Analysis of Interest Groups in Korea-EU FTA Negotiations Using the Tullock Contest Model

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Contents

Abstract

This study analyzes the influence of interest groups from Korea and Europe during the 2015 Korea-Europe FTA negotiations. First, the effort exerted by these interest groups is measured by using the Tullock contest model with a logistic function. In addition, the impact of each interest group on the conclusion of the FTA is mathematically evaluated based on this effort. Finally, future tasks suggest the need to expand this model by applying it to various international policies under more relaxed assumptions.

1. Introduction

The FTA between Korea and the EU was settled in 2015. The implementation of the FTA resulted in the removal of tariffs, reduction of trade barriers, and deregulation, which in turn allowed interest groups in each country to potentially increase their profits. These interest groups, representing various sectors and industries, likely exerted substantial efforts, including financial contributions, advocacy activities, and time investments, to influence policymakers and ensure the ratification of the FTA. Thus, this thesis aims to analyze the influence of these interest groups on policy-making by examining the extent of effort each interest group can expend to reach an agreement.

The analysis employs the Tullock contest model, utilizing a logistic function to measure the efforts exerted by these groups. The Tullock contest model, widely used in political, international economy, provides a robust framework for analyzing competitive behaviors and the allocation of resources among competing entities. By applying this model, the study aims to offer a mathematical evaluation of the impact of interest groups on the conclusion of the Korea-Europe 2015 FTA.

Research on the impact of interest groups on trade policy-making has been ongoing. Previous studies have focused on the impact of FTAs on the overall economy, changes in trade volumes, economic growth, the effects on specific industries, and the influence and direction of interest groups' impact on policy decisions. These topics have been examined by researchers such as Decreux, Milner, and Péridy (2010), Anderson and Yotov (2016), Han (2014), Dür and De Bièvre (2007), and Stoyanov (2009).

However, most existing studies rely on qualitative analysis and case studies, and there is a relative lack of research that theoretically analyzes the influence of interest groups by applying it to actual policies. In particular, the amount research on the strategic actions and resource allocation of interest groups during the policy negotiation process is very small.

While free trade can have positive effects on the overall economy, it can also have negative impacts. This lack of research is a significant issue given that export-oriented companies may benefit from new opportunities and growth potential, whereas import-oriented companies may face intensified competition due to the entry of foreign products into the domestic market. This increased competition can make it challenging for existing import companies to maintain their market share, leading to more intense competition and cost pressures.

However, most of the previous studies rely on empirical analysis and case studies. Therefore, more theoretical analyses that apply these findings to real policies and assess the impact of interest groups are needed. In particular, if further research is conducted on the strategic behavior and resource allocation of interest groups during the policy negotiation process, it will be able to theoretically interpret and predict real-world issuses, significantly contributing to future policy formations, policy implementations, and international negotiations.

This paper is structured as follows: Section 2 reviews the theoretical backgrounds of this thesis. Section 3, the modified Tullock contest game is used to theoretically calculate the amount of effort required to settle the FTA, analyzing their policy influence. Finally, Section 4 summarizes the paper and concludes with final remarks.

2. Literature review

2.1 Lobbying

Lobbying is a legal and transparent activity that seeks to influence or attempt to influence legislative or administrative decisions through monitoring, documentation, direct communication, and providing information on the potential future effects of decisions (Vasilcovschi & Oanta, 2014). However, lobbying often has a negative connotation, and it is argued that lobbying gives unfair advantages to those who practice it and is contrary to democracy (Warlight & Fairbrass, 2002). Therefore, perspectives on lobbying vary. L. Milbrath (1960) defined lobbying as a communication process aimed at changing perceptions on specific issues, while Van Schendelen (2005) described lobbying as an attempt to influence public authorities through informal information exchanges. Koeppl (2001) argued that lobbying is an intentional and structured exercise of influence. As such, lobbying can be understood from various perspectives, and discussions about its role and influence continue.

In Europe, lobbying activities are legally permitted to increase the transparency of lobbying activities and strengthen regulations to ensure the reliability of the policy-making

process (European Commission, 2006). This legal permission aims to provide information and expertise through lobbying activities to help make better policy decisions and reflect the opinions of various stakeholders.

The legalization of lobbying activities in Europe has historical reasons. As the powers of EU institutions gradually expanded, interest groups found it increasingly necessary to actively communicate their positions to decision-making bodies and ensure their interests were reflected in policies (Vasilcovschi & Oanta, 2014). Therefore, there are a lot of lobbying have been established in Europe. For example, the European Cancer Patient Coalition (ECPC) has lobbied for bans on tobacco advertising and smoking in public places, while the European Trade Union Confederation (ETUC) advocates for workers' rights. These lobbying efforts have been utilized to promote public interests.

