Global Sourcing under Exchange-rate Uncertainty

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1. Problem Description

This study examines the impact of exchange-rate uncertainty on global sourcing policies. Global sourcing decisions are often motivated by the desire to access to low-cost suppliers. However, global sourcing also makes a firm exposed to exchange-rate fluctuations that impact the overall operational costs. We investigate the conditions under which single and dual sourcing policies are desirable under varying operational costs from suppliers. We identify the key drivers for single and dual sourcing policies; specifically, we determine the conditions that lead to onshore sourcing, offshore sourcing and dual sourcing policies. We then examine the influence of increasing exchange-rate variation on the firm's optimal policy choice.

Our work is motivated by global sourcing practices of a US-based furniture company that specializes in school and library furniture. Selling in a domestic market (US), this company outsources most of its products from either a domestic or an international supplier. Depending on the product, the firm's international supplier may be located in Europe or Asia.

The operating environment and the sequence of decisions can be described as follows: The firm reserves capacity from suppliers every four months before the selling season begins and in the presence of exchange-rate uncertainty. When the season approaches, the firm makes production decisions based on the realization of the random exchange rate and places orders with its suppliers. The firm may or may not utilize its entire reserved capacity at its suppliers. In the case of international suppliers, fluctuating Euro and appreciating Chinese Yuan created the incentive for company executives to revisit their sourcing policies.

2. Methodology

We consider a firm that sells a product in its home country at a given price. The firm outsources its manufacturing, and for this purpose, it can use one domestic and one international supplier.

We develop a two-stage stochastic program to examine the firm's capacity reservation and production orders in the presence of exchange-rate and demand uncertainty. In the first stage, the firm determines how much capacity to be reserved from the two suppliers in the presence of exchange-rate and demand uncertainty. After observing the realized value of the exchange rate, consequently at the beginning of the second stage in our model, the firm decides how much to order from each supplier under demand uncertainty subject to the constraint associated with the first-stage capacity reservation decisions.

When sourcing from two different suppliers, the firm incurs two types of costs: (1) A capacity reservation cost which must be paid upfront for every unit of capacity the firm may need to utilize for production in the future (and is applied in the first-stage of the model), and (2) a manufacturing/operational cost which is paid in the supplier's currency when the firm orders production to the suppliers (incurred in the second-stage of the model). The latter cost term is inclusive of all the transportation, duty, and localization costs. Our model considers the setting where these two costs differ between the two suppliers. The firm is interested in choosing an optimal sourcing policy that maximizes its expected profit.

Our model can be commonly observed in contract manufacturing settings. Large manufacturers often utilize multiple contract manufacturers that are not necessarily located in the same country of their demand. As a consequence, the firm in our model is required to determine its capacity requirements at its suppliers in advance in order to plan for resources and schedule production in an effective manner.

3. Key Findings

Our analyses lead to four main findings. First, we identify that, while demand uncertainty by itself does not lead to dual sourcing, exchange-rate uncertainty creates an incentive to engage in global dual sourcing.

Second, low cost of sourcing from a supplier is neither a necessary nor a sufficient condition to source from that supplier. We specifically indicate that a firm may source only from the high-cost supplier under exchange-rate uncertainty, and this can be optimal even if the cost of sourcing is higher than the selling price, in expectation.

Third, we identify two classes of dual sourcing policies and demonstrate that they are characteristically different. One dual sourcing policy features extra capacity investment and is intended to benefit from the flexibility to alter the production decisions from one supplier to another based on the realization of the exchange rate, whereas the second dual sourcing policy is based on rationing limited capacity in order to minimize the negative consequences of exchange-rate fluctuations. This suggests that dual sourcing does not always entail redundancies, but also builds risk-mitigation aspirations.

Fourth and finally, we find that under the optimal sourcing policy, a firm's expected profit always (weakly) increases in exchange-rate volatility. In addition, exchange-rate volatility can be extremely beneficial that the firm can choose to forgo some allocation flexibility and capitalize the probability of exchange-rate appreciation.

It is noteworthy that our main results hold for any probability distributions of exchange-rate and demand uncertainty, thus provide robust and general insights into global sourcing problems.