International Commerce and Information Review
Volume 13, Number 4, December, 2011: pp. 399~410
통상정보연구 제13권 4호 (2011년 12월 27일)

논문투고일자 : 2011. 11. 22
심사(수정)일 : 2011. 12. 9
게재확정일자 : 2011. 12. 10

Tariffs on Irrelevant Industries

Rhee, Byungchae

Assist. Professor, Department of Economics, Chungnam National University

Contents

Abstract

Traditionally, tariffs have been used to protect domestic industries. In particular, a country with more bargaining power makes a punitive threat to maintain a certain level of market share in the market of other country. In this paper, we study the effect of punitive tariffs on an irrelevant industry. In particular, when a country tries to achieve a market share or quantity target in an industry, we examine the effect of threats to impose tariffs on the major export of another industries which are irrelevant to the targeted industry.

Using a simple duopoly model, we show that there is a Cournot-Nash equilibrium which supports that a country has an incentive to resolve a trade dispute voluntarily to protect its major export industry under the credible treat of punitive tariffs. This result is mainly due to the fact that the trade policy of a country concerns the aggregate benefits from trade over all its export industries. To obtain this result, this paper employs the linkage between the targeted and irrelevant industries by using the lobby of the irrelevant industry to curb the targeted industry. A lot of recent bilateral trade agreements can be applied to our results.

Key Words : Irrelevant Industry, Punitive Tariffs, Lobby, Cournot-Nash Equilibrium, Voluntary Import Expansion

* This study was financially supported by research fund of Chungnam National University in 2010.

Ⅰ. Introduction

In the age of trade wars, each country in the world is striving to find how to ensure its own gains from trade by means of a variety of trade policies. (Conybeare, 1985) Since the General Agreement on Tariffs and Trade (GATT) in 1948, many countries have tried to enjoy the benefits from free trade to improve the efficiency of resources allocation in the short run as well as fundamental economic growth in the long run by means of several multilateral trade agreements such as Uruguay Round and World Trade Organization (WTO). From a theoretical point of view, free trade is the most desirable situation under some regular assumptions.[1] In practice, however, there are so many impediments to free trade, which reflects the reality that the regular assumptions are not satisfied more or less. In this context, almost all countries impose some kinds of impediments such as tariffs, quotas, and so on. (Satapathy, 1999)

From the perspectives of trade war, one of the notable experiences was the "Super 301" by the US government enacted in 1974, which provided the United States government with a most formidable weapon as a trade policy.[2] Super 301 gives authority to the US Trade Representative, an executive office of the US president, to investigate other countries to see whether other countries' trade policies are fair and open enough or not from the US traders' point of view. If a country fails to meet the investigation, then Super 301 can potentially impose huge penalties not only on the market in question, but on the entire trade markets of that country. It is usual that when a country is identified to take an unfair trade practice as a trade partner, the other country should impose punitive tariffs on the market over which the dispute was centered. Super 301, however, gives power to the US government to impose punitive sanctions on the other markets regardless of their relevance to the market in which the dispute takes place. Until recently, this kind of protectional idea such as Super 301, as a super-powered trade policy literally, was reflected in bilateral trade agreements such as NAFTA. In bargaining Free Trade Agreement (FTA) with foreign countries, the US government usually reserves certain kinds of comprehensive

1) For the gains from free trade, for example, Dixit and Norman (1980) provide the assumptions under which free trade is Pareto-optimal.

2) Initially, Sections 301-310 of the US Trade Act of 1974 played a major role in initiating investigations on unfair trade practices, and then the US government reinforced them in 1988, which was dubbed as "Super 301." It expired officially in 1990, but was revived several times via the executive orders of the President until late 1990s. See Kherallah and Beghin (1998) and Perroni and Whalley (2000) for more details.

and exclusive measures to penalize the unfair trade practices that the partner countries may take in the future.