On the other hand, in Korea, lobbying activities are legally prohibited to minimize negative effects in the policy-making process and to maintain public trust (Lee, 2005). This aims to prevent stakeholders from exercising undue influence in the policy-making process and to put public interests first.

There are reasons for Korea's prohibition of lobbying activities for historical and political reasons. The Hanbo incident in 1993 and the Daewoo Group corruption cases in 1997 revealed companies' corruption, strengthening negative perceptions of lobbying. Accordingly, the Republic of Korea's government legally banned lobbying activities to regulate lobbying activities.

However, despite these legal sanctions, corporate corruption has not been mitigated, resulting in negative consequences of creating an environment in which the influence of interest groups is exercised through informal and opaque means (Kim & Lee, 2010; Yoo, 2018). The political and economic influence of most interest groups in Korea appears through indirect methods, such as the form of covert bribery and corporate influence in public policy (Kang, 2002; Park, 2013). An actual example was revealed in the Park Geun Hye presidential crisis in 2010.

As such, as lobbying is illegal in Korea, little research has been done on lobbying, and discussions on the exercise of the influence of interest groups have been taboo. However, interest group in South Korea are still influencing policy decisions through informal methods. Therefore, it is necessary to clearly find out their influence in making policy decisions. This paper introduces the concept of lobbying to evaluate the influence of interest groups through the case of the Korea-Europe FTA, and based on this, it is intended to clarify their role in the policy-making process.

2.2 FTA

A Free Trade Agreement (FTA) is a treatment between two or more countries to reduce or eliminate trade barriers, such as tariffs and import quotas, to facilitate the free exchange of goods and services. FTA also creates a more efficient and competitive international marketplace by fostering closer economic ties and increasing access to markets for the involved countries (Lawrence, 1996).

However, the conclusion of such FTAs is not solely determined by economic efficiency or intergovernmental negotiations, but significantly depends on the influence and activities of domestic interest groups (Stoyanov, 2009). This means that FTAs can be shaped in a way that enhances the interests of politically connected special interest groups such as international banks, pharmaceutical companies, and multinational corporations. These groups are export-oriented and can exert strong political influence, thus agreements may be formed to reflect their interests (Rodrik, 2018).

Studies have shown that FTAs favor exporting sectors, and substantial lobbying occurs in these areas. Exporting sectors support and lobby for the conclusion of FTAs, while importing sectors lobby against them (McKenzie, 2014). These lobbying activities significantly influence the negotiation and conclusion processes of FTAs.

Not only domestic industries, but also foreign companies operating domestically, lobby to reduce trade barriers. This is part of their efforts to facilitate market access and maximize their economic interests. Consequently, lobbying activities by foreign companies play a significant role in FTA negotiations (Stoyanov, 2009).

The policy agreement between Europe and Korea takes place in different ways. In South Korea, the main institutions responsible for FTA negotiations are primarily the Ministry of Foreign Affairs and the Korea Trade-Investment Promotion Agency (KOTRA). These two organizations work to protect and promote South Korea's trade and economic interests.

On the other hand, the main institutions responsible for FTA negotiations on the European side are the European Commission, the European Parliament, and the European Council. Unlike South Korea, which represents the interests of a single nation, these three institutions represent the member states of the EU and aim to maintain the interests and balance of the entire EU. The European Commission conducts the negotiations, and the approval of the agreements is carried out by the Parliament and the Council..

2.3 Tullock contest model

Tullock contest is an economic model where individuals or groups expend resources to compete for valuable prizes (Tullock, 1980). In this model, each interest groups invest effort to acquire their respective prizes. The probability of winning is determined by the effort expended by each group, consequently affecting their profits. Therefore, the earnings of each participant change based on the probability of winning the prize and the costs associated with their efforts (Hillman & Katz, 1984).

Nitzan (1994) explains various rent-seeking contest models and analyzes the direct relationship between expended effort and the probability of winning. He also tries to find out how asymmetry and uncertainty in expanded contest models affect the total resources or effort invested by players (rent dissipation). Furthermore, Chowdhury and Sheremeta (2011) generalized the existing Tullock contest model, analyzing the impact of parameter changes and proposing a structure in which a player's outcome, contingent upon winning or losing, is determined as a linear function of prizes, own effort, and the effort of the competitor.

However, many studies try to empirically analyze these subjects, and few studies apply the Tullock contest model to actual policies. In accordance with this, this study tries to introduce the Tullock contest model based on the Korea-Europe FTA to evaluate the influence of interest groups.

2.4. sigmoid function

Sigmoid equation is as follows.

$$\delta(x) = \frac{1}{1 + e^{-x}}$$

In this equation, e represents the base of the natural logarithm. The sigmoid function is a nonlinear function commonly used in neural networks and logistic regression. Its output ranges between 0 and 1, approaching 1 as the input increases and 0 as the input decreases, making it interpretable in probabilistic terms. The graph of the sigmoid function forms an S-shaped curve (Han & Moraga, 1995).

