Supply Risk in Fragile Contracts

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Increasing length, complexity and interdependence in supply chain contracts is resulting in more critical and costly supply disruptions, yet despite that risk, commodity procurement is mainly handled via long-term, fixed-price contracts containing naive terms and clauses in the case of breach. The risk of these breaches is very real. In the first half of 2005, St. Louis-based Peabody Energy Corp., one of the world’s largest private-sector coal companies, reported $34 million in losses due to contract breach by one of its suppliers.

Fortunately, spot markets are emerging for a host of commodities, and buyers can use these to make up for the lost supply. Spot markets are getting more and more organized in their functionality, diverse in the range of commodities traded and efficient in providing economies of scale. Buyers often turn to spot markets to mitigate the impact of demand risk. However, since future spot prices are uncertain, the prospect of trading in these markets exposes buyers to a different type of risk. The challenge is how to manage the interrelated issues of demand, spot prices and breach risks.

To analyze this question, we built a model for fragile contracts with interacting demand, spot price and contract breach uncertainties. The model incorporates additional features such as transaction costs incurred by buyers for trading in spot markets and supplier penalties for breaching the contract. Simulation results from this model helped us construct profit probability distribution in a variety of scenarios, including high-tech commodities that have high demand risk as well as functional commodities with lower associated risks. Similarly, we accounted for a wide variation in spot price and breach risks. The model operated in two stages associated with the most critical of management decisions. In the first stage, it computed optimal contract volumes for a particular contract, given the three interacting risks. In the second stage, we analyzed the trade-off between the expected profits and the risk to profits from various breaches. Results obtained from the simulation yielded some interesting strategic insights.

First, it is almost always the correct strategy to procure a little less volume than expected demand and to rely on the spot market to fill the gap. Alternately, the reaction to an increase in spot prices and breach uncertainties should be to increase the contract volume slightly. This also holds true for an increase in the dependency between the spot price and demand risks. However, procuring far more than necessary may actually increase the likelihood of large losses.

Second, the reaction to an increase in demand uncertainty should be to decrease the contract volumes slightly. Both demand and spot price risks are detrimental to the buyer. However, the dependency between them is just as damaging: They decrease the expected profits while also increasing variability, because the spot price is not under the buyer’s control. An active de-
mand management strategy to reduce demand variability and demand-price correlation can help. This may be possible via procuring substitutes, adopting modular product designs, developing more accurate forecasting capabilities and so on.

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Finally, while breach penalties mitigate risk to the buyers, they can also increase the variability of profits. This rise in profit variability may be quite steep when both spot price and demand risks are high (as is often the case with high-tech commodities). Hence, breach penalty selection should be a prudent decision that reflects not just expected profits but also variability.

Intelligent management of fragile supply chain contracts in the presence of spot markets presents a challenging problem for executives worldwide. But a more proactive demand management strategy coupled with timely use of spot markets and more considered and moderate contractual terms will maximize profits while decreasing volatility.

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