)(a-bp), \tag{A4}$$

$$s.t. \quad \begin{cases} p = w + \gamma(w-c) \\ w > w_2 \\ w \leq w_1 \end{cases} \tag{A5}$$

The optimal wholesale price and the manufacturer's profit are given below

$$w = \begin{cases} w_2 & \text{if } 0 < \beta \leq \frac{1}{1+\gamma} \\ \bar{w}_{II} & \text{otherwise} \end{cases} \quad \text{and} \quad \Pi = \begin{cases} \frac{(a-bc)^2(1-\beta)\gamma}{b(1-\beta-\beta\gamma+2\gamma)^2} & \text{if } 0 < \beta \leq \frac{1}{1+\gamma} \\ \frac{(a-bc)^2}{4b(1+\gamma)} & \text{otherwise} \end{cases} \tag{A6}$$

where $\bar{w}_{II} = \frac{a+bc+2b\gamma c}{2b(1+\gamma)}$.

If the manufacturer chooses a wholesale price from range $w > w_1$, then the manufacturer's optimization problem is given by

$$\max_w \quad (w-c)(a-bp), \tag{A7}$$

$$s.t. \quad \begin{cases} p = \frac{a+bw}{2b} + \frac{\alpha\gamma(w-c)}{2(1+\alpha)} \\ w > w_1 \end{cases} \tag{A8}$$

The optimal wholesale price and the manufacturer's profit are given below

$$w = \begin{cases} \bar{w}_{III} & \text{if } 0 < \alpha \leq \frac{2\gamma-1}{1+\gamma} \\ w_1 & \text{otherwise} \end{cases} \quad \text{and} \quad \Pi = \begin{cases} \frac{(a-bc)^2(1+\alpha)}{8b(1+\alpha+\alpha\gamma)} & \text{if } 0 < \alpha \leq \frac{2\gamma-1}{1+\gamma} \\ \frac{(a-bc)^2(1+\alpha)\gamma}{b(1+\alpha+\alpha\gamma+2\gamma)^2} & \text{otherwise} \end{cases} \tag{A9}$$

where $\bar{w}_{III} = \frac{(a+bc)(1+\alpha)+2\alpha b\gamma c}{2b(1+\alpha+\alpha\gamma)}$.

[1] Note equation (A1) is not concave for some parametric values.

Therefore, the manufacturer will compare the resulting payoffs to determine the globally optimal payoff. The globally optimal wholesale price and profits are given by

$$\begin{cases} w^* = \bar{w}_I,\ \Pi^* = \frac{(a-bc)^2(1-\beta)}{8b(1-\beta-\beta\gamma)} & \text{if } 0 < \beta \le \frac{1-2\gamma}{1+\gamma} \text{ and } \alpha \ge \beta \\ w^* = \bar{w}_{III},\ \Pi^* = \frac{(a-bc)^2(1+\alpha)}{8b(1+\alpha+\alpha\gamma)} & \text{if } \frac{1-2\gamma}{1+\gamma} < \beta < \frac{1}{1+\gamma} \text{ and } \beta \le \alpha < \bar{\alpha} \\ w^* = w_2,\ \Pi^* = \frac{(a-bc)^2(1-\beta)\gamma}{b(1-\beta-\beta\gamma+2\gamma)^2} & \text{if } \frac{1-2\gamma}{1+\gamma} < \beta < \frac{1}{1+\gamma} \text{ and } \alpha \ge \mathtt{max}\{\bar{\alpha}, \beta\} \\ w^* = \bar{w}_{III},\ \Pi^* = \frac{(a-bc)^2(1+\alpha)}{8b(1+\alpha+\alpha\gamma)} & \text{if } \beta = \frac{1}{1+\gamma} \text{ and } \beta \le \alpha < \frac{\gamma-1}{1+\gamma} \\ w^* = w_2,\ \Pi^* = \frac{(a-bc)^2}{4b(1+\gamma)} & \text{if } \beta = \frac{1}{1+\gamma} \text{ and } \alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\} \\ w^* = \bar{w}_{III},\ \Pi^* = \frac{(a-bc)^2(1+\alpha)}{8b(1+\alpha+\alpha\gamma)} & \text{if } \frac{1}{1+\gamma} < \beta < 1 \text{ and } \beta \le \alpha < \frac{\gamma-1}{1+\gamma} \\ w^* = \bar{w}_{II},\ \Pi^* = \frac{(a-bc)^2}{4b(1+\gamma)} & \text{if } \frac{1}{1+\gamma} < \beta < 1 \text{ and } \alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\} \end{cases} \tag{A10}$$

