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A Theory of Economic Sanctions



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Baran Han

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A Theory of Economic Sanctions

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EXECUTIVE SUMMARY

This paper presents a work-horse model to analyze the mechanism of triadic sanctions, where the receiver of the sanction is not the actual target. With a motivating example of the US sanctions against Iran and a simple game theoretic framework, we show that the threat of such sanction is not credible in situations where the game ends after single stage, or when the entities are not concerned with future transactions amongst each other. In a repeated game setting, on the other hand, the threats become credible, but the level of enforcement would differ across firms/countries depending on the economic interdependency and how the parties perceive the probability that the games would continue to the next period.

Keywords: Iran Sanctions, Triadic Sanctions

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A Theory of Economic Sanctions

Baran Han

I. Introduction

On January 12, 2012, the US government called upon China's state-run Zhuhai Zhenrong Company (ZZC) for its violation of the Comprehensive Iran Sanctions, Accountability, and Divestment Act of 2010 (CISADA).¹ According to the administration, ZZC, Iran's largest supplier of refined oil, had allegedly brokered sales of \$500 million worth of refined petroleum, an amount clearly greater than the allowed \$5 million per year, to Iran between July 2010 and January 2011. Three sanctions were imposed: ban on US export licenses, ban on financing from the Export-import bank of the US, and denial of loans over \$10 million from US banks. The determination bore significance because it signaled the US's increased commitment to the sanctions against Iran, and because ZZC was the first firm from China – Iran's biggest trade partner – to have been accused of violation.

¹ On the same day, Kuo Oil Pte. Ltd. of Singapore and Fal Oil Company Ltd. were also determined to be sanctioned by the CISADA 2010.

CISADA's predecessor, Iran Sanction Act (ISA) of 1996 had been often criticized for its lack of enforcement: during the 14 years that the ISA was in effect, only 2 entities² were actually sanctioned for their transactions with Iran. Since CISADA, however, determinations of sanctions have become more regular. In May 25th, 2011, the US government issued its first seven sanctions determinations,³ and in January 12, 2012, three additional firms were determined to have violated CISADA, ZZC being one of them. It was an indication that the administration would enforce the sanctions more seriously this time.

The naming of the ZZC, in addition, caught immediate attention since in spite of the continuous trade and investment relations between Chinese firms and Iran in "sanctionable" sectors in "sanctionable" amounts, the US had never publically accused any of them under the ISA or CISADA. Was the US finally making its stand against China? The media, soon discovered that ZZC did almost no business with the US and thus the sanction actually had no bite - sanctioning ZZC was a mere "signal" that the US was serious about enforcing CISADA (Reuters 2012. 01.12),⁴ rather than a real punishment. The feasibility of the signal, though, has been of question since the target of the sanction was not Sinopec, CNPC or CNOOC, politically powerful oil majors which invested significant amounts of dollars in both the US's and Iran's energy sector.

² The two entities were a Nafiran Intertrade Company, a Swiss-based Iranian-owned oil trading company (on September 30, 2010) and Belarusneft, a subsidiary of the Belarus government owned Belneftekhim (on March 29, 2011).

³ The seven firms sanctioned were Petrochemical Commercial Company International (PCCI) of Bailiwick of Jersey and Iran, Royal Oyster Group (UAE), Tanker Pacific (Singapore, affiliated with Ofer Brothers Group), Allvale Maritime (Subsidiary of Ofer Brothers Group, a Europe-based trust), Societe Anonyme Monegasque Et Aerienne (SAMAMA, Monaco, but affiliated with Ofer Brothers Group), Speedy Ship (UAE/Iran), Associated Shipbroking (Monaco), and Petroleos de Venezuela, of Venezuela.

⁴ <http://www.reuters.com/article/2012/01/12/us-iran-usa-sanctions-idUSTRE80B1DW20120112>

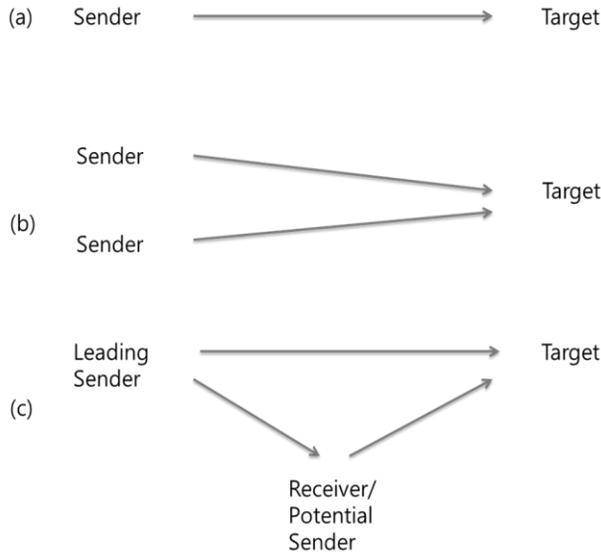
Motivated by the example of the US sanctions against Iran, we investigate the enforcement and compliance mechanisms of such triadic sanctions using a game framework. We study whether triadic sanctions are actually effective in coercing the third party and thus pressuring the target. We show that if and only if it is credible that the sanction will be enforced and the enforcement has significant effect on the receiver, there would be behavioral change by the third party. In other words, a single stage game, the Nash equilibrium which can induce a high compliance level is not Subgame Perfect, or the threat of sanction is not credible (there is no incentive for the sender to enforce the sanctions) and thus the third party will not comply. In a repeated game setting, there exists an equilibrium path where the third party (here ZZC) complies to the sender's will because now it has an incentive to enforce the sanctions more than before. The interaction is repeated and the sender's behavior now determines the third party's behavior in the later periods and thus affects the overall outcome of the sanction game.

Chapter 2 of the paper discusses the various types of sanctions based on the existing literature. Chapter 3 presents a game that captures the dynamics of triadic sanctions. Chapter 4 discusses the US-Iran sanctions and explains its various features using the results from Chapter 3. Chapter 5 concludes.