In this paper, we study the effect of punitive tariffs on *irrelevant* industries. In particular, when a country tries to achieve a market share or quantity target in an industry, we examine the effect of threats to impose tariffs on the export of another industries which are irrelevant to the targeted industry. The use of threats in trade policy is common in many countries. Since it is well realized that an implemented punitive tariff reduces welfare for both countries that are in dispute, such a threat to induce a certain kind of voluntary import expansion (VIE) plays an important role in trade policy as long as it is credible. Krishna and Morgan (1998) and Ethier and Horn (1996) analyze the effect of a results-oriented trade policy in the context of VIE.[3] They show that by making threats to a *linked* market, a market share target may be implemented with fairly weak information and administrative requirements. According to their models, credible threats to impose tariffs on a linked market achieve a market share target without its execution. To obtain these results, they assume that the markets are linked, so that the threats in one market affect another market through linked demand functions.

In reality, however, we have witnessed a lot of cases where such market share targets are violated as well as satisfied.[4] In this paper, adapting the model of Krishna and Morgan (1998), we develop a simple model of tariffs on irrelevant industry to explain this reality. Our model may possess a Nash equilibrium supporting a violation that the market share target is not met. To derive this result, we introduce a new concept which links the targeted market and the irrelevant market: lobbying of the irrelevant industry to the government against the targeted industry. In most of countries, especially in developing countries, the governments try to increase the overall value of exports by controlling the relative size of their exporting industries. In the process for the government to adjust the relative trade volumes, it is natural that an industry would lobby to its government when it expects losses caused not by its own behavior, but by an irrelevant industry. Also, the government influenced by the one industry's lobby would give some disadvantages to another industry that caused problems, such as tax investigations and reducing subsidies. Using these concepts of lobbying and penalty, we could make an indirect linkage

3) See also Nagaoka (1997) for a Bertrand competition model of VIE.

4) Refer to 2011 Special 301 Report by the Office of the US Trade Representative (2011) to figure out the frequency and diversity of trade disputes between other countries and the US. Recently, one of distinguished cases is the intellectual property dispute with China. See Ionascu and Zigic (2004).

between the two irrelevant industries.

This paper is organized as follows. In Section 2, we characterize an extensive form game we are studying. In Section 3, we find a Nash equilibrium for this game in which a market share target may be violated or satisfied depending on market demands. In Section 4, we discuss the implications of the model and provide concluding remarks.

Ⅱ. The Model

There are two countries, home(H) and foreign(F), and two industries A and B which are irrelevant to each other.[5] For example, it would be make sense that H denotes Korea, F the United States, A automobile industry, and B cellular phone industry. Suppose that the industries A and B exist only in country H. In market A, two firms, one from H and another from F, compete à la Cournot while in market B, a H company enjoys monopoly power.[6] The two firms in industry A are assumed to be identical with constant marginal cost c.[7] The F government has set a result-oriented trade policy in industry A, which implies a market share target in the sense that the F firm's sales share should be at least α in market A. The F government can make threats to impose tariffs τ (>0) on the exports of industry B firm of H country if the market share target of A is not satisfied. The H government is assumed have no policy tool corresponding to the threats.

The extensive form game we are considering can be described as follows: At the beginning, the F government announces the market share target level α and the tariff rates τ which will be imposed in case of target violation. Next, the two firms in market A compete à la Cournot and the announced target is either met or not. If the target is met, then the game ends. If not, however, the F government imposes the announced tariffs τ on industry B. Corresponding to the tariff τ, the H monopolist in market B can lobby to the H government. Finally, the H

5) We use the term "industry" and "market" interchangeably as long as it may cause no confusion since we are considering the markets or industries in only one country, i.e., country H throughout this paper.

6) For a canonical model of Cournot competition, refer to, for example, Varian (1992) and Osborne and Rubinstein (1994).

7) The assumption of identical firms are just for analytical convenience.

government imposes an excise penalty $\phi(\tau)$ to the H firm of industry A.