where $\bar{\alpha} = \frac{(1-\beta-\beta\gamma-2\gamma)^2-8\beta\gamma^2}{8\gamma^2-(1-\beta-\beta\gamma-2\gamma)^2}$. It is straightforward to calculate the retailer's utility and profits, given equations (A10) and (2.12). Furthermore, the retail price equals the channel-profit maximizing retail price $p = p^* = \frac{a+bc}{2b}$ in the fifth and seventh cases in equation (A10), *i.e.*, $\beta \ge \frac{1}{1+\gamma}$ and $\alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$. In both cases the retailer's utility and profit are given by $\pi^* = u^* = \frac{(a-bc)^2\gamma}{4b(1+\gamma)}$. Since inequity always brings disutility to a fair-minded retailer as in equation (2.2), channel utility is always no greater than channel profit. When the channel profit is maximized with $w^* = w_2$ for $\beta = \frac{1}{1+\gamma}$ and $\alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$ and with $w^* = \bar{w}_{II}$ for $\frac{1}{1+\gamma} < \beta < 1$ and $\alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$, the channel utility, $U_c = \Pi + u$, is equal to channel profit since the retailer will set retail price at $p = w+\gamma(w-c)$. The channel utility is therefore also maximized for $\beta \ge \frac{1}{1+\gamma}$ and $\alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$.

Technical Appendix B

Proof for Proposition 3

Since the retailer makes decisions solely based on wholesale price w, the retailer's decisions are still given by

$$p(w) = \begin{cases} \bar{p}_2 = \frac{a+bw}{2b} - \frac{\beta\gamma(w-c)}{2(1-\beta)} & \text{if } w \le w_2 \\ p_0 = w + \gamma(w-c) & \text{if } w_2 < w \le w_1 \\ \bar{p}_1 = \frac{a+bw}{2b} + \frac{\alpha\gamma(w-c)}{2(1+\alpha)} & \text{if } w > w_1 \end{cases} \tag{B1}$$

which is same as equation (2.12).

Proposition 1 shows that the players will choose the channel-coordinating actions for $\beta \ge \frac{1}{1+\gamma}$ and $\alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$ when only the retailer cares about fairness, i.e., $\alpha_0 = \beta_0 = 0$. More specifically, the manufacturer will choose $w = w_2 = \frac{a-a\beta-\beta b\gamma c+2b\gamma c}{b(1-\beta-\beta\gamma+2\gamma)}$ for $\beta = \frac{1}{1+\gamma}$ and $\alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$ and choose $w = \bar{w}_{II} = \frac{a+bc+2b\gamma c}{2b(1+\gamma)}$ for $\beta > \frac{1}{1+\gamma}$ and $\alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$, and the retailer will choose $p = p^*$. We will check whether the current wholesale price is still optimal for the manufacturer when the manufacturer cares about fairness.

(a) $\beta = \frac{1}{1+\gamma}$ **and** $\alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$**.**

When $\beta = \frac{1}{1+\gamma}$ and $\alpha \ge \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$, the manufacturer will choose $w = w_2$ in the scenario of $w \le w_2$ if it does not care about fairness and the retailer will choose $p = \bar{p}_2 = \frac{a+bw}{2b} - \frac{\beta\gamma(w-c)}{2(1-\beta)}$ as shown in equation (2.12). At the point of $w = w_2 = \frac{a-a\beta-\beta b\gamma c+2b\gamma c}{b(1-\beta-\beta\gamma+2\gamma)} = \frac{a+bc+2b\gamma c}{2b(1+\gamma)}$, we have

$$\mu(\bar{p}_2 - w) - (w - c) = \frac{(a-bc)(\mu\gamma-1)}{2b(1+\gamma)} \begin{cases} > 0 & \text{if } \mu\gamma > 1 \\ \leq 0 & \text{if } \mu\gamma \leq 1 \end{cases} \tag{B2}$$

Case 1. Acrimonious channel: $\mu\gamma > 1$. In an acrimonious channel, the manufacturer's utility is given by

$$U(w) = (w-c)(a-b\bar{p}_2) - \alpha_0[\mu(\bar{p}_2 - w) - (w-c)](a - b\bar{p}_2) \tag{B3}$$

and we have

$$\begin{cases} \frac{dU}{dw} = \frac{(a-bc)}{2}(1+\alpha_0+\alpha_0\mu) > 0 \\ \\ \frac{d^2U}{dw^2} = 0 \end{cases} \tag{B4}$$

Since $w \leq w_2$, the manufacturer will still choose $w = w_2$ to maximize its utility if w_2 provides it with non-negative utility. Its utility by choosing $w = w_2$ is given below

$$U(w = w_2) = \frac{(a-bc)^2(1+\alpha_0-\alpha_0\mu\gamma)}{4b(1+\gamma)} \begin{cases} \geq 0 & \text{if } \alpha_0 \leq \frac{1}{\mu\gamma-1} \\ < 0 & \text{if } \alpha_0 > \frac{1}{\mu\gamma-1} \end{cases} \tag{B5}$$

Case 2. Harmonious channel: $\mu\gamma \leq 1$. In a harmonious channel, the manufacturer's utility is given by

$$U(w) = (w-c)(a-b\bar{p}_2) - \beta_0[(w-c) - \mu(\bar{p}_2 - w)](a - b\bar{p}_2) \tag{B6}$$

and we have

$$\begin{cases} \frac{dU}{dw} = \frac{(a-bc)}{2}(1-\beta_0-\beta_0\mu) \\ \\ \frac{d^2U}{dw^2} = 0 \end{cases} \tag{B7}$$

Since $w \leq w_2$, the manufacturer will choose w as follows

$$w = \begin{cases} w_2 & \text{if } \beta_0 \leq \frac{1}{1+\mu} \\ < w_2 & \text{if } \beta_0 > \frac{1}{1+\mu} \end{cases} \tag{B8}$$

and its utility is given by

$$U(w = w_2) = \begin{cases} \frac{(a-bc)^2(1-\beta_0+\beta_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \beta_0 \leq \frac{1}{1+\mu} \\ > \frac{(a-bc)^2(1-\beta_0+\beta_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \beta_0 > \frac{1}{1+\mu} \end{cases} \tag{B9}$$

Since $w = w_2$ is a corner solution for $w \leq w_2$ when $\beta = \frac{1}{1+\gamma}$ and $\alpha \geq \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$, we also need to check whether $w = w_2$ is a stable solution within the $w_2 < w \leq w_1$ regime. When the manufacturer chooses a close to w_2 wholesale price in the scenario of $w_2 < w \leq w_1$, the retailer will choose $p = p_0 = w + \gamma(w-c)$ as shown in equation (B1). At the point of $w = w_2 = \frac{a-a\beta-\beta b\gamma c+2b\gamma c}{b(1-\beta-\beta\gamma+2\gamma)} = \frac{a+bc+2b\gamma c}{2b(1+\gamma)}$, we have

$$\mu(p_0 - w_2) - (w_2 - c) = (\mu\gamma - 1)(w_2 - c) \begin{cases} > 0 & \text{if } \mu\gamma > 1 \\ \leq 0 & \text{if } \mu\gamma \leq 1 \end{cases} \tag{B10}$$

Case $1'$. *Acrimonious channel:* $\mu\gamma > 1$. In an acrimonious channel, the manufacturer's utility is given by

$$U(w) = (w-c)(a-bp_0) - \alpha_0(\mu\gamma-1)(w-c)(a-bp_0) \tag{B11}$$

and we have

$$\begin{cases} \frac{dU}{dw} = (1+\alpha_0-\alpha_0\mu\gamma)(a+bc-2bw-2b\gamma w+2b\gamma c) \\ \\ \frac{d^2U}{dw^2} = -2b(1+\gamma)(1+\alpha_0-\alpha_0\mu\gamma) \end{cases} \tag{B12}$$