II. Overview of Triadic Sanctions

Economic sanctions are “deliberate, government-inspired withdrawal, or threat of withdrawal, of customary trade or financial relations” (Hufbauer, Schott, and Elliott 1990: 1, henceforward, HSE) from a sender (senders) to specific receiver (receivers) in order to coerce the receivers into particular behavior. The history of sanctions goes as far as the 432 BC (HSE 1990, 4) in Ancient Greece, levied upon Megara by the Athenian Empire: when Megarians cultivated the Hieria Orgas, or Holy Meadow, located between Athens and Megara without Athenian consent and killed the herald who was sent to reproach them, Pericles proposed a “Megarian decree” which prohibited the Megarians from the Athenian ports and markets. (McDonald 1994) Since then, sanctions have been a coercion tool in international diplomacy often used by large nations to pursue an active foreign policy.

Triadic sanction, the topic of this paper, is one such action but has a distinguishing feature from other sanctions, which in general are dyadic and have a sender (senders) and a receiver, with the receiver being the actual target of the behavior change. Triadic sanctions or “secondary boycotts” as used in the literature of sanctions (see for example, Elliott and Hufbauer 1999), on the other hand, the receiver of the sanction is not the actual target but a potential sender, a means through which the original sender punish the target. The receiver of the Iran Sanction Act was not Iran but foreign entities investing in or trading with Iran. By threatening to cease business relations with the foreign entities in case they continue their transactions with Iran, the US in theory can hurt Iran more than the time it withdrew its own relations.

Figure 1. Sanction Structure

Source: author.

The purpose of a triadic sanction is to enforce multilateral cooperation. When the sanction is dyadic and allies of the target help out or if the sender is the only entity that pursues the sanction and others continue their relationship with the target, it is quite likely that the sanction would have a limited affect.⁵ (HSE 1990; Hufbauer *et al* 1997; Martin 1993) Sometimes this leads to free-riding (when the goal itself is a public good and only certain countries participate), which affects the overall outcome. Thus, in order to solve the issue of effectiveness, “leading”

⁵ Of course, such use of economic dependency is not the only key to sanction success. Pape (1997, 109), argues that economic sanctions against target states whose trade is completely dependent on the coercer is not necessarily effective.

senders such as the US attempts to expand the previous bilateral relations to a multilateral one, by making its allies participate in the sanctioning process.

Rallying others to voluntarily participate, however, is hard since participating may mean the entity would have to let go existing or even expanding business opportunities. Therefore coming up with an enforcement mechanism to make other parties or countries participate may be vital in isolating the target and achieving the sender's goal. One such way is the triadic sanction where the sender threatens to punish a third party if it continues an economic or political relationship with the target.

Are the triadic sanctions actually effective in coercing the third party and thus pressuring the target? Not so surprisingly, such sanctions tend to induce vehement opposition from other countries, as we will see soon in the example of the US sanctions against Iran in chapter 4. There is evidence that when the leading sender somehow fails to rally others despite imposing sanctions, the third parties may even gain from sanctions. For example, in their work examining the impact of US economic sanctions on bilateral trade between the US and target countries using gravity model, Hufbauer *et al.* (1997) find that in the case of Cuba, when the US imposed triadic sanctions (The Helms Burton Act (1996)), the bilateral trade between Cuba and countries such as Belgium, Canada, France, Germany, Ireland, Italy, Mexico, the Netherlands, and Spain was bigger than expected, given their size, income, and distance. Yang *et al.* (2004) also finds that when the US imposes comprehensive sanctions towards countries, they tend to increase trade between target countries and the EU or Japan.

Why didn't the US cease its economic relations with Belgium, Canada, France, Germany, Ireland, Italy, and Spain upon realizing that they were continuously trading with Cuba? When is the US more likely to enforce the triadic sanctions?

In addition, as we have seen in the enforcement of US sanctions against Iran, why would the sender show different levels of enforcement across different foreign entities? The model in the next chapter attempts to answer these questions.

III. A Model of Triadic Sanctions

I bring together two strands of literature and investigate the enforcement and compliance mechanisms of triadic sanctions using a game framework. There has been literature which uses game theory to describe sanctions. For example, Tsebelis (1990), using a two player game, shows that under certain conditions, the size of the punishment has no impact upon the behavior of the target country. Lacy and Niou (2004) models economic sanctions as a multi-stage game of two-sided incomplete information between a target and a coercer, and Drezner (1998) develops a two player game-theoretic model of economic coercion to show that both “senders” and “targets” of economic coercion incorporate expectations of future conflict as well as the short-run opportunity costs of coercion into their behavior. The other strand of literature is of three party nonsymmetrical interactions. The seminal paper is Basu (1986). With an example of a landlord, a laborer, and a merchant, he describes how the landlord can push the laborer into accepting a sub-reservation wage by threatening the merchant not to do business with the laborer unless the laborer accepts. Naqvi and Wemhoner (1995) and Hatlebakk (2002) builds up on Basu’s model and each constructs a Subgame Perfect Nash equilibrium in an infinitely repeated game under minor changes in the overall environment.

There has not been any work that we know of that formalizes the triad interaction in economic sanctions. A suggestion, however, has been made in Basu (2000, 148). He gives an example of the US’s Helms-Burton Act of 1996 on Cuba through which the US attempts to penalize companies or nations doing business in Cuba.

1. A Stage Game

Suppose there are three players – a leading sender (U), a target (I), and a third party (C). The leading sender U's payoff depends on gains from trade with others and the compliance level of target I. The third party C's payoff depends only on gains from trade with others. The target's payoff depends on gains from trade with others and the compliance level.

The total expected gains from trade for player j if all of them engage in trade among one another is T_j , or T_I for the target, T_u for sender, and T_c for the third party. We assume economic interdependence such that the constant α_{IC} is the third party C's trade share in target country I, and α_{IU} is the sender's trade share in the target country. One could interpret α_{IU} as the amount which I relies on U. The constant α_{CI} is the target country I's market share in the third country C and α_{CU} is the sender country U's market share in the third country C. The constant α_{UC} is the third country C's market share in the sender country U, and lastly, α_{UI} is the target country I's market share in the sender country U. The trade dependency relationship among the three parties can be summarized in the below table:

For example, if U and I sever trade ties, the payoff of U becomes $(1 - \alpha_{UI})T_u$ and the payoff of I becomes $(1 - \alpha_{IU})T_I$. We assume $\alpha_{CU} > \alpha_{CI}$, so that C's economic dependency on U is greater than C's economic dependency on I.