The sigmoid function is an important method in artificial neural networks and machine learning, making it widely used in computer science and artificial intelligence. Due to its probabilistic interpretation, it is particularly useful for models where the output is a probability. In economics, the sigmoid function can model demand and supply curves under specific conditions or in financial economics for certain scenarios (He et al., 2018; Baione, Biancalana, & De Angelis, 2021).

However, existing research has primarily used the sigmoid function in neural networks or specific economic models, and it has rarely been used to evaluate the influence of interest groups in policy analysis. Therefore, this study aims to apply the sigmoid function to the Tullock contest model to assess the influence of interest groups during the Korea-Europe FTA negotiations. Through this, the study seeks to expand the application scope of the sigmoid function from neural networks and financial models to policy analysis.

2.5 Research gap and contribution

The contribution of this study is to substitute the Tullock contest model into the FTA that is currently being actively signed around the world and to identify the influence of interest groups that affect trade policy. Moreover, while there is relatively little research on how interest groups influence policy in countries where lobbying activities are legally prohibited, this paper leverages the characteristics of the logistic function to understand the political influence of interest groups even under such legal constraints.

3. Theoretical Model Of FTA-Tullock Contest model

This section introduces the basic model considered in this study. There are two participants: a representative of European lobbying and a representative of a South Korean interest group.

South Korea has remained a divided nation since the Korean War in 1950. As a result, although Korea is one country, South Korea has developed under a democratic system, while North Korea has evolved under a communist system. Due to the distinct characteristics of these political systems, this paper constructs the model from the perspective of South Korea. Henceforth, all references to the Korean representative will be denoted as SK (South Korea).

Each participant invests a certain amount of resources to achieve their desired payoff. These resources are referred to as effort. Moreover, both sides proceed with the game under perfect information (Buzila, 2018). As a result, European and Korean interest groups can anticipate each other's choices and select the most effective strategy.

However, considering the policy characteristics of the FTA, some assumptions of the model are modified. The success of the FTA is determined probabilistically, and the probability of Europe and Korea successfully concluding the agreement is proportional not only to each country's negotiation power but also to the amount of effort invested by each participant (interest groups). In other words, the more effort invested by both participants, the higher the probability of success, but the conclusion of the FTA is not guaranteed.

Furthermore, the payoff each participant receives is not directly determined by the amount of effort they invest. Furthermore, the payoff each participant receives is not directly determined by the amount of effort they invest. For instance, if one participant exerts more effort, it implies that the likelihood of both sides receiving a payoff increases.

Additional assumptions other than the Turlock Contest model are as follows. First, it is assumed that the influence of Korean lobbying will be greater than that of European lobbying. It is because, European lobbying directly participates in policymaking and proceeds in a more cooperative and coordinated manner (Bouwen, 2002). However, Korean lobbying directly affects policymakers in the form of bribes, making them follow its decision-making. Therefore, it is assumed that the influence of Korean lobbying is greater than that of Europe, which makes it more cost-effective.

3.1 Basic model

In general, Tullock contest model is used in the case that the winner possess benefit exclusively. (Chowdhury & Sheremeta, 2011). However, to sign FTA, both side need to negotiate and mutually put effort. Therefore, modeling the probability of concluding an FTA requires a cooperative approach that reflects the efforts of both sides. This paper uses some elements of the Tullock contest game while defining the probability that can reflect cooperative outcomes using a sigmoid function:

$$P(FTA|effort) = \frac{1}{1+e^{-x}}$$

This function implies that as the effort invested by each participant increases, the probability of concluding the FTA increases as S-curve. In other words, initial efforts may not significantly impact the probability of concluding the FTA, but once a certain level of effort is invested, the probability increases rapidly. Therefore, this function realistically reflects the relationship between effort and the probability of concluding an FTA.

The more detailed probabilistic structure based on the Tullock contest game is as follows:

$$p(FTA) = \begin{cases} \frac{1}{2} \ if \ E_{EU} = E_{SK} = 0 \\ \frac{1}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}} \ if \ E_{EU} + E_{SK} > 0 \end{cases}$$

$$p(Protectionsism) = 1 - p(FTA) = 1 - \frac{1}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}}$$

The probability of concluding an FTA consists not only the effort of both participants' investments (E_i) but also the negotiation power (k_i) of each government. Whereas, the probability that the FTA will not be concluded and that both sides will impose the previously existing tariffs is represented as p(Protectionism), which is 1−(FTA). Here, k_i is a constant representing negotiation power, which also complements the efficiency of effort. Negotiation power indicates how efficiently given efforts can be utilized, which can be explained as the efficiency of effort.

The probability of concluding an FTA increases in an S-curve manner once the combined effort of both sides exceeds zero. This is because the political influence of lobbying and interest groups increases the likelihood of concluding a trade agreement. Therefore, initially, the probability of concluding an FTA increases slowly, then rapidly increases after a certain level of effort is invested, and finally levels off.