To simplify the analysis, if the market share target is not met, then the H monopolist is assumed to be able to spend enough money in lobbying to ensure that the government penalty $\phi(\tau)$ makes the H firm of industry A worse off than when the target is met.[8)]

Ⅲ. Equilibrium Analysis

Let x^j denote the quantity supplied by the country j firm in the market A, for $j = H, F$. Assume that the inverse demand function faced by the A industry firms can be expressed by

$$p = p(x^H + x^F).$$

Notice that the demand function stays the same no matter whether the tariff is imposed or not unlikely as in Krishna and Morgan (1998).

As the next step, consider the profit functions of A industry firms. First, the F firm's profit function is independent of the imposition of tariff since the tariff is imposed on the irrelevant industry B. Thus the profit function of F firm in market A is

$$\pi^F(x^H, x^F) = [p(x^H + x^F) - c]\, x^F. \tag{1}$$

However, the H firm's profit function depends on the imposition of tariff since if tariff is imposed on industry B, then the H government may penalize it corresponding to the lobby of B industry firm. If the imposition of tariff reduces the profit of B industry firm over the lobby costs, then B industry firm would lobby the government. Suppose for a while that it is the case. Thus, the composite profit function of H firm in market A is given by

$$\pi_o^H(x^H, x^F) = [p(x^H + x^F) - c]\, x^H$$

when no tariff is imposed, while it is given by

$$\pi_\tau^H(x^H, x^F) = [p(x^H + x^F) - c - \phi(\tau)]\, x^H$$

when tariff is imposed on industry B. We assume that these profit functions are concave and that due to $\phi(\tau) > 0$, for a given x^F,

8) The meanings of this assumption are discussed in Section 4 in detail.

$$\pi_o^H(x^H, x^F) > \pi_\tau^H(x^H, x^F) \tag{2}$$

for all x^H. Notice that for a given x^F,

$$\pi_o^H(x^H, x^F) - \pi_\tau^H(x^H, x^F) = \phi(\tau)x^H \tag{3}$$

The market share target is $\frac{x^F}{x^H + x^F} \geq \alpha \Leftrightarrow x^H \leq \frac{1-\alpha}{\alpha}x^F$. Therefore, denoting the profit function of H firm by $\pi^H(x^H, x^F)$, it follows that

