Coordinating Investment, Production, and Subcontracting

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Abstract

We value the option of subcontracting to improve financial performance and system coordination by analyzing a competitive stochastic investment game with recourse. The manufacturer and subcontractor decide separately on their capacity investment levels. Then demand uncertainty is resolved and both parties have the option to subcontract when deciding on their production and sales. We analyze and present outsourcing conditions for three contract types: (1) *price-only contracts*where an ex-ante transfer price is set for each unit supplied by the subcontractor; (2) *incomplete contracts*, where both parties negotiate over the subcontracting transfer; and (3) *state-dependent*price-only and incomplete contracts for which we show an equivalence result.

While subcontracting with these three contract types can coordinate *production*decisions in the supply system, only state-dependent contracts can eliminate all decentralization costs and coordinate capacity *investment*decisions. The minimally sufficient price-only contract that coordinates our supply chain specifies transfer prices for a small number (6 in our model) of contingent scenarios. Our game-theoretic model allows the analysis of the role of transfer prices and of the bargaining power of buyer and supplier. We find that sometimes firms may be better off leaving some contract parameters unspecified ex-ante and agreeing to negotiate ex-post. Also, a price-focused strategy for managing subcontractors can backfire because a lower transfer price may decrease the manufacturer's profit. Finally, as with financial options, the option value of subcontracting increases as markets are more volatile or more negatively correlated.

< Previous Back to Top Next >

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