For the sanction sender and the target, the level of compliance by I or $k_i \in \mathbb{R}^+$ affects the overall payoff. If the target meets k_i , the sender obtains the payoff of k_i . In the US sanctions against Iran, the compliance level k_i could be thought of as the number of required IAEA inspections per year that U wants in

Table 1. Trade Dependency Relationship Among Three Players

	U	I	C
U		α_{IU}	α_{CU}
I	α_{UI}		α_{CI}
C	α_{UC}	α_{IC}	

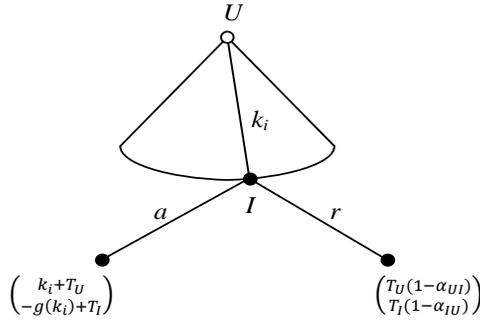
I. The target, on the other hand, has to pay the cost of $-g(k_i)$, where $g(k_i) > 0$ and an increasing function of k_i , in order to comply at the level k_i . Such cost may be incurred through inspection costs, or through political costs domestically. For simplicity, we assume here that C is not affected by I's compliance level k_i . That is, we suppose that the third parties such as China, Korea, and Japan are not so much concerned with the number of nuclear inspections in I.

1.1. The Dyadic Sanction

Suppose there are two players – a sender (U) and a target (I). There is no third party or C involved. The timeline of the game is as follows. There is no trade relationship between the two to begin with. During the first stage, the sender announces to the receiver a level of expected compliance level of $k_i (>0)$ and announces: “If target accepts the proposed compliance level k_i I will trade with the target. Otherwise, I will not trade with the target.” Here, we assume that U can commit to not to trade with I in case of non-compliance.

Through backward induction, we see that I will choose $\{a\}$ if and only if $k_i \leq k_d$, where $k_d = g^{-1}(\alpha_{IU}T_I)$. For U, U will choose a level of k_i such that it maximizes $k_i + T_U$ subject to $k_i \leq k_d$. Thus U will choose k_d . That is, the maximum compliance level that U can induce from such dyadic sanction is k_d .

Figure 2. Dyadic Sanction



1.2. The Triadic Sanction

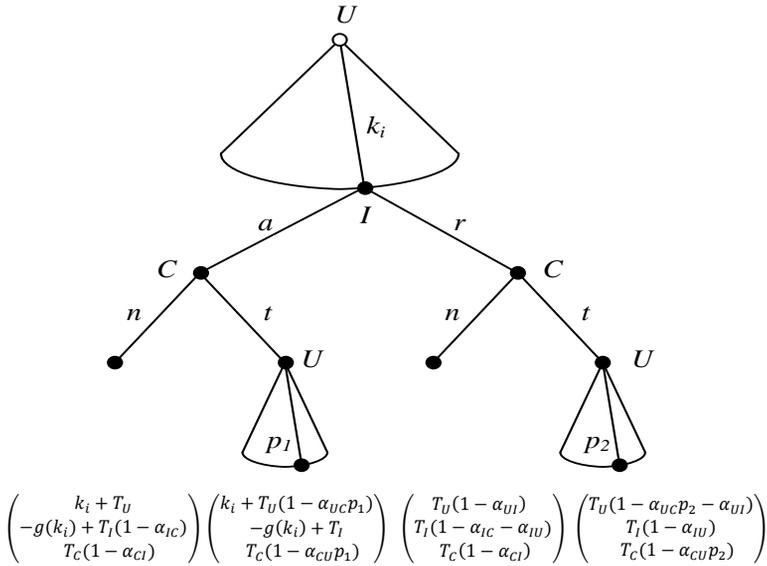
The timeline of the game is as follows. To start with, U and C trade and I and C trade but U and I do not have a trade relationship. During the first stage, the sender announces to the receiver a level of expected compliance level of k_i and threatens the third party to an economic sanction: “If target accepts the proposed compliance level k_i , U will start to trade with the target I and continue trading with C. If the target rejects the proposed compliance level, U will continue not to trade⁶ with the target I and U will cease to trade with C that trade with the target I.” During the second stage, the target accepts the compliance level, or plays {a}, or rejects the compliance level, or plays {r}. During the third stage, observing the target I’s behavior, C decides whether to continue its trade relations with the target, or play {t}, or to discontinue its trade relations with the target, or play {n}. Here, we again assume that U can commit to not to trade with I in the

⁶ For simplicity, we restrict the economic transaction between two countries to be trade. In reality, it could be any economic transaction between two countries, such as trade, aid, and investment.

case of non-compliance by I in order to focus on the dynamics between U and C.

When C decides not to trade with the target, the game ends at the node. When C decides to trade with the target, U chooses the punishment level $p \in [0,1]$ by which U reduces its trade with C. We assume here that when the expected payoff is the same between accepting and rejecting the demanded compliance level, I choose to accept the compliance level k_i . Likewise, when the expected payoff is the same between trading and not trading with the counterpart, the countries choose to trade. The game tree of this game is in the following Figure:

Figure 3. The Game Tree



Proposition 1. There are two Nash equilibrium outcomes in this stage game: a high compliance equilibrium $(k_t, a, t, p_1=0)$ and a low compliance equilibrium $(k_d, a, t, p_1=0)$ where $k_t = g^{-1}((\alpha_{IC} + \alpha_{IU})T_I)$ and $k_d = g^{-1}(\alpha_{IU}T_I)$.