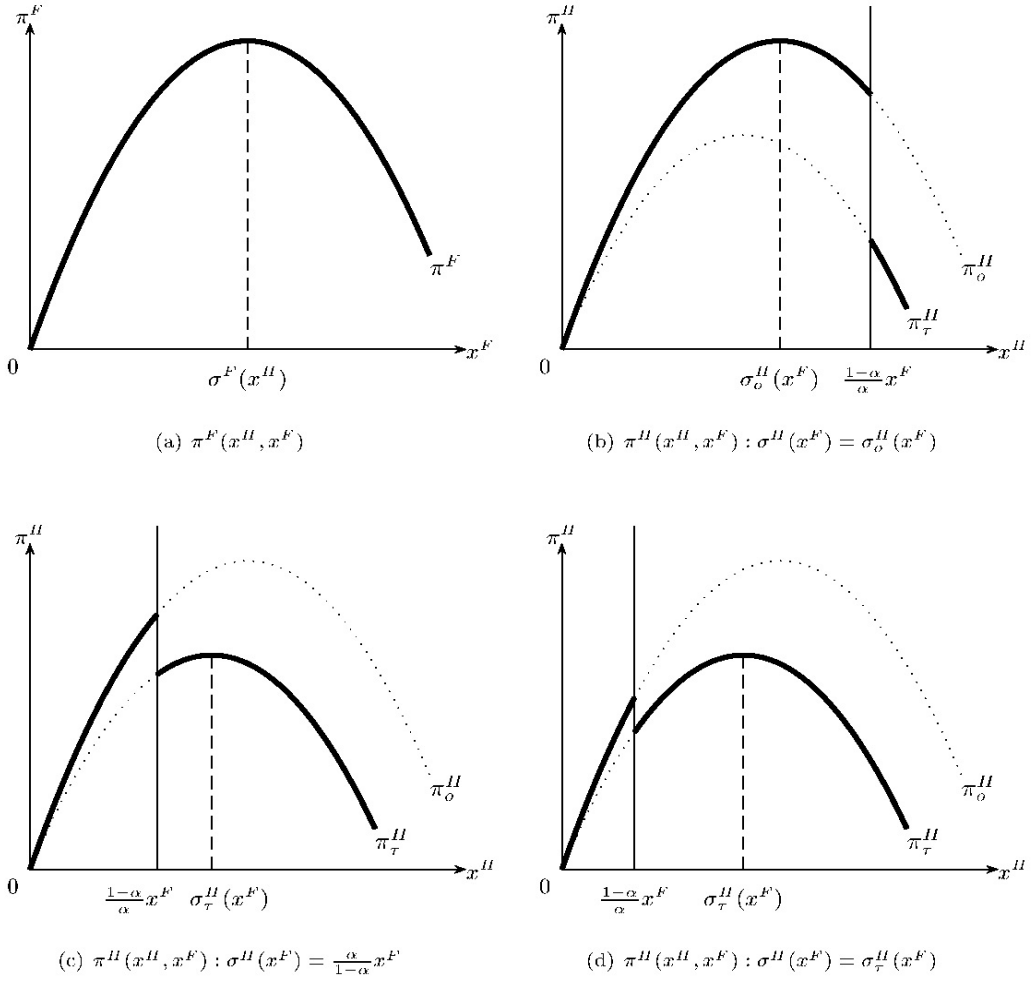


Figure 1: Profit Functions

$$\pi^H(x^H,x^F)=\begin{cases}\left[p(x^H+x^F)-c\right]x^H & \text{if} \quad x^H \le \dfrac{1-\alpha}{\alpha}x^F \\ \left[p(x^H+x^F)-c-\phi(\tau)\right]x^H & \text{if} \quad x^H > \dfrac{1-\alpha}{\alpha}x^F\end{cases} \tag{4}$$

Figure 1(a) depicts $\pi^F(x^H,x^F)$, and Figure 1(b)-(d) show the possible cases of $\pi^H(x^H,x^F)$ for a given x^F. Note that by inequality (2), $\pi_o^H(x^H,x^F)$ is above $\pi_\tau^H(x^H,x^F)$ and the peak point of $\pi_o^H(x^H,x^F)$ is to the right of that of $\pi_\tau^H(x^H,x^F)$.[9)]

Since the two firms in market A are under Cournot competition, consider the best response of each firm given the other firm's choice. To begin, for each x^H, the F firm's best response function $\sigma^F(x^H)$ is

$$\sigma^F(x^H)= \arg\max_{x^F} \pi^F(x^H,x^F). \tag{5}$$

To find the H firm's best response function $\sigma^H(x^F)$, consider Figure 1(b)-(d), which depicts the composite profit functions $\pi^H(x^H,x^F)$ for possible cases as the bold curves. Let $\sigma_o^H(x^F)$ denote the best response of H firm against x^F when no tariff is imposed. Analogously, let $\sigma_\tau^H(x^F)$ denote the best response when tariff is imposed. That is,

$$\sigma_o^H(x^F)= \arg\max_{x^H} \pi_o^H(x^H,x^F),$$
$$\sigma_\tau^H(x^F)= \arg\max_{x^H} \pi_o^H(x^H,x^F).$$

Define implicitly $\hat{x}^F$ and $\tilde{x}^F$ respectively as the (unique) solutions[10)] of

$$\sigma_o^H(x^F)=\frac{1-\alpha}{\alpha}x^F,$$
$$\pi_\tau^H\left(\sigma_\tau^H(x^F),x^F\right)=\pi_o^H\left(\frac{1-\alpha}{\alpha}x^F,x^F\right).$$