Since $w2 < w \leq w_1$, the manufacturer will choose w as follows

$$w = \begin{cases} w_2 & \text{if } \alpha_0 \leq \frac{1}{\mu\gamma-1} \\ > w_2 & \text{if } \alpha_0 > \frac{1}{\mu\gamma-1} \end{cases} \tag{B13}$$

and its utility is given by

$$U(w=w_2) = \begin{cases} \frac{(a-bc)^2(1+\alpha_0-\alpha_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \alpha_0 \leq \frac{1}{\mu\gamma-1} \\ > \frac{(a-bc)^2(1+\alpha_0-\alpha_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \alpha_0 > \frac{1}{\mu\gamma-1} \end{cases} \tag{B14}$$

Case $2'$. *Harmonious channel:* $\mu\gamma \leq 1$. In a harmonious channel, the manufacturer's utility is given by

$$U(w) = (w-c)(a-bp_0) - \beta_0[(w-c)-\mu(p_0-w)](a-bp_0) \tag{B15}$$

and we have

$$\begin{cases} \frac{dU}{dw} = (1-\beta_0+\beta_0\mu\gamma)(a+bc-2bw-2b\gamma w+2b\gamma c) \\ \\ \frac{d^2U}{dw^2} = -2b(1+\gamma)(1-\beta_0+\beta_0\mu\gamma) < 0 \end{cases} \tag{B16}$$

Since $w_2 < w \leq w_1$, the manufacturer will choose $w = w_2$ and its utility is given by

$$U = \frac{(a-bc)^2(1-\beta_0+\beta_0\mu\gamma)}{4b(1+\gamma)} > 0 \tag{B17}$$

From Cases $1, 2$ and Cases $1', 2'$, we could have the following conclusion for $\beta = \frac{1}{1+\gamma}$ and $\alpha \geq \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$.

(i). If $\mu\gamma - 1 > 0$, then

$$\begin{cases} w^* = w_2,\ p = p^*,\ \ U^* = \frac{(a-bc)^2(1+\alpha_0-\alpha_0\mu\gamma)}{4b(1+\gamma)}, & \\ \qquad\qquad\qquad\qquad U_c^* = \frac{(a-bc)^2(1+\gamma+\alpha_0-\alpha_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \alpha_0 \leq \frac{1}{\mu\gamma-1} \\ w^* > w_2,\ p > p^*,\ U^* > \frac{(a-bc)^2(1+\alpha_0-\alpha_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \alpha_0 > \frac{1}{\mu\gamma-1} \end{cases}. \tag{B18}$$

(ii). If $\mu\gamma - 1 = 0$, then

$$w^* = w_2,\ p = p^*,\ U^* = \frac{(a-bc)^2}{4b(1+\gamma)},\ U_c^* = \frac{(a-bc)^2}{4b}. \tag{B19}$$

(iii). If $\mu\gamma - 1 < 0$, then

$$\begin{cases} w^* = w_2,\ p = p^*,\ \ U^* = \frac{(a-bc)^2(1-\beta_0+\beta_0\mu\gamma)}{4b(1+\gamma)}, & \\ \qquad\qquad\qquad\qquad U_c^* = \frac{(a-bc)^2(1+\gamma-\beta_0+\beta_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \beta_0 \leq \frac{1}{1+\mu} \\ w^* < w_2,\ p = p^*,\ U^* > \frac{(a-bc)^2(1-\beta_0+\beta_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \beta_0 > \frac{1}{1+\mu} \end{cases}. \tag{B20}$$

(b) $\beta > \frac{1}{1+\gamma}$ and $\alpha \geq \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$.

When $\beta > \frac{1}{1+\gamma}$ and $\alpha \geq \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$, the manufacturer will choose $w = \bar{w}_{II} = \frac{a+bc+2b\gamma c}{2b(1+\gamma)}$ in the scenario of $w_2 < w \leq w_1$ if it does not care about fairness and the retailer will choose $p = p_0 = w + \gamma(w-c)$ as shown in equation (2.12). At the point of $w = \bar{w}_{II} = \frac{a+bc+2b\gamma c}{2b(1+\gamma)}$, we have

$$\mu(p_0 - w) - (w - c) = (\mu\gamma - 1)(w - c)\begin{cases} > 0 & \text{if } \mu\gamma > 1 \\ \leq 0 & \text{if } \mu\gamma \leq 1 \end{cases} \tag{B21}$$

