

How Cooperative Is ‘Cooperative Investment’?

Supply Chain Contracting in Presence of Epistemic Quality Uncertainty

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ABSTRACT

The literature identifies the importance of cooperation in enhancing supply chain performance, but only a few papers have studied the role of cooperative investment in supply chain contracting. This article contributes to the literature of supply chain contracts by highlighting the importance of a cooperative investment in improving quality in presence of uncertainty. When the delivery of a high-quality product is uncertain and costly, the supplier may choose to deliver a less costly standard product, delivery of which is not uncertain, and hence the buyer needs to incentivize the supplier to take the risk. Using a principal-agent set-up, this article shows that incentivizing the supplier to choose the risky action of attempting delivery of the high-quality product is easier for the buyer in presence of shared cooperative investment that reduces epistemic quality uncertainty. However, the supplier passes the entire burden of investment on the buyer. The optimal investment for the buyer depends on parameters that determine effectiveness of the investment in reducing quality uncertainty.

KEYWORDS

Buyer-Supplier Relation, Contract Theory, Cooperative Investment, Effectiveness of Investment, Game Theory, Principal-Agent Problem, Quality Uncertainty, Supply Chain

INTRODUCTION

The concept of buyer-supplier cooperation developed in Japan after the First World War when the extreme demand for goods insisted companies to utilize their suppliers in order to increase their productions temporarily. (Nishiguchi, 1994). Till the 1960s and 1970s, buyer-supplier relationships were considered as adversarial arm's-length transactions, characterized primarily by bargaining on price. From the beginning of the 90s, relationships demanded an even greater degree of interaction due to the added need for product innovation and cooperation in technological developments, and this high level of interaction is termed as a partnership (Lamming, 1993). Organizations moved towards a greater cooperative relationship with their suppliers (Spekman, 1988) because the buyer-supplier

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relationship plays an extremely important role in firm's ability to respond to irregular changes in the industry in which the firm operates (Musanga et al., 2015).

Cooperation in a supply chain is characterized by a set of joint actions of firms in close relationship to accomplish a shared goal that is mutually beneficial (Mentzer et al., 2000; Moharana et al., 2012). Apart from dealing with material and information flows, Supply Chain Management (SCM) deals with the management of financial flows in a network consisting of vendors, manufacturers, distributors, and customers (Anupindi and Bassok 1999). Managing the financial flows in a relationship can be ensured by a contract between the buyer and the supplier. This process can be termed as supply chain contracting (Höhn, 2010). According to Höhn (2010), an important objective of supply chain contracting (SCC) is a system-wide performance improvement. A second motive is sharing the risk arising from the uncertainty in the supply chain. Another motive of SCC is facilitating long-term relationships (Tsay et al., 1999). Supply chain performance may be suboptimal due to lack of coordination. To facilitate coordination, the supply chain resorts to contracts. In general, the goal is to write contracts that induce coordination through appropriate provisions for information and incentives such that supply chain performance will be optimized. This type of approach recurs in a broad range of settings. Cachon (2003) and Chen (2003) review the research on supply chain contracts. Early overviews on supply chain coordination with contracts were given by Whang (1995), Cachon (1999), Lariviere (1999), and Tsay et al. (1999).

Principal-agent relationships play a central role in contract theory. In a supply chain, the buyer can be considered as the principal and the supplier as the agent. In standard principal-agent models the principal designs a contract and makes a take-it-or-leave-it offer to the agent. The problem of moral hazard occurs when the actions of the agent cannot be observed by the principal after the contract is signed (Maskin and Riley, 1984; Hart and Holmström, 1987). In presence of such ex post moral hazard, contract is signed on deliverables rather than on actions. But in presence of production uncertainty, the supplier becomes liable to risk and may refuse to sign the contract. This risk essentially arises from the quality uncertainty in production. The quality uncertainties are primarily of two types namely – aleatory and epistemic (Hoffman and Hammonds, 1994). While the former refers to those uncertainties that are irreducible, the latter refers to uncertainties that are reducible by information availability. In presence of aleatory uncertainty, the supplier may choose effort intending to develop the high-quality product but the outcome is uncertain. For example, in the trucking industry, the truck service contract can incentivize the service provider to be more responsible, but due to the irregular demand, the waiting time of the customers may increase and the service provider does not have any control over it (Vany and Saving, 1977). Epistemic uncertainty can be reduced (Quigley et al., 2018), but might be expensive, and the supplier may not want to invest in reducing such uncertainty. Examples from manufacturing industries reveal that manufacturers that outsource part of the production loses control on quality (Gilley and Rasheed, 2000; Xiao et al., 2014). In a related research, Zhu et al. (2007) investigates supplier's quality improvement due to investment to reduce non-conformance rate.

Evidence from automobile industries shows that the big three automakers practice cooperation in battery technology for electric vehicles (Chen et al., 2015) to avoid such quality related risk. Cooperating with the supplier for improving the product quality is a common practice in Toyota Motor Co. Ltd. since 1970 (Chen et al., 2015). Banker et al. (1998) have studied the influence of quality cooperation on product quality. Chen et al. (2015) proposes the view of investing in quality for building up cooperation in a manufacturing supply chain system and analyses the situation with a three-stage game. Their results prove that 'cooperative quality investment' is beneficial for the enhancement of the quality of products. But except few studies, the extant literature is silent on the role of cooperative investment in SCC.

This article contributes to the literature by analysing a situation where signing an SCC becomes easier in presence of cooperative investment that reduces epistemic quality uncertainty. A contract on deliverable should be signed to address moral hazard. The supplier can either choose to deliver a risk-free standard product or may choose to take the risk of attempting delivery of a high-value

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