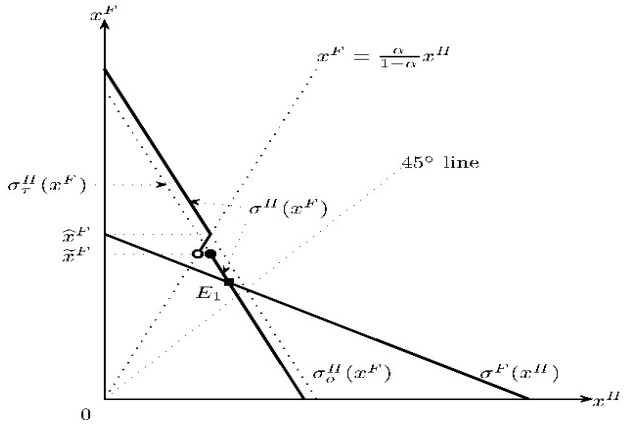
Then, it follows that

Proposition 3.1: The best response function of H firm in market A is

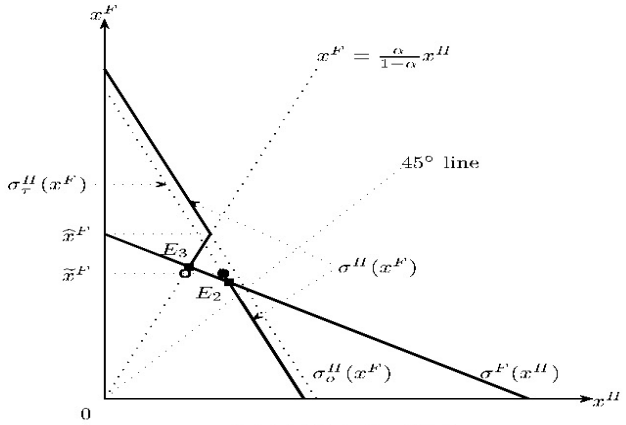
---

9) To see this, consider $\dfrac{\partial\pi_o^H}{\partial x^H}-\dfrac{\partial\pi_\tau^H}{\partial x^H}=\phi(\tau)>0$. Thus, if $x^H$is such that $\dfrac{\partial\pi_o^H}{\partial x^H}=0$, that is, at the peak point of $\pi_o^H(x^H,x^F)$, then $\dfrac{\partial\pi_\tau^H}{\partial x^H}<0$, that is, the slope of $\pi_\tau^H(x^H,x^F)$ should be negative.

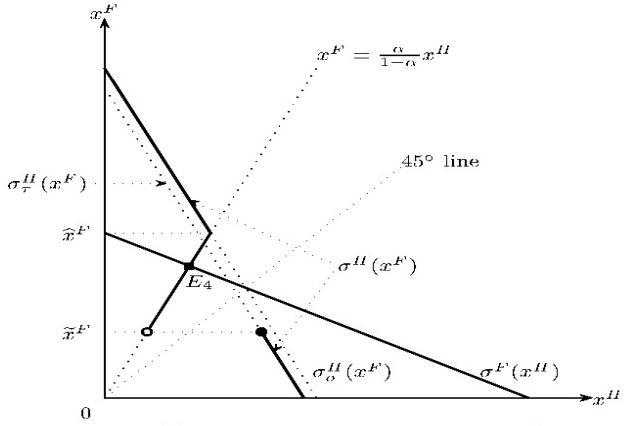
10) We assume that these solutions are unique. If $p=p(x^H+x^F)$ is linear, this assumption holds.