The high compliance Nash equilibrium sequence $(k_t, a, t, p_1=0)$ is achieved when U demands the compliance level $k_t = g^{-1}(\alpha_{IC} + \alpha_{IU})T_I$, I accepts or plays $\{a\}$ if the demanded compliance level $k_i \leq k_t$ and rejects or plays $\{r\}$ if $k_i > k_t$. For C, if I accepts, it continues to trade with I or plays $\{t\}$. On the other hand, if I rejects C ceases to trade with I, or plays $\{n\}$. When I accepts k_t and C trades with I, U trades with C and does not punish C ($p_1=0$). When I rejects k_t and C trades with I, U punishes C by reducing trade by $p_2 = \frac{\alpha_{IC}}{\alpha_{CU}}$. When I rejects k_t and C does not trade with I, U trade with C the game ends. Note here in this equilibrium, U can demand a higher compliance level k_i as I's dependency of U (α_{IU}) and C (α_{IC}) increase.

This high compliance Nash equilibrium, however, is based on an incredible threat. Suppose I rejects the compliance level $k_i = k_t$ and C decides to continue to trade with I. The best strategy for U then would be to trade with C. According

Figure 4. High Compliance Strategy Profile

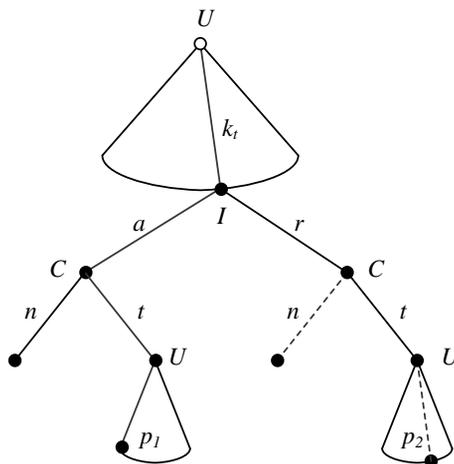
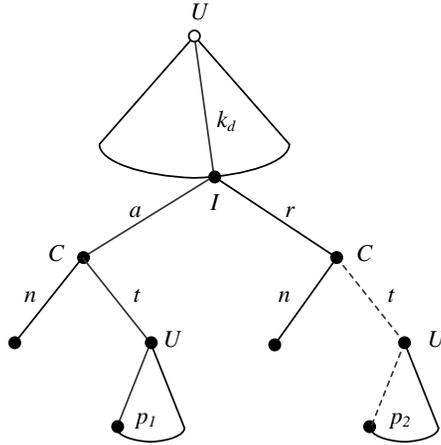


Figure 5. Low Compliance Strategy Profile



to the above high compliance Nash equilibrium, U should be punishing C by reducing trade by $p_2 = \frac{\alpha_{IC}}{\alpha_{CU}}$, but since the game ends right after U's action, the optimal strategy for U is to continue its relationship with C and not punish C at all, or $p_2 = 0$. Thus, the high compliance Nash equilibrium is based on an incredible threat, and it is not a Subgame Perfect equilibrium.

The low compliance Nash equilibrium sequence $(k_d, a, t, p_1=0)$ is achieved when U demands the compliance level $k_d = g^{-1}(\alpha_{IU}T_I)$, I accepts or plays {a} if the demanded compliance level $k_i \leq k_d$ or rejects or plays {r} if $k_i > k_d$. Note here that $k_d < k_t$. For C, it continues to trade with I or plays {t} regardless of I's action. When I accepts k_d and C trades with I, U trades with C and does not punish C ($p_1=0$). When I rejects k_d and C trades with I, U does not punish C, or $p_2 = 0$. When I rejects k_t and C does not trade with I, the game ends – U does not trade with I and U and does trade with C. Note here in this equilibrium, U can demand higher compliance level k_i as I's dependency of U or α_{IU} increase.

I's economic dependency on C or α_{IC} does not affect the level of compliance.

The above low compliance Nash equilibrium is based on a credible threat. Suppose I rejects the compliance level $k_i = k_d$ and C decides to continue to trade with I. The optimal strategy for U then would be to trade with C fully, or $p_2 = 0$. This is a Subgame Perfect equilibrium.

Here, the existence of C does not affect the outcome of the game. That is, C does not play any role in the sanction because I and C both know that U will not punish C when C keeps on trading with I in case of rejecting k_t . Knowing this, C will continue to trade even I does not accept the compliance level, and knowing this, I will comply only for $k_i \leq k_d$. Even though the triadic sanction pressures the third party, since the leading sender cannot make a credible threat to punish the 3rd party, the 3rd party is unlikely to be participating and thus the overall triadic sanction becomes ineffective.

The reality actually goes further than what the model predicts. For triadic sanctions against Cuba, it turned out that the trade between Cuba and Belgium, Canada, France, Germany, Italy, and Mexico were greater than what the actual distance and economic size predicts after the US sanctions (Hufbauer *et al.* 1997). That is, it almost looks like the leading sender's place can be filled with the third party's presence in the sanctioned country.

2. An Infinitely Repeated Sanction Game

The high compliance equilibrium where I accepts the compliance level of k_t can be Subgame Perfect if we allow for infinitely repeated sanction games as we know from the folk theorems of repeated games. Here, we show such strategy profile. Infinite repetition need not be thought of as the game being actually re-

peated infinitely. As noted in Osborne and Rubinstein (1994, 135) it only requires that the decision makers not know when the game will actually end when they make a move.

