Supply Contracts with Financial Hedging

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Abstract

We study the performance of a stylized supply chain where two firms, a retailer and a producer, compete in a Stackelberg game. The retailer purchases a single product from the producer and afterward sells it in the retail market at a stochastic clearance price. The retailer, however, is budget constrained and is therefore limited in the number of units that he may purchase from the producer. We also assume that the retailer's profit depends in part on the realized path or terminal value of some observable stochastic process. We interpret this process as a financial process such as a foreign exchange rate or interest rate. More generally, the process can be interpreted as any relevant economic index. We consider a variation (the flexible contract) of the traditional wholesale price contract that is offered by the producer to the retailer. Under this flexible contract, at $t = 0$ the producer offers a menu of wholesale prices to the retailer, one for each realization of the financial process up to a future time τ. The retailer then commits to purchasing at time τ a variable number of units, with the specific quantity depending on the realization of the process up to time τ. Because of the retailer's budget constraint, the supply chain might be more profitable if the retailer was able to shift some of the budget from states where the constraint is not binding to states where it is binding. We therefore consider a variation of the flexible contract, where we assume that the retailer is able to trade dynamically between zero and τ in the financial market. We refer to this variation as the *flexible contract with hedging*. We compare the decentralized competitive solution for the two contracts with the solutions obtained by a central planner. We also compare the supply chain's performance across the two contracts. We find, for example, that the producer always prefers the flexible contract with hedging to the flexible contract without hedging. Depending on model parameters, however, the retailer might or might not prefer the flexible contract with hedging.

Previous Back to Top Next

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