If both participants invest zero effort, the probability of concluding an FTA is 50%, representing the baseline probability of concluding an FTA without any lobbying activities. Before lobbying is intervened, each country considers both the positive effects of concluding an FTA, such as economic activation and increased consumer choice, and the negative effects, such as the need to protect domestic industries from increased imports (Caporale, Rault, Sova, & Sova, 2009). By considering these benefits and costs, it is assumed that each country would have a baseline 50% probability of wanting to conclude an FTA. Whereas, if both participants invest near-zero effort, the probability of concluding an FTA returns to 50%, and both sides would choose protectionism.

First, solve the model in the perspective of EU. The expected payoff of the European lobby can be calculated through their model. The expected payoff of the European lobby, based on the probability, is as follows:

$$\pi_{EU}(E_{EU}, E_{SK}) = p(FTA) \times V_{EU} + p(Protectionism) \times P_{EU} - C_{EU}(E_{EU}) \quad (1)$$

$$C_{EU}(E_{EU}) = C_{EU}E_{EU}^2$$

Each participant's payoff function can be calculated by subtracting the cost from the expected revenue obtained from the game. That is, it is calculated by subtracting the amount of effort used during the game from the profit obtained when the FTA is successfully concluded and the profit obtained when the FTA fails. In this case, V_i represents the amount of payoff obtained when the FTA is successfully concluded, and p_i represents the amount of payoff obtained when the FTA fails.

If there are no trade barriers, each interest group is able to get higher profit (Hansen & Sala, 2013). Therefore, the profit generated when Korea and Europe conclude an FTA is higher than the profit when the FTA fails ($V_i > P_i$). For this reason, both participants prefer the outcome that the FTA is concluded, and both simultaneously expend effort E_i, to ensure the FTA is concluded.

The cost function of effort is expressed as a quadratic function. Effort is perceived as a cost, and as the effort invested by the participant increases, the cost increases more rapidly (Alexeev & Leitzel, 1996). c_i represents the reciprocal of the effort efficiency of the participant, and the larger the c_i, the less cost will be incurred for the same amount of effort. This indicates that the effort is more efficient, then less cost is incurred for the same effort. Based on the previously mentioned assumption, it is assumed that the effort efficiency of South Korea is better than that of Europe. Therefore, ($C_{EU} < C_{SK}$) is hold.

The equation with the cost function substituted into the reward function is as follows:

$$\pi_{EU}(E_{EU}, E_{SK}) = \frac{1}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}} \times V_{EU} + (1 - \frac{1}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}}) \times P_{EU} - C_{EU}(E_{EU})$$

$$= \frac{1}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}} \times (V_{EU} - P_{EU}) + P_{EU} - C_{EU}(E_{EU}) \quad (2)$$

Based on equation (2), the optimization condition for the EU is obtained as follows :

$$\frac{\partial \pi_{EU}(E_{EU}, E_{SK})}{\partial E_{EU}} = \frac{\partial}{\partial E_{EU}}\left[\frac{1}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}} \times (V_{EU} - P_{EU}) + P_{EU} - C_{EU}(E_{EU})\right]$$

$$\frac{k_{EU}e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}}{\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2} \times (V_{EU} - P_{EU}) - 2C_{EU}E_{EU} = 0 \quad (3)$$

$$\frac{k_{EU}e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}}{\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2} \times (V_{EU} - P_{EU}) = 2C_{EU}E_{EU}$$

$$E_{EU} = \frac{k_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}(V_{EU}-P_{EU})}{2C_{EU}\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2} \quad (4)$$

The second derivative of equation (3) is as follows :

$$\frac{\partial^2 \pi_{EU}(E_{EU},E_{SK})}{\partial^2 E_{EU}} = \frac{k_{EU}(e^{-2(k_{EU}E_{EU}+k_{SK}E_{SK})}-1)}{e^{(k_{EU}E_{EU}+k_{SK}E_{SK})}\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^4} \times k_{EU} \times (V_{EU} - P_{EU}) - 2C_{EU} \quad (5)$$

For convenience, let $k_{EU}E_{EU} + k_{SK}E_{SK}$ be replaced by 'x'.

$$\frac{\partial^2 \pi_{EU}(E_{EU}, E_{SK})}{\partial^2 E_{EU}} = \frac{k_{EU}(e^{-2x}-1)}{e^x\{1+e^{-x}\}^4} \times k_{EU} \times (V_{EU} - P_{EU}) - 2C_{EU}$$

To find the optimization condition, derive the first derivative of the payoff function and set it to zero. The result of derivation is suggested in equation (3), and by organizing equation (3), it is able to find the first derivative of the payoff function (marginal benefit) equals the first derivative of the cost function (marginal cost). Then, compute the second derivative to confirm whether point (4) is a maximum. The process of finding the second derivative is attached in *Proof 3*.