Suppose the stage game that we have described in the previous section is repeated infinitely. There are three players – a leading sender (U), a target (I), and a third party C with the same trade dependency relationship as before. The players discount the future payoffs with discount factors θ_U , θ_I , and θ_C which can be also interpreted as each player's perception on the probability that the game will continue to the next period. In proposition 2 we present a Subgame Perfect equilibrium of this repeated game using the notation of Abreu (1988) and Hatlebakk (2002):

Proposition 2. Suppose p_2 , the punishment by U to C when C does trade with I after I rejects the compliance level, satisfies $p_2 \geq \frac{\alpha_{CI}}{\alpha_{CU}} - \frac{\hat{p}_1 \theta_C}{1 - \theta_C}$ and $p_2 \leq (k_t - k_d) \frac{\theta_U}{(1 - \theta_U) \alpha_{UC} T_U}$, where \hat{p}_1 is an exogenous amount of disfavor that is imposed to C once C deviates from the equilibrium path. Then the following strategy profile constitutes a Subgame Perfect Nash equilibrium:

- Equilibrium path: play according to the sequence $(k_t, a, t, p_1 = 0)$
- The target specific punishment path (which applies whenever the target plays r after k_t): C plays n and the period game ends. For the next period on, they play $(k_t, a, t, p_1 = 0)$.
- The third party specific punishment path (which applies whenever C plays t after I plays r): U reduces trade with C by a fraction of p_2 for a single period and then return to the equilibrium outcome $(k_t, a, t,$

$p_1 = \hat{p}_1$) where $\hat{p}_1 > 0$.

- Sender specific punishment path (which applies whenever U deviates from the third party punishment path or the equilibrium path): play according to the stage game outcome $(k_d, a, t, p_1 = \hat{p}_1)$ forever.

Proof of Proposition 2.

First of all, the target will not deviate from the equilibrium outcome as long as the expected payoff of accepting k_t outweighs the expected payoff of rejecting k_t . That is:

$$\frac{(T_I - g(k_t))}{1 - \theta_I} \geq T_I(1 - \alpha_{IC} - \alpha_{IU}) + \frac{\theta_I(T_I - g(k_t))}{1 - \theta_I} \quad (1)$$

which is always satisfied since $k_t = g^{-1}((\alpha_{IC} + \alpha_{IU})T_I)$.

Second of all, the third party C will not deviate from the target specific punishment path as long as the expected payoff of not trading with I outweighs the expected payoff of trading with I in case of I's rejection of k_t . That is:

$$T_C(1 - \alpha_{CI}) + \frac{\theta_C T_C}{1 - \theta_C} \geq T_C(1 - \alpha_{CU} p_2) + \frac{\theta_C T_C(1 - \alpha_{CU} \hat{p}_1)}{1 - \theta_C},$$

or $p_2 \geq \frac{\alpha_{CI}}{\alpha_{CU}} - \frac{\theta_C \hat{p}_1}{1 - \theta_C}$. (2)

Note here that for $\theta_C \leq \frac{\alpha_{CI}}{\alpha_{CU} + \hat{p}_1}$, $\frac{\alpha_{CI}}{\alpha_{CU}} - \frac{\theta_C \hat{p}_1}{1 - \theta_C} \geq 0$. Note here that once C deviates, even if I accepts k_t the next period and C trades with I, U will continue to punish C by \hat{p}_1 . One can think of this as due to mis-trust led by C's previous non-cooperative behavior.

Lastly, the sender U will not deviate from the third-party specific punishment

path as long as the expected payoff of punishing C outweighs the expected payoff of not punishing C. That is:

$$T_U(1 - \alpha_{UI} - \alpha_{UC}p_2) + \frac{\theta_U(k_t + (1 - \alpha_{UC}\hat{p}_1)T_U)}{1 - \theta_U} \geq T_U(1 - \alpha_{UI}) + \frac{\theta_C(k_d + T_U(1 - \alpha_{UC}\hat{p}_1))}{1 - \theta_U},$$

or $p_2 \leq (k_t - k_d) \frac{\theta_U}{(1 - \theta_U)\alpha_{UC}T_U}$ (3) Q.E.D.

Let's examine the necessary conditions of the proposition 2, or equations (2) and (3). Equation (2) shows the minimum punishment of p_2 or $\frac{\alpha_{CI}}{\alpha_{CU}} - \frac{\theta_C p_1}{1 - \theta_C}$ that U should impose on C to make C follow its will. Let's denote $\frac{\alpha_{CI}}{\alpha_{CU}} - \frac{\theta_C p_1}{1 - \theta_C}$ as \underline{p}_2 . Equation (3) shows the maximum amount of punishment p_2 or $(k_t - k_d) \frac{\theta_U}{(1 - \theta_U)\alpha_{UC}T_U}$ that U is willing to impose on C: For $p_2 > (k_t - k_d) \frac{\theta_U}{(1 - \theta_U)\alpha_{UC}T_U}$, too much loss will be incurred and it will not be worth to punish C. Let's denote $(k_t - k_d) \frac{\theta_U}{(1 - \theta_U)\alpha_{UC}T_U}$ as \bar{p}_2 . For $\theta_U \leq \frac{\alpha_{UC}T_U}{(k_t - k_d) + \alpha_{UC}T_U}$, $\bar{p}_2 < 1$.

Let's first examine \underline{p}_2 , the minimum amount of punishment required to induce C to participate in the sanction. Note here that as α_{CI} or C's trade dependency on I increases, \underline{p}_2 increases. As C's trade dependency on U increases, on the other hand, \underline{p}_2 decreases: the threat of punishment does not have to be big if C relies heavily on U. Moreover, as C discounts the future less, or when θ_C increases, \underline{p}_2 , or the minimum amount of punishment required to induce C to participate in the sanction, decreases: the future is important to C and it only takes a small amount of punishment on C for it to comply. In similar note, if C believes that the interaction with U and I is more likely to continue to the next period, the minimum amount of punishment to induce C to participate decreases.

Recall that \hat{p}_1 was the disfavor towards C after C has deviated from the equilibrium path. As the amount of \hat{p}_1 increases, \underline{p}_2 , the minimum amount of required punishment would also decrease.

Let's now examine \bar{p}_2 , or the maximum amount of punishment That U is willing to impose on C. As α_{UC} or U's trade dependency on C increases, \bar{p}_2 decreases. As T_U , the total amount of expected trade increases, the maximum amount of punishment That U is willing to impose, or \bar{p}_2 also increases. As θ_U increases or as U discounts the future less, \bar{p}_2 increases. Another interpretation of this result is that if U thinks that the interaction with C and I is more likely to continue to the next period, the maximum amount of punishment that U is willing to impose increases. If $k_t - k_d$, or the gain that U experiences by making C participate in the sanction becomes greater, \bar{p}_2 increases.

