A STRATEGY OF LNG EXPORTING COUNTRIES FOR TRADING IN THE NORTHEAST ASIAN REGION: OLIGOPOLISTIC STRUCTURES IN SPOT AND LONGTERM TRADINGS

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Overview

In this study, oligopolistic structures of LNG trading in Northeast Asia were estimated and the strategies of LNG exporting countries when they determine LNG prices were examined based on the estimation results. This study is a further study of Choi and Heo (2017a) estimating only the oligopolistic structures of LNG spot trading in Northeast Asia. This study examined the oligopolistic behaviors of exporting countries when they determine LNG long-term contract prices of LNG as well as spot prices. In this study, Indonesia and Qatar were considered as LNG exporting countries and Korea and Japan were considered as LNG importing countries. A total of four oligopolistic structures for each spot and long-term prices were considered: Bertrand competition, price leadership of Indonesia, price leadership of Qatar, and price collusion. In addition, Voung's closeness tests were conducted to determine the superiority of the models.

There are two different opinions about the effect of long-term contracts on the competition in spot trading: anti-competitive (Liski and Montero, 2006) and pro-competitive (Allaz, 1992; Allaz and Villa, 1993). It is important to examine the oligopolistic behaviors of exporting countries in spot trading since the proportion of LNG spot trading expands in the Northeast Asian region. However, LNG long-term contracts still dominate, and long-term contracts play an important role in stable LNG supply for importing countries. Empirically, as Choi and Heo (2016) and Choi and Heo (2017b) pointed out, there were price premiums and discounts in the long-run LNG contract price formula. Therefore, it is also important to examine the oligopoly structure and competition of LNG long-term trading as well as spot trading. The results of this study can be used as a basic research for establishing LNG import strategy and policy in Northeast Asian countries.

Methods

In this study, the oligopolistic circumstance of a 1-importing country (Korea or Japan) and 2-exporting countries (Indonesia and Qatar) was assumed. The basic functions used in this study are expressed as equation (1) to (4). Equation (1) is a demand function of an importing country for LNG spot volumes and equation (2) is a profit function of exporting countries. Equation (3) is an expected utility function of an importing country which is risk-averse to the long-term contract prices and equation (4) is an expected profit function of exporting countries which are risk-averse. Equation (3) and (4) are used when exporting and importing countries adjust the long-term contract prices.

$$q_i^S = \alpha_i + \beta_{1,i} P_{IND}^S + \beta_{2,i} P_{QAT}^S + \gamma_{1,i} P_{IND}^F + \gamma_{2,i} P_{QAT}^F + \delta_i INC \quad \forall i = Indonesia, Qatar \tag{1}$$

$$\Pi_i = P_i^S q_i^S + P_i^F q_i^F - C_i(q_i^S + q_i^F) \quad \forall i = Indonesia, Qatar \tag{2}$$

$$EU_i = E[(P_i^S - P_i^F)q_i^F] - (\theta_i^{IMP}/2)\text{var } E[(P_i^S - P_i^F)q_i^F] \quad \forall i = Indonesia, Qatar \tag{3}$$

$$E\Pi_i = E(\Pi_i) - (\theta_i^{EXP}/2)\text{var}(\Pi_i) \quad \forall i = Indonesai, Qatar \tag{4}$$

Under this oligopolistic circumstance, simultaneous equations models were constructed using demand functions and the first order conditions for spot pricing and adjusting long-term contract prices. The simultaneous equations models consist of a total of six equations, including two spot LNG demand functions, two first order conditions for maximizing profit functions of exporting countries (spot pricing), and two first order conditions for maximizing joint profit functions between exporting and importing countries (adjusting long-term contract prices). Here, the first order conditions for spot and long-term contract pricing depend on the four oligopolistic structures assumed in this study.

These simultaneous equations models can be expressed by Ax+b=u, where x is a vector of endogenous variables which consist of LNG spot volumes, spot prices, and long-term contract prices for each exporting country and u is a vector of disturbance terms. Matrix A and vector b are consist of exogenous variables and parameters to be estimated. This general form of simultaneous equations models was estimated by Full Information Maximum Likelihood method after imposing structure-specific constraints. After estimating all models, Voung's closeness test which is a pair-wise test of fittingness was conducted to find the best model which can describe the LNG trade in the Northeast Asia region.

Results

Table 1 shows results of Voung's closeness tests of 4 oligopolistic models for the case of Korea before Fukushima nuclear accident. As shown in Table 1, the model of price collusion in long-term contract pricing and Bertrand competition in spot pricing was superior to any other model.

Table 1. Results of Vuong's Tests for Selected Models (The Case of Korea - Before Fukushima nuclear accident)

	Spot: Bertrand Long-term: Leadership (Indonesia)	Spot: Bertrand Long-term: Leadership (Qatar)	Spot: Bertrand Long-term: Collusion
Spot: Bertrand Long-term: Bertrand	1.193	-2.007**	-1.701*
Spot: Bertrand Long-term: Leadership (Indonesia)	-	-3.914***	-1.942*
Spot: Bertrand Long-term: Leadership (Qatar)	-	-	-2.271**

Null Hypothesis: Each model fits the data equally
*, **, and *** denotes that null hypothesis is rejected at 10%, 5%, 1% significe level, respectively.
Negative test statistics mean that the model in the column fits better.
Positive test statistics mean that the model in the row fits better.

Conclusions

Supposing that the model of price collusion in long-term contract pricing and Bertrand competition in spot pricing is the best model among 16 oligopolistic structures, it means that Indonesia and Qatar had adjusted long-term contract price collusively while they had set spot price competitively. If these results are the same after the Fukushima nuclear accident, Korea should prepare LNG import policies and strategies to eliminate the incentive for Indonesia and Qatar to cooperate collusively. Even if it changes to Bertrand competition after Fukushima nuclear accident, it is necessary to develop a strategy to reduce incentives to do collusive behavior again.

References

Allaz, B.(1992): "Oligopoly, uncertainty and strategic forward trasactions," International Journal of Industrial Organization, Vol. 10, pp. 297-308

Allaz, B. and Vila, J.-L.(1993): "Cournot Competition, Forward Markets and Efficiency," Journal of Economic Theory, Vol. 59, pp. 1-16.

Choi, G. and Heo, E.(2016): "The Structure of the LNG Import Price in the Northeast Asia: Considering the Price premium," presented at 5th International Association for Energy Economics Asian Conference, Perth, Australia.

Choi, G. and Heo, E.(2017a): "A Strategy of LNG Exporting Countries for Trading in the Northeast Asian Region: Price Competition, Leadership, or Collusion?," presented at 40th International Association for Energy Economics Conference, Singapore, Singapore.

Choi, G. and Heo, E.(2017b): "Estimating the price premium of LNG in Korea and Japan: The price formula approach," Energy Policy, Vol. 109, pp. 676-684.

Liski, M. and Montero, J.-P.(2006): "Forward trading and collusion in oligopoly," Journal of Economic Theory, Vol. 131, pp. 212-230.