To check that point (4) is a maximum, the second derivative must be negative. According to equation (5), if $(\mathrm{V_{EU}} - \mathrm{P_{EU}}) > 0$ and $x > 0$ $(k_{EU}E_{EU} + k_{SK}E_{SK} > 0)$ then the second derivative is negative, and the reward function is concave. This means that the reward of concluding the FTA is greater than the reward of not concluding it, and when the sum of the efforts of both sides is positive, then the graph is concave.

To get the Best response of EU's participant, differentiate payoff function, $\pi_{EU}(E_{EU}, E_{SK})$ with respect to the effort variable, E_{EU}, and then set the result to 0. By setting the equation to zero and solving for E_{EU}, the best response of the European lobby is obtained. This is suggested in equation (3). The first derivative process of the payoff function is attached in *Proof 1*. Equation (4) is rearranged with respect to E_{EU}, and the rearrangement process is attached in *Proof3*.

According to proof 2, the equation for each participants' effort are as follows :

$$E_{EU} = \frac{K_{EU}(V_{EU} - P_{EU})}{12c_{EU}} \qquad (6)$$

$$E_{SK} = \frac{K_{SK}(V_{SK} - P_{SK})}{12c_{SK}} \qquad (7)$$

The best response for each participant depends on the strategy of the other party. That is, each player needs to know the fixed strategy of the opponent to choose their best response (Ozdaglar, Sayin, & Zhang, 2021). However, according to equations (6) and (7), the level of optimal effort level is determined independently of the effort level of the other country, resulting in independent optimization without strategic interaction. In other words, the marginal return of the EU is independent of the efforts of South Korea. Therefore, there is no need to analyze strategic equilibrium through interaction, and the concept of Nash equilibrium does not apply in this case. Hence, there is no mutual dependency between the two players, and it is interpreted as an independent decision-making problem rather than a strategic game.

Based on the analysis, the minimum and optimal effort required by both participants to conclude the FTA is $E = \frac{K_i(V_i - P_i)}{12c_i}$. In other words, if the European lobby and the Korean

interest group exert an effort of at least $E \geq \frac{K_i(V_i - P_i)}{12c_i}$, , the probability of concluding the FTA increases as each lobbyist exerts more effort beyond this value.

The effort that each participant needs to exert for concluding the FTA is inversely proportional to the cost and directly proportional to the negotiation power. This means it implies that each lobbyist exerts less effort when their cost efficiency is higher and exert more effort when their negotiation power is higher. Additionally, the required effort level is directly proportional to the negotiation power. The stronger the negotiation power of each country, the more effort their lobbyists will exert.

As mentioned earlier, it is assumed that South Korea's cost efficiency is better than that of Europe. Therefore, South Korea can achieve more efficient results at the same level of effort. The greater the reward from concluding the FTA compared to the reward from choosing protectionism, the more effort each country's lobbyists will exert.

4. Conclusion

The influence of interest groups in Europe and Korea at the conclusion of the FTA was analyzed through the Tullock contest model and logistic function from the perspective that the efforts made by the interest groups could be interpreted as influence.

The study found the optimal level of effort required by European and Korean interest groups to conclude an FTA ($E_{EU} = \frac{K_{EU}(V_{EU} - P_{EU})}{12c_{EU}}$, $E_{SK} = \frac{K_{SK}(V_{SK} - P_{SK})}{12c_{SK}}$). Based on the derived optimal efforts, the following interpretations are possible:

First, investing effort beyond the optimal level can increase the likelihood of concluding the FTA. In addition, the amount of effort each participant invests in concluding the FTA decreases as the cost of effort increases. In other words, higher effort costs make it more difficult to exert additional effort. Conversely, as negotiation power improves, participants tend to invest more effort because they can exert greater influence with the same amount of effort. Therefore, each country should appropriately allocate resources (effort). It is necessary to secure sufficient resources for the negotiation process and allocate them efficiently to increase the likelihood of concluding the agreement.

Second, the amount of effort which is invested can be interpreted as 'Influence'. This is because the influence of each interest group can be measured by the amount of resources invested in policymaking. Therefore, it can be interpreted that the more effort invested, the greater the influence of the interest group on policy decisions. Hence, each country needs to enhance the transparency of lobbying activities. As more resources are invested, the influence

of lobbying increases, so if the policy aims to improve overall social welfare rather than lobbying, it is necessary to make lobbying activities public and clarify their influence through transparent procedures.

Third, the efforts of European and Korean lobbies are determined independently. In other words, each lobby chooses its optimal effort in FTA negotiations without considering the choices (efforts) of the other party. Given that the FTA is based on negotiations between the two countries, these results are somewhat contrary to the nature of the agreement. Therefore, while this result indicates that both sides can make independent decisions to maximize their own interests, it also means that they may miss opportunities for cooperation by not considering the other party. For example, if each side insists only on the strategy that is best for them in the EU-Korea FTA, the negotiations are likely to fail. Thus, each country needs to explore ways to strengthen independent strategies while considering cooperative approaches.