Moreover, note here that when $\bar{p}_2 < \underline{p}_2$, or when the maximum amount of punishment That U is willing to impose on C is less than the minimum amount of punishment required to induce C to participate in the sanction, the equilibrium strategy profile no longer is valid. That is, for example, if U's trade dependency on C is significant, U will only want to punish little, which may be too small to force C to stop trading with I in case of I's non-compliance. Knowing this, I will thus only comply at a suboptimal level from the perspective of U.

In the next chapter we review the US-Iran sanction through the above game framework. As the analysis predicts, we will see that when the US is short-sighted and considers the triadic sanction as a one-shot game, there is no incentive for the US to enforce the triadic sanctions. Once the US considers the long term consequences of enforcement failure more seriously, however, the US becomes actually more willing to enforce despite its immediate losses. The enforcement, however, seems to vary across different entities based on the US's dependency on

the third party on how the US discounts the future as we have seen through Equation (3). Moreover, the cooperativeness of the third party depends on its relative economic dependency on Iran and the US and how it discounts the future. Equation (2) has predicted as such.

IV. US-Iran Sanction

1. Evolution of the US-Iran Sanction

To penalize and curb Iran's illicit nuclear proliferation activities, support for terrorism and arms exports, (later on, human rights abuses) the US government has imposed an Iran Libya Sanction Act of 1996 (Iran Sanction Act, from 2004⁷), followed by a Comprehensive Iran Sanctions, Accountability, and Divestment Act of 2010 (CISADA). Under ISA, foreign companies that make investment of more than \$20 million a year in Iran's energy sector (petroleum and natural gas) were threatened to be sanctioned by the US. Having the 3rd largest proven petroleum reserves in the world, Iran's petroleum sector generated about 20% of its total GDP and 80% of its total exports. Iran's gas reserves rank second in the world, most of which is yet to be developed. When Iran opened its energy sector to foreign investment in 1995, the US was in need of a mechanism to halt the country's development of the energy sector and economic growth. Since by the mid-1995 the US domestic firms were not allowed to trade with or invest in Iran through several executive orders, the Clinton administration pushed forward a sanction act that could restrict foreign investment in Iran. By limiting the investment to the petroleum sector that is the backbone of the Iranian economy, the US expected to undermine Iran's anti-US administration, its support for terrorism, and later on nuclear proliferation activities.

⁷ The original Iran Libya Sanction Act was transformed to Iran Sanction Act in 2004 when Libya gave up WMD.

CISADA expanded the ISA, restricting foreign company's exports of refined petroleum to Iran and sales of equipment or services which could help Iran to produce or import refined petroleum. By restricting exports of refined petroleum to Iran, the US could more effectively pressure Iran: despite its rich petroleum resources, Iran's refining technology and capacity is far below the subsistence level due to lack of technology and foreign investment. Even though it has the second biggest proven reserves of oil, Iran thus has been importing more than 40% of domestic refined petroleum use.

ISA and CISADA distinguished themselves from other sanctions that are in general dyadic, where there is a sender and a receiver and the receiver is the actual target of the sanction. For ISA and CISADA, the receiver, or the third party entities, is not the target but a potential collaborator in punishing the actual target – in this case, Iran.

The practice of ISA turned out to be trickier. Enforcement of ISA started with a doomed note: when the act was introduced, the European Union stood adamantly against the “extra-territorial” application of the US domestic law, threatening to file a complaint before the WTO. In the end, they reached an agreement where the US waived penalizing the project which was first determined to be a violation of the ISA, and the EU decided not to file any complaints to the WTO and promised to collaborate with the US on further nonproliferation and counterterrorism activities. (Katzman 2012, p. 12) From 1996 till September 2010, there were NO violations determinations. The waiver clause where it lets the US President to waive sanctions if he certifies that doing so is important to the “US national interest,” was in full effect. Such lack of enforcement basically led to backfilling by other countries. Especially, the non-US firms to expand its businesses in Iran's most profitable energy sector, The below table

Table 2. Non-Chinese Oil Majors that have Invested in Iran's Energy Sector since 1999

Company	Date	Field/Project	Value	status
Royal Dutch Shell (Netherland)	Nov-99	Soroush and Nowruz (oil)	\$800 million	In progress
	Feb-07	Phase 13, 14-South Pars (gas)	\$4.3 billion	Ended
ENI (Italy)	Jul-00	Phase 4 and 5, South Pars (gas)	\$1.9 billion	In progress
	Jun-01	Darkhovin (oil)	\$1 billion	In progress
Total (France) ENI (Italy)	Feb-99	Doroud (oil)	\$1 billion	In progress
	Apr-99	Balal (oil)	\$300 million	In progress
Statoil (Norway)	Oct-02	Phase 6, 7, 8, South Pars (gas)	\$2.65 billion	In progress
Inpex (Japan)	Jan-04	Azadegan (oil)	\$200 million	10% stake
GS Engineering and Construction (Korea)	Sep-02	Phase 9 + 10, South Pars (gas)	\$1.6 billion	In progress
	Oct-09	South Pars Gas Field-Phases 6-8,	\$1.4 billion	Canceled
Daelim (Korea)	Feb-07	LNG Tanks at Tombak Port	\$320 million	In progress
	Mar-07	Esfahan refinery upgrade	NA	In progress
	Nov-09	South Pars: Phase 12-Part 2	\$2 billion	In progress

Source: Katzman (2012).

shows various oil majors that have invested in Iran's energy sector since 1999.

China, become Iran's number 1 trading partner and investor. By the end of 2010, more than 100 Chinese state-owned firms operated in Iran. The following tables show major Chinese firms that have invested in Iran's energy sector since 1999.