(a) Unique Equilibrium with Tariff



(b) Multiple Equilibria



(c) Unique Equilibrium without Tariff

Figure 2: Possible Cournot-Nash Equilibrium Depending on $\varphi(\tau)$

$$\sigma^H(x^F)=\begin{cases}\sigma_o^H(x^F) & \text{if} \quad \widehat{x^F}\le x^F \\ \dfrac{1-\alpha}{\alpha}x^F & \text{if} \quad \hat{x}^F \le x^F < \tilde{x}^F \\ \sigma_\tau^H(x^F) & \text{if} \quad x^F < \widetilde{x^F}\end{cases} \tag{6}$$

Proof: Using Figure 1(b)-(d), it suffices to consider the three cases that are distinguishable depending in the relative size of x^F.

(i) $\widehat{x^F}\le x^F$: In this case, it is obvious that $\sigma^H(x^F)=\sigma_o^H(x^F)$.

(ii) $\hat{x}^F \le x^F < \tilde{x}^F$: In this case, $\pi_\tau^H\left(\sigma_\tau^H(x^F),x^F\right) \le \pi_o^H\left(\dfrac{1-\alpha}{\alpha}x^F,x^F\right)$. Thus, it follows that $\sigma^H(x^F)=\dfrac{1-\alpha}{\alpha}x^F$.

(iii) $x^F < \widetilde{x^F}$: In this case, $\pi_\tau^H\left(\sigma_\tau^H(x^F),x^F\right) > \pi_o^H\left(\dfrac{1-\alpha}{\alpha}x^F,x^F\right)$. Thus, we have $\sigma^H(x^F)=\sigma_\tau^H(x^F)$. Q.E.D.

In market A, we can define the Cournot-Nash equilibrium as the solution of simultaneous equations (5) and (6). Figure 2 shows the equilibrium for the three possible cases depending on the H government's penalty $\phi(\tau)$. From Figure 2, it is clear that there always exists at least one oure strategy Cournot-Nash equilibrium. For a given level of market share target α, there could be a unique equilibrium as in Figures 2(a) or Figure 2(c), while multiple equilibria as in Figure 2(b).

Ⅳ. Discussion and Concluding Remarks

According to equation (2), the difference between the profit functions without tariff and with tariff is $\phi(\tau)x^H$ for x^F given. If $\phi(\tau)$ is large enough that $\phi(\tau)x^H$ increases highly as x^H, then the difference between $\hat{x}^F$ and $\tilde{x}^F$ is also large enough that such a Cournot-Nash equilibrium as in Figure 2(c) would exist. If $\phi(\tau)$ is not large enough, however, then those

equilibria as in Figure 2(a) or 2(b) would be prevailing.

From the perspective of country F which influences $\phi(\tau)$ by means of the tariff rate τ, it is desirable to maintain the equilibrium like E_4 (or E_3) rather than E_1 (or E_2). Thus, assuming that the penalty level function $\phi(\tau)$ is increasing, country F should impose large tariff rate enough to guarantee the equilibrium like E_4. Of course, in this situation, such a trade policy is just a reliable threat since in the equilibrium such a threat is not implemented as a result.

This result explains, for example, why the trade disputes between the United States and other countries usually end up with compromises under the heavy threats by the United States. Facing the jeopardy of losses in domestic industry, the US government or congress has frequently announced the tariff retaliations or punitive sanctions against the industry in dispute as well as the linked or even irrelevant industries. Those countries under such threats want to control the disputed industry to avoid the more severe retaliations that would have hurt their major exporting industries had the demand of the US government not be satisfied.

In practice, it is observed from time to time that such a threat is implemented when the inter-industry control has failed. The present model is also providing the explanations for those cases. On the one hand, the threat of the US might not be as credible as expected. Recall that the threat should be a credible commitment. On the other hand, it happens that the threat is not that serious so that it would have a limited impact on the disputed market. This situation is consistent with the case as in Figure 2(a). Even though a high tariff rate is expected, its impact could be ignorable regarding to the disputed industry.