The significance of this paper is that it presented a new negotiation model more realistically by modeling the situation in which each country independently determines the optimal effort using logistic functions in the Tullock model. For this reason, unlike the emphasis on interdependent strategies in existing negotiation theories, this study was able to clearly analyze the negotiation results when each country acted independently.

This study is based on strong theoretical assumptions, which makes it hard to accurately reflect reality. First, in the study, each interest group assumed symmetric equilibrium and complete information, but in reality, it is rare for all players to choose the same strategy under perfect information. For example, in real economic conditions, people have asymmetric information and strategic interactions are intricately intertwined. Thus, the results might be different from the results of theoretical assumptions. Second, since the study results were derived under certain assumptions and certain trade agreements, the same results may not appear under other conditions or environments. In other words, the model used in this study is based on an FTA and political environment, its applicability may be limited in other countries or regions' situations. Finally, this study considered only export-side lobbying when making trade policy decisions, However, in real cases, both export and import lobbying should be considered. This is because, in most cases, exporters and importers engage in strong lobbying, and the two have a significant influence on policy decisions mutually.

Given these points, future research should incorporate more relaxed assumptions and a variety of variables to further analyze diverse trade policy decisions by applying the model to a broader range of contexts.

Appendix. Proofs

Proof 1. F.O.C of payoff function

The process of the first-order differential value of the equation (2) is as follows.

$$\pi_{EU}(E_{EU}, E_{SK}) = \frac{1}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}} \times V_{EU} + (1 - \frac{1}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}}) \times P_{EU} - C_{EU}(E_{EU})$$

The above payoff function consists of three parts, which is 'Expected payoff when the FTA is concluded',' Expected payoff when they choose to maintain protectionism', and 'cost function'. For simplification of calculations, each of these three parts will be differentiated separately.

The differentiation of the expected payoff when the FTA is concluded is as follows:

$$\frac{\partial}{\partial E_{EU}}[\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^{-1} \times V_{EU}]$$

$$= V_{EU} \times (-1) \times \{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^{-2} \times \{0+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\} \times (-k_{EU})$$

$$= \frac{V_{EU} \times k_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}}{\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2}$$

The differentiation of expected payoff when they choose to maintain protectionism is as follows :

$$\frac{\partial}{\partial E_{EU}}\{(1 - \frac{1}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}}) \times P_{EU}\}$$

$$\Rightarrow \frac{\partial}{\partial E_{EU}}(P_{EU} - \frac{P_{EU}}{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}})$$

$$\Rightarrow \frac{\partial}{\partial E_{EU}}[P_{EU} - P_{EU} \times \{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^{-1}]$$

$$= P_{EU} \times \{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^{-2} \times \{0+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\} \times (-k_{EU})$$

$$= \frac{-P_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})} \times k_{EU}}{\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2}$$

The differentiation of cost function is as follows :

$$\frac{\partial}{\partial E_{EU}} C_{EU}E_{EU}^2$$

$$= C_{EU} \times 2 \times E_{EU}$$

$$= 2C_{EU}E_{EU}$$

As such, differentiation function of total expected payoff function can be rearranged as follows :

$$\frac{\partial \pi_{EU}(E_{EU}, E_{SK})}{\partial E_{EU}} =$$

$$\frac{V_{EU} \times k_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}}{\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2} - \frac{P_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})} \times k_{EU}}{\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2} - 2C_{EU}E_{EU} = 0$$

$$\frac{V_{EU} \times k_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})} - P_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})} \times k_{EU}}{\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2} - 2C_{EU}E_{EU} = 0$$

$$\frac{k_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}(V_{EU}-P_{EU})}{\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2} - 2C_{EU}E_{EU} = 0$$

Solve for E_{EU}.

$$\frac{k_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}(V_{EU}-P_{EU})}{\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2} = 2C_{EU}E_{EU}$$

$$\therefore E_{EU} = \frac{k_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}(V_{EU}-P_{EU})}{2C_{EU}\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2}$$

Proof 2. rearrangement process

$$E_{EU} = \frac{k_{EU} \times e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}(V_{EU}-P_{EU})}{2C_{EU}\{1+e^{-(k_{EU}E_{EU}+k_{SK}E_{SK})}\}^2}$$

For simplification of calculations put '$k_{EU}E_{EU} + k_{SK}E_{SK}$' as 't'.

$$E_{EU} = \frac{k_{EU} \times e^{-t}(V_{EU}-P_{EU})}{2C_{EU}\{1+e^{-t)}\}^2}$$

$$k_{EU} \times e^{-t}(V_{EU}-P_{EU}) = 2E_{EU}C_{EU}\{1+e^{-t)}\}^2$$

Multiply e^t in both sides.

$$K_{EU}(V_{EU}-P_{EU}) = 2E_{EU}C_{EU}\{1+e^{-t)}\}^2 e^t$$

$$\frac{K_{EU}(V_{EU}-P_{EU})}{2C_{EU}} = E_{EU}(e^t + e^{-t} + 2)$$

$$= E_{EU}e^t + E_{EU}e^{-t} + 2E_{EU}$$

Take the natural logarithm (ln) of both sides.

$$lnK_{EU}(V_{EU}-P_{EU}) - ln2c_{EU} = lnE_{EU}e^t + lnE_{EU}e^{-t} + ln2E_{EU}$$

$$= lnE_{EU} + lne^t + lnE_{EU} + lne^{-t} + ln2E_{EU}$$

$$= lnE_{EU} + t + lnE_{EU} - t + ln2E_{EU}$$

$$= 3lnE_{EU} + ln2$$

$$lnK_{EU}(V_{EU}-P_{EU}) - ln2c_{EU} = 3lnE_{EU} + ln2$$

Solve for E_{EU} .

$$lnK_{EU}(V_{EU} - P_{EU}) - ln2c_{EU} - ln2 = 3lnE_{EU}$$

$$ln\frac{K_{EU}(V_{EU} - P_{EU})}{12c_{EU}} = lnE_{EU}$$

$$\therefore E_{EU} = \frac{K_{EU}(V_{EU} - P_{EU})}{12c_{EU}}$$

Proof 3. Second order derivation

By using Quotient Rule, it is able to get second order derivation.

$$\frac{\partial \pi_{EU}(E_{EU}, E_{SK})}{\partial E_{EU}} = \frac{k_{EU} \times e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})}(V_{EU} - P_{EU})}{\{1 + e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})}\}^2} - 2C_{EU}E_{EU}$$

$$= \frac{e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})}}{\{1 + e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})}\}^2} \times k_{EU} \times (V_{EU} - P_{EU}) - 2C_{EU}E_{EU}$$

$$\frac{\partial^2 \pi_{EU}(E_{EU}, E_{SK})}{\partial^2 E_{EU}}$$

$$= [-k_{EU} \times e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})} \times \{1 + e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})}\}^2$$

$$- e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})} \times 2 \times (1$$

$$+ e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})}) \times (-k_{EU}) \times e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})}]$$

$$\times \frac{1}{\{1 + e^{-(k_{EU}E_{EU} + k_{SK}E_{SK})}\}^4} \times k_{EU} \times (V_{EU} - P_{EU}) - 2C_{EU}$$

Replace with $k_{EU}E_{EU} + k_{SK}E_{SK} = x$ for simplicity.

$$\frac{\partial^2 \pi_{EU}(E_{EU}, E_{SK})}{\partial^2 E_{EU}}$$

$$= \frac{-k_{EU} \times e^{-x} \times \{1 + e^{-x}\}^2 - e^{-x} \times 2 \times (1 + e^{-x}) \times (-k_{EU}) \times e^{-x}}{\{1 + e^{-x}\}^4} \times k_{EU}$$

$$\times (V_{EU} - P_{EU}) - 2C_{EU}$$

$$= \frac{-k_{EU}e^{-x}(1 + e^{-x}) \times (1 + e^{-x} - 2e^{-x})}{\{1 + e^{-x}\}^4} \times k_{EU} \times (V_{EU} - P_{EU}) - 2C_{EU}$$

$$= \frac{-k_{EU}e^{-x}(1 + e^{-x}) \times (1 - e^{-x})}{\{1 + e^{-x}\}^4} \times k_{EU} \times (V_{EU} - P_{EU}) - 2C_{EU}$$

$$= \frac{-k_{EU}e^{-x}(1 - e^{-2x})}{\{1 + e^{-x}\}^4} \times k_{EU} \times (V_{EU} - P_{EU}) - 2C_{EU}$$

$$= \frac{k_{EU} e^{-x}(e^{-2x} - 1)}{\{1 + e^{-x}\}^4} \times k_{EU} \times (V_{EU} - P_{EU}) \ - 2C_{EU}$$

$$= \frac{k_{EU}(e^{-2x} - 1)}{e^{x}\{1 + e^{-x}\}^4} \times k_{EU} \times (V_{EU} - P_{EU}) \ - 2C_{EU}$$

References

Alexeev, M., & Leitzel, J. (1996). Rent shrinking. *Southern Economic Journal*, 620-626.

Anderson, J. E., & Yotov, Y. V. (2016). Terms of trade and global efficiency effects of free trade agreements, 1990–2002. *Journal of International Economics*, *99*, 279-298.