Table 3. Chinese State-Owned Energy Firms that have Invested in Iran since 1999

Company	Date	Field/Project	Value	status
Sinopec	Oct-04	Yadavaran (oil)	\$2 billion	In progress
	Jun-06	Garmsar bloc (oil)	\$20 million	In progress
	Jul-06	Arak Refinery expansion	\$959 million	In progress
	Aug-09	Abadan refinery (Pending)	\$6 billion	Pending
CNPC	May-02	Masjid-e-Soleyman (oil)	\$80 million	In progress
	Jan-09	North Azadegan (oil)	\$1.75 billion	In progress
	Aug-09	South Azadegan field	\$2.25 billion	MOU
	Jun-09	South Pars: Phase 11	\$4.7 billion	In progress
CNOOC	Dec-06	North Pars Gas Field (During 20 years)	\$16 billion	Pending

Source: Katzman (2012).

With the passage of the UN 1929 against Iran in June 2010,⁸ there now is a stronger basis for multilateral cooperation and the enforcement of CISADA is taken more seriously. EU, Japan, Korea, Norway, Canada, etc., have announced their independent sanctions following CISADA, and Total (France), ENI (Italy), INPEX (Japan), Royal Dutch Shell (Britain and the Netherlands) promised the US government and the international community that they will close down their businesses and would not start new investment projects in the energy sector. On May 24th, 2011, the US government announced the list of seven firms⁹ to be

⁸ The UN has imposed four rounds of sanctions on Iran, the Security Council resolutions 1737 (December 2006), 1747 (March 2007), 1803 (March 2008), and 1929 (June 2010), for its presumable proliferation activities raised by IAEA Board's report of noncompliance. The sanctions focus on hampering Iran's ability to acquire equipment, technology, and finance for nuclear enrichment and major arms (such as ballistic missiles) development.

⁹ The seven firms sanctioned were Petrochemical Commercial Company International (PCCI) of Bailiwick of Jersey and Iran, Royal Oyster Group (UAE), Tanker Pacific (Singapore, affiliated with Ofer Brothers Group), Allvale Maritime (Subsidiary of Ofer Brothers Group, a Europe-based trust), Societie Anonyme Monegasque

sanctioned for their sales of gasoline and related equipment and services to Iran.

The US government also has increased its efforts to have China, Iran's number 1 trading partner and investor, on board in its pursuit. China not only officially opposes to Iran's illicit nuclear activities but also to the US-led economic sanctions against Iran for coercion. In August 2010, Li Keqiang, the Executive Vice-Premier of the State Council of China reassured the Iranian Oil Minister Massoud Mirkazemi that it would continue the large-scale projects in the energy sector, even though the US directly called on Beijing to observe sanctions. (Park 2010) And as an effort to show its commitment, of the three firms that the US has determined to have violated the CISADA, there was the Chinese ZZC with Kuo Oil Pte. Ltd. (Singapore) and FAL Oil Company Ltd. (UAE).

2. Insights from the Game Theoretic Analysis

In this section we discuss the US-Iran sanctions based on the presented game theoretic framework and answer why there was a lack of enforcement of ISA 1996. We also answer why even though starting with CISADA the US is more committed in enforcing the sanctions towards the third parties, there still are variances in enforcement and compliance.

Putting the game framework into context for Iran and US's case, let's suppose that the k_0 is an exogenous level of k_i , which may be politically determined by the US public, a level of compliance that the US wants from Iran. We know that previously, the dyadic sanction has not worked. Therefore we can conclude $k_d < k_0$. Suppose here that $k_d < k_0 < k_t$. If the triadic sanction had

Et Aerienne (SAMAMA, Monaco, but affiliated with Ofer Brothers Group), Speedy Ship (UAE/Iran), Associated Shipbroking (Monaco), and Petroleos de Venezuela, of Venezuela).

worked, then it would have been possible for the US to achieve k_0 since $k_0 < k_t$. But since the triadic sanction was based on an incredible threat, the maximum possible level of k_i for the US to demand of Iran was only k_d , which is not good enough for the US. With such lack of enforcement, the triadic sanction was basically ineffective and the compliance level has been very low till the passage of CISADA in 2010.

With the passage of CISADA, however, the US seem to have decided to become more forward looking (thus think from an infinitely repeated game framework) and decide to bear the immediate cost of sanctioning third parties in order to induce compliance by Iran. The repeated game framework implies that this is the reasonable thing to do from a long term perspective.

There have been however, relatively eager followers of the sanction like the EU, Japan, and Korea and less than eager followers like China and the UAE. As we have seen in equation (2) $p_2 \geq \frac{\alpha_{CI}}{\alpha_{CU}} - \frac{\theta_C \hat{p}_1}{1 - \theta_C}$ and equation (3) $p_2 \leq (k_t - k_d) \frac{\theta_U}{(1 - \theta_U) \alpha_{UC} \tau_U} = \bar{p}_2$, the minimum punishment threat p_2 that is required to induce the third party to comply depends on the trade dependency relationship between the third party and the sender and target, or α_{CI} and α_{CU} . Moreover, the maximum punishment that the sender is willing to impose on the third party also depends on how dependent it is on the third party, or α_{UC} .

For example, for the third parties with greater relative reliance on Iran vis-à-vis the US (i.e., with bigger $\frac{\alpha_{CI}}{\alpha_{CU}}$) the minimum punishment threat p_2 that is required to induce the third party to participate is greater than others. That is, suppose \underline{p}_{2k} is the minimum required punishment for a Korean firm (for example, GS Engineering and Construction) and \underline{p}_{2c} is the minimum required punishment for a Chinese firm (for example, ZCC). With ZCC's lack of transactions

with the US, we can easily assume that $\underline{p}_{2k} < \underline{p}_{2C}$. In such case, it could be very much possible that when the minimum required punishment for the GS E&C to participate in the sanction is less than the maximum the US is willing to impose on the firm in case of violation, and the minimum required punishment for the ZZC is less than the maximum that the US is willing to impose on the firm: $\underline{p}_{2k} < \bar{p}_{2k} < \bar{p}_{2C} < \underline{p}_{2C}$. Suppose the actual level of the punishment signified in the sanction, or \dot{p}_2 , is at a level $\bar{p}_{2k} < \dot{p}_2 < \bar{p}_{2C}$. Given such sanction, GS E&C will comply but ZZC will not. Of course, the US will also punish ZZC here, but there the punishment will be meaningless because the level is too low to induce ZZC to actually participate in the sanction, and the equilibrium strategy profile fails to be effective in drawing out I's compliance at a desired level.