Case 1. Acrimonious channel: $\mu\gamma > 1$. In an acrimonious channel, the manufacturer's utility is given by

$$U(w) = (w - c)(a - bp_0) - \alpha_0(\mu\gamma - 1)(w - c)(a - bp_0) \tag{B22}$$

and we have

$$\begin{cases} \frac{dU}{dw} = (1 + \alpha_0 - \alpha_0\mu\gamma)(a + bc - 2bw - 2b\gamma w + 2b\gamma c) \\ \frac{d^2U}{dw^2} = -2b(1 + \gamma)(1 + \alpha_0 - \alpha_0\mu\gamma) \end{cases} \tag{B23}$$

The manufacturer will still choose $w = \bar{w}_{II}$ if $\bar{w}_{II}$ provides it with non-negative utility. Its utility by choosing $w = \bar{w}_{II}$ is given below

$$U(w = \bar{w}_{II}) = \frac{(a - bc)^2(1 + \alpha_0 - \alpha_0\mu\gamma)}{4b(1 + \gamma)}\begin{cases} \geq 0 & \text{if } \alpha_0 \leq \frac{1}{\mu\gamma - 1} \\ < 0 & \text{if } \alpha_0 > \frac{1}{\mu\gamma - 1} \end{cases} \tag{B24}$$

Case 2. Harmonious channel: $\mu\gamma \leq 1$. In a harmonious channel, the manufacturer's utility is given by

$$U(w) = (w - c)(a - bp_0) - \beta_0(1 - \mu\gamma)(w - c)(a - bp_0) \tag{B25}$$

and we have

$$\begin{cases} \frac{dU}{dw} = (1 - \beta_0 + \beta_0\mu\gamma)(a + bc - 2bw - 2b\gamma w + 2b\gamma c) \\ \frac{d^2U}{dw^2} = -2b(1 = \gamma)(1 - \beta_0 + \beta_0\mu\gamma) < 0 \end{cases} \tag{B26}$$

The manufacturer's utility by choosing $w = \bar{w}_{II}$ is given by

$$U(w = \bar{w}_{II}) = \frac{(a - bc)^2(1 - \beta_0 + \beta_0\mu\gamma)}{4b(1 + \gamma)} > 0 \tag{B27}$$

From Cases 1 and 2 above, we could have the following conclusion for $\beta > \frac{1}{1+\gamma}$ and $\alpha \geq \mathtt{max}\{\frac{\gamma-1}{1+\gamma}, \beta\}$.

(i). If $\mu\gamma - 1 > 0$, then

$$\begin{cases} w^* = \bar{w}_{II},\ p = p^*,\ U^* = \frac{(a-bc)^2(1+\alpha_0-\alpha_0\mu\gamma)}{4b(1+\gamma)}, & \\ \qquad\qquad\qquad\quad U_c^* = \frac{(a-bc)^2(1+\gamma+\alpha_0-\alpha_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \alpha_0 \leq \frac{1}{\mu\gamma-1} \\ w^* \neq \bar{w}_{II},\ p \neq p^*,\ U^* > \frac{(a-bc)^2(1+\alpha_0-\alpha_0\mu\gamma)}{4b(1+\gamma)} & \text{if } \alpha_0 > \frac{1}{\mu\gamma-1} \end{cases}. \tag{B28}$$

(ii). If $\mu\gamma - 1 = 0$, then

$$w^* = \bar{w}_{II},\ p = p^*,\ U^* = \frac{(a-bc)^2}{4b(1+\gamma)},\ U_c^* = \frac{(a-bc)^2}{4b}. \tag{B29}$$

(iii). If $\mu\gamma - 1 < 0$, then

$$w^* = \bar{w}_{II},\ p = p^*,\ U^* = \frac{(a-bc)^2(1-\beta_0+\beta_0\mu\gamma)}{4b(1+\gamma)},\ U_c^* = \frac{(a-bc)^2}{4b}. \tag{B30}$$

We can see that manufacturer's concern for fairness will not affect the maximization of either channel profit or channel utility, unless the manufacturer is very averse to its own disadvantageous inequality. This leads to Proposition 3.