Recently, a lot of bilateral agreements have been enacted in international trade, especially, as a result of FTA. It is usual for the bargaining countries of an FTA to persist some retaliation methods once a trade dispute is initiated. Our model could easily be applied to the case of FTA case of trade dispute.

References

Conybeare, John, "Trade Wars: A Comparative Study of Anglo-Hanse, Franco-Italian, and Hawley-Smoot Conflicts," *World Politics*, Vol. 38(1), pp. 147-172, 1985.

Dixit, A. K. and V. Norman, *Theory of International Trade*, Cambridge University Press, 1980.

Ethier, Wilfred J. and Henrik Horn, "Results-Oriented Trade Policy," *Review of International Economics*, Vol. 4(1), pp. 17-39, 1996.

Greaney, T. M., "Import Now! An Analysis of Market-Share Voluntary Import Expansions," *Journal of International Economics*, Vol. 40, pp. 149–163, 1996.

Kherallah, Mylène and John Beghin, "U.S. Trade Threats: Rhetoric or War?" *American Journal of Agricultural Economics*, Vol. 80(1), pp. 15-29, 1998.

Krishna, Kala and John Morgan, "Implementing Result-Oriented Trade Policies: The Case of the US-Japanese Auto Parts Dispute," *European Economic Review*, Vol. 42(8), pp. 1443-1467, 1998.

Nagaoka, S., "Economic Consequences of VIE When Consumers Are Constrained," *Japan and the World Economy*, Vol. 9(4), pp. 557-565, 1997.

Office of the United States Trade Representative, "2011 Special 301 Report," available at USTR website: http://www.ustr.gov/webfm_send/2841.

Osborne, M. J. and A. Rubinstein, *A Course in Game Theory*, MIT Press, 1994.

Perroni, Carlo and John Whalley, "The New Regionalism: Trade Liberalization or Insurance?" *Canadian Journal of Economics*, Vol. 33(1), pp. 1-24, 2000.

Satapathy, C. "Trade Sanctions and Other Barriers to Free Trade," *Economic and Political Weekly*, Vol. 34(51), pp. 3583-3585, 1999.

Varian, Hal R., *Microeconomic Analysis*, 3rd ed., W. W. Norton & Company, Inc. 1992.

Ionascu, D. and K. Zigic, "Tariff Protection, Intellectual Property Rights and North-South Trade with Perfect Price Flexibility," *CEPR Discussion Paper*, No. 4690, 2004.

국문초록

무관한 산업에 대한 징벌적 관세부과

이병채*

전통적으로 자국 산업의 이익보호를 위해 관세는 널리 사용되어 왔다. 개발도상의 단계에 있는 나라들은 자국의 유치산업을 보호할 목적으로 관세를 사용하는 반면, 선진국들은 자국의 상품이 타국의 시장에 진출할 수 있도록 타국을 압박하는 수단으로 사용되는 경우가 많다.

본 논문에서는 선진국이 자국의 특정 수출품을 개발도상국 시장에 일정한 비율 이상 진출시키기 위해 개발도상국의 제3의 생산품에 관세를 부과하겠다는 위협을 하는 경우 그 경제적 효과를 간단한 게임이론 모형을 통해 살펴본다. 만약 관세가 부과된 제3의 생산품이 주력 수출품인 경우 개발도상국 정부는—주력 수출품 생산자들의 로비 등을 통해—문제가 된 상품에 일정한 제재를 부과함으로써 선진국과의 마찰을 자발적으로 해소하려는 유인을 갖게 됨을 보인다. 이러한 결과는 최근 FTA로 대변되는 양자 간 무역협정의 체결에서 나타나는 산업 간 이해득실의 차이를 개별 산업의 협상력 차이로 설명할 수 있다는 의미를 지닌다.

주제어 : 무관 산업, 징벌적 관세, 로비, 쿠르노-내쉬 균형, 자발적 수입확대

* 충남대학교 경제학과 조교수