This is why the US sanctions against China's ZZC bore limited significance. It was the first time that the US had publically accused a Chinese firm under the ISA or CISADA but the commitment of the US to enforce CISADA, however, was questioned since ZZC has almost no financial relations with the US, which basically nullifies the effect of the sanction. The target of the sanction was not Sinopec, CNPC or CNOOC, politically powerful oil majors investing heavily in Iran and also invested significant amounts of dollars in both in the US's energy sector.

To review this phenomenon using the game framework we answer why the US had not punished CNOOC instead of ZZC to show its commitment. It is not hard to see that the maximum amount of punishment depends on α_{UC} or U's amount of dependency to the third party from equation (3) $p_2 \leq (k_t - k_d) \frac{\theta_U}{(1-\theta_U)\alpha_{UC}T_U} = \bar{p}_2$. The below table 4. shows China's Investment to the US energy sector for 2005-2011.

Table 4. China's Investment to the US Energy Sector for 2005-2011

Year	Contractor	USD millions	Share Size	Partner
2007	Sinopec	\$100		Syntroleum
2009	CIC	\$1,580	15%	AES
2010	CNPC	\$180	51%	INOVA Geophysical Equipment
2010	Hopu	\$100	1%	Chesapeake Energy
2010	China Communications Construction	\$130		Friede Goldman United
2010	CNOOC	\$2,370	33%	Chesapeake Energy
2010	Huaneng Power	\$1,230	50%	InterGen
2011	Xinjiang Goldwind	\$200		

Source: The Heritage Foundation (2012), "China-Global-Investment-Tracker."

Note here that CNOOC has invested more than 2 billion dollars in the US energy market in 2010. It is not hard to imagine that due to a significant reliance on CNOOC, or a significant α_{UC} , the level of maximum possible punishment to CNOOC by the US government was lower than \dot{p}_2 , the actual level of punishment implemented in the sanction. Also, based on CNOOC's pending investment of \$16 billion in Iran, the actual level of punishment implemented in the sanction may be below \underline{p}_{2CNOOC} , or the level required to induce CNOOC to cooperate.

V. Conclusion

This paper studies the structure of triadic sanctions through a simple game and a case study and analyzes their effectiveness. Despite the significant volume of literature in economic sanctions, most work looks at the mechanism in dyadic terms – an exertion of power by country A to country B. As we have seen in Comprehensive Iran Sanctions, Accountability, and Divestment Act of 2010 (CISADA 2010), however, economic sanctions in general make full use of triadic relationships: the US (A) threatens to restrict a third country's (C) US market access if it exports refined petroleum to Iran (B). Under such threat, it is evident that countries B and C both will experience a loss in welfare vis-à-vis the pre-sanction days when C succumbs to such threat. Such triadic sanction is especially effective when there is not a strong trade or investment relationship between the target and the sanction sender.

Without such sanction that impose restrictions on surrounding nations and international companies, one can imagine that the economic effect on the target would be limited. Even if the sender's market share of the target country market is big enough, in such a globalized market like today, there will be another country that is willing to take the imposer's place in the medium and long run.

Based on a case study and a simple game theoretic model, we have shown that triadic sanctions inherently are faced with a credibility/enforcement issue. Triadic sanctions are hard to “work” if players are short sighted and perceive it as a one-shot game. There are, however, Subgame Perfect equilibria based on credible

threats in infinitely repeated game settings. That is, if and only if it is credible that the sanction will be enforced and the enforcement has significant effect on the receiver, there would be behavioral change by the third party. We have seen that in order to support the Subgame Perfect equilibrium in the presented model, the amount of punishment toward the target depends on the economic dependency among the sender, target, and the receiver (or third party) of the sanction and how much they value the future transactions. This analysis show that depending on the third party's economic reliance on the US or Iranian market, we see relatively eager third parties of the sanctions like Korean and Japanese firms, and less-eager third parties like Chinese ones. Moreover, we have seen that depending on the US's dependency on the third party's firms, the level of sanction enforcement varies.

From the analysis, we conclude that if the US continues to overtly or covertly waive CISADA for enterprises to which significant national interests are tied, the certain third parties are likely to continue their businesses with Iran and the actual effectiveness of the sanctions would be undermined, as it was for the ISA.

References

- Abreu, D. 1998. "On the Theory of Infinitely Repeated Games with Discounting." *Econometrica*, 56(2), pp. 383-396.
- Basu, K. 1986. "One Kind of Power." *Oxford Economic Papers*, Vol. 38, pp. 259-282.
- _____. 2000. *Prelude to Political Economy*. Oxford, UK: Oxford University Press.
- Drezner, D. W. 1998. "Conflict Expectations and the Pradox of Economic Coercion." *International Studies Quarterly*, 42(4), pp. 709-731.
- Elliott, K. A., and Gary C. Huufbauer. 1999. "Same Song, Same Refrain? Economic Sanctions in the 1990's." *The American Economic Review*, Vol. 89, No. 2, pp. 403-408.
- Galtung, J. 1967. "On the Effects of International Economic Sanctions: With Examples from the Case of Rhodesia." *World Politics*, 19(3), pp. 378-416.
- Hatlebakk, M. 2002. "A New and Robust Subgame Perfect Equilibrium in a Model of Triadic Power Relations." *Journal of Development Economics*, Vol. 68, pp. 225-232.
- Hufbauer, G. C., Schott, J. J., and K. A. Elliott. 1990. *Economic Sanctions Reconsidered*. 2nd edition. Volume 1 and volume 2. Washington, DC: Institute for International Economics.
- Hufbauer, G. C., Elliott, K. A., Cyrus, T., and E. Winