The Informational Role of Buyback Contracts

1 Motivation and Introduction

Buy-back contracts, which commit suppliers to repurchase unsold inventories from downstream retailers, are a widely used contractual arrangement in supply chains across a variety of industries. Yet, in practice, the retailer may be less informed about market conditions (e.g., compared to large manufacturers who invest considerable resources in proprietary market research), or unsure about the manufacturer’s intrinsic reliability of honoring the buyback commitment (e.g., in the case of small or foreign manufacturers, or due to adverse economic environment). Therefore, the implications of designing buyback contracts under these practical situations need to be understood. Indeed, prior literature (e.g., Chu 1992, Desai 2000, Gal-Or et al. 2008, Jiang et al. 2016) has highlighted the role of wholesale price contracts in signaling a manufacturer’s demand information to the retailer. Whether and how the buyback contract can be structured to credibly signal demand conditions or the intrinsic reliability of the buyback commitment, and how such a strategy compares to using the wholesale price alone to signal (as examined in prior research), remain as open questions. In this paper, we aim to shed light on these questions. Our results offer an understanding of the informational role of buyback arrangements, over and above its oft-studied transactional role.

2 Model Framework

We consider a standard buy-back contracting environment extensively studied in the operations and marketing literature (e.g., Marvel and Peck 1995, Padmanabhan and Png 1997, Wang 2004, Gurnani et al. 2010, Tran et al. 2018). A manufacturer sells a product at a wholesale price to a downstream retailer, who stocks inventory before the uncertainty in end demand is realized and sets the retail price upon the realization of demand potential. At the end of the selling season, the retailer requests the manufacturer to repurchase unsold inventory, if any, at the returns price pre-specified in the buy-back contract.

As a nuanced feature of our model, we consider two distinctive information scenarios: (i) the retailer is wary of the manufacturer’s returns risk, which refers to the manufacturer’s intrinsic probability of honoring the buyback commitment; (ii) the manufacturer possesses proprietary information about her demand potential, which refers to the likelihood of the product having a high demand. In both information scenarios, the manufacturer’s buyback contract terms offered at the start of the game can “signal” her
private information. We use Perfect Bayesian Equilibrium (PBE) as our solution concept to analyze the strategic interaction in the channel. As is well known, games of incomplete information can have multiple PBEs, because the equilibrium concept does not constrain off-equilibrium beliefs. Therefore, we use Cho and Kreps’s (1987) Intuitive Criterion refinement to fix off-equilibrium beliefs and select a unique equilibrium (e.g., Chu 1992, Lariviere and Padmanabhan 1997, Mayzlin and Shin 2011).

3 Key Findings

Regardless of whether the manufacturer is better informed about its demand or returns risk, the returns price is a more efficient instrument than the wholesale price in signaling the manufacturer’s information to the retailer. In the presence of stochastic demand and inventory considerations, what distinguishes a manufacturer based on the demand potential or returns risk is its expected cost of buying back unsold inventory. Specifically, a high demand potential manufacturer faces a lower returns cost than a low demand potential manufacturer, whereas a more reliable manufacturer (i.e., with lower returns risk) faces a higher return cost than a less reliable manufacturer (i.e., with higher returns risk). Since the returns price directly targets this cost (through the price paid for unsold inventory as well as its influence on the excess (unsold) inventory carried by the retailer), it is a more efficient means to signal to the retailer. In contrast, the wholesale price only indirectly influences the cost of buying back unsold inventory (through its influence on the retailer’s upfront order quantity). Thus, it is not as efficient as the returns price. Interestingly, under both forms of asymmetric information, the direction of signaling distortion in the wholesale price when used jointly with the returns price is the opposite of what it would be if the wholesale price is used on its own. Essentially, the wholesale price in and of itself is no longer useful for signaling information if the return price can also be used for this purpose. We further find that signaling through the returns price alone garners most of the gains from signaling through both the returns and wholesale price. Our findings underscore the importance of explicitly considering the informational role of the buyback contracts in channels that carry inventory.

We further show how the nature of manufacturer’s private information influences how the buyback contract is structured. A manufacturer with high demand potential has lower likelihood of having to repurchase unsold inventory than a manufacturer with low demand potential. Therefore, to credibly signal high demand potential, the optimal contract should induce higher unsold inventory (than under symmetric information), since offering such a contract is relatively more costly for a manufacturer with low demand potential. Consequently, the optimal contract to signal high demand potential distorts the returns price to be higher (than under symmetric information). In contrast, a manufacturer with low
returns risk has a higher likelihood of repurchasing the unsold inventory than a manufacturer with high returns risk. Hence, to credibly signal a low returns risk, the optimal contract should induce lower unsold inventory (than under symmetric information), since such a contract generates relatively higher cost savings for the more reliable manufacturer. As a result, the optimal contract to signal a low returns risk distorts the return price to be lower (than under symmetric information).

4 Conclusion

To the best of our knowledge, we are the first to examine how a manufacturer can design the buyback arrangement if the retailer is less informed about the demand or returns risk than the manufacturer. The contribution of our work is as follows. First, prior research (e.g., Chu 1992, Desai 2000, Gal-Or et al. 2008, Jiang et al. 2016) has mostly considered how a manufacturer may design a contract without a buyback component, in the absence of stochastic demand and inventory considerations, to credibly signal only the demand conditions of the manufacturer’s product. We show that, when the retailer must carry inventory to tackle demand risk, the buyback component plays an important role in signaling the market potential of the manufacturer’s product through a characteristically different mechanism. Second, we introduce the analysis of manufacturer’s returns risk to the literature, and study how to optimally design the buyback contract to signal returns risk. Lastly, we contrast the distinct nature of the buyback contract designs under these two sources of information asymmetry. In both cases, we evaluate the signaling roles of the wholesale and returns prices individually as well as in combination. Doing so not only allows us to isolate the individual effects, but also provides a better contrast with prior work that has by and large considered the signaling role of only the wholesale price without a buyback arrangement.

References


