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“Security of Supply Concerns and Forward Price
Premia in Natural Gas Markets”

In procuring inputs, firms often face a choice between buying on a spot market or through a forward transaction. The optimal decision is an exercise in risk management, and will often depend both on firm characteristics and on the characteristics of the input being purchased. For example, in markets where forward prices are unbiased predictors of spot prices, risk-averse firms are more likely to procure on forward markets than on spot markets. Forward markets will also be more attractive if the input involves important “specificities” that must be negotiated between the firms and their suppliers.

Our proposed research focuses on quantity risk—also known as “security of supply”—as another factor affecting firms’ choices between forward or spot procurement. Put simply, security of supply refers to a firm’s desire to have supplies of inputs on hand in case they are needed to respond to an unexpected increase in product demand, rather than rely on the spot market. This is likely an important consideration for firms in many industries. For instance, consider the hypothetical example of a manager of an auto plant who has on hand more tires than he thinks he is likely to need given the range of output levels the plant might be called on to produce in the next month. Should he try to rid the plant of some of the excess supply of tires if he can do so at a profit? If he makes a profit on the sale, it is likely to lead to a small reward. However, if the plant is called upon to produce an unusually large number of cars, and the production line has to be shut down because there aren’t enough tires, then the manager is likely to suffer substantial negative consequences. Here, the asymmetric penalty for having insufficient vs excess supplies is the root cause of the security of supply concern.

However, security of supply concerns only become salient in industries in which spot markets are illiquid, in the sense that a buying firm may not be able to arrange a spot purchase even if it is willing to pay a very high price. For example, the hypothetical plant manager discussed above will not be in danger of stocking out if there exists a liquid, reliable spot market for tires. Only those firms in industries in which spot markets are illiquid are actually exposed to quantity risk.

The U.S. wholesale natural gas industry presents an excellent opportunity to investigate the impacts of quantity risk and illiquid spot markets on firms’ procurement decisions. First, the primary purchasers of wholesale gas are regulated local distribution companies (LDCs). These firms face asymmetric penalties for having too much vs. insufficient gas inputs to meet demand. The consequence of having insufficient supplies of gas is the curtailment of gas supply to downstream customers, which is likely to cause considerable regulatory scrutiny and political fallout. On the other hand, the costs of excess supply are much smaller—inventory holding costs or the opportunity cost of not selling excess holdings can be passed on to ratepayers via rate of return regulation.

Second, natural gas industry participants have told us that spot markets in end-use locations lose liquidity in high demand periods. These markets are not centralized and bilateral deals are often arranged via telephone conversations. In peak demand periods, when very few firms have gas available for sale, it becomes exceedingly difficult for an LDC to successfully arrange purchases of gas and corresponding pipeline transportation.

We propose to test whether the combination of security of supply concerns and illiquid spot markets in the natural gas industry generate forward price premia paid to guarantee access to natural gas supply. We propose first to develop a model of natural gas forward and spot markets. The expected prediction of this model is that in low-demand periods when spot gas is readily available, the forward price will equal the expected spot price. However, when gas supply is “tight” and the gas pipeline transportation network is capacity constrained, the forward price will exceed the expected spot price. In a second step, we propose to use a dataset of forward and spot prices to investigate whether empirical evidence is consistent with this model.