Baione, F., Biancalana, D., & De Angelis, P. (2021). An application of Sigmoid and Double-Sigmoid functions for dynamic policyholder behaviour. Decisions in Economics and Finance, 44(1), 5-22. https://doi.org/10.1007/s10203-020-00279-7

Bouwen, P. (2002). Corporate lobbying in the European Union: the logic of access. *Journal of European public policy*, *9*(3), 365-390.

Buzila, E. (2018). The Emergence of the Tullock-Contest. Retrieved from https://ssrn.com/abstract=3293155 or http://dx.doi.org/10.2139/ssrn.3293155

Caporale, G. M., Rault, C., Sova, R., & Sova, A. (2009). On the bilateral trade effects of free trade agreements between the EU-15 and the CEEC-4 countries. *Review of World Economics*, *145*, 189-206.

Chowdhury, S. M., & Sheremeta, R. M. (2011). A generalized Tullock contest. *Public Choice*, *147*(3/4), 413–420. http://www.jstor.org/stable/41483667

Decreux, Y., Milner, C., & Péridy, N. (2010). The Economic Impact of the Free Trade Agreement (FTA) between the European Union and Korea. *Report for the European Commission1 DG Trade. Retrieved on*, *10*, 2018.

Dür, A., & De Bièvre, D. (2007). The question of interest group influence. *Journal of Public Policy*, *27*(1), 1-12.

European Commission. (2006). *Green Paper on European Transparency Initiative* (COM(2006) 194 final).

Han, L. (2014). "Industry Specific FTAs: Korean FTAs Example". In *Regional Cooperation and Free Trade Agreements in Asia*. Leiden, The Netherlands: Brill | Nijhoff. https://doi.org/10.1163/9789004279902_010

Hansen, J., & Sala, D. (2013). On the equivalence of tariffs and quotas for customs unions. *Discussion Papers on Business and Economics*, (11)

Hillman, A. L., & Katz, E. (1984). Risk-averse rent seekers and the social cost of monopoly power. The Economic Journal, 94(373), 104-110.

He, Y., Chen, F., Jiao, Z., Guang, F., Gao, X., & He, Q. (2018). Research on user demand response under time-of-use tariff policy based on Sigmoid function. In *E3S Web of Conferences* (Vol. 53, p. 03030). EDP Sciences.

Kang, D. C. (2002). Crony Capitalism: Corruption and Development in South Korea and the Philippines. Cambridge University Press.

Kim, B., & Lee, H. (2010). Lobbying and Policy Influence in Korea: Analysis of Corporate Lobbying in the National Assembly. Korean Journal of Public Administration, 48(1), 51-75.

Koeppl, P. (2001). The acceptance, relevance and dominance of lobbying the EU Commission: A first-time survey of the EU Commission's civil servants. *Journal of Public Affairs, 1*(1), 69-82.

Lawrence, R. Z. (1996). Regionalism, multilateralism, and deeper integration. Washington, DC: Brookings Institution.

Lee, U.-Y. (2005). 한국의 로비활동 법제화 노력에 대한 입법학적 관점에서의 분석: "로비스트 등록 및 활동 공개에 관한 법률안"을 중심으로 [An analysis of the legislative efforts to legalize lobbying activities in Korea from a legislative perspective: Focusing on the "Lobbyist Registration and Activity Disclosure Act"]. 법학 [Law], 46(3), 341-396.

McKenzie, F. (2014). Faith, fear, and free trade. *International Journal*, *69*(2), 233–245. http://www.jstor.org/stable/24709504

Milbrath, L. W. (1960). Lobbying as a communication process. Public Opinion Quarterly, 24, 32-39.

Nitzan, S. (1994). "Modelling rent-seeking contests." European Journal of Political Economy, 10(1), 41-60

Ozdaglar, A., Sayin, M. O., & Zhang, K. (2021). Independent learning in stochastic games. In *International Congress of Mathematicians*.

Rodrik, D. (2018). What Do Trade Agreements Really Do? *The Journal of Economic Perspectives*, *32*(2), 73–90. http://www.jstor.org/stable/26409425

Stoyanov, A. (2009). Trade policy of a free trade agreement in the presence of foreign lobbying. *Journal of International Economics*, 77*(1), 37-49. https://doi.org/10.1016/j.jinteco.2008.10.001

Tullock, G. (1980). Efficient Rent-Seeking. In J. M. Buchanan, R. D. Tollison, & G. Tullock (Eds.), Toward a Theory of the Rent-Seeking Society (pp. 97-112). Texas A&M University Press.

Vasilcovschi, N., & Oanta, S. I. (2014). Lobby activities and their evolution in the European Union context. CES Working Papers, 6(2a), 171-185. Alexandru Ioan Cuza University of Iasi, Centre for European Studies. ISSN 2067-7693.

Warleight, A., & Fairbrass, J. (2002). *Influence and interests in the European Union: The new politics of persuasion and advocacy*. London: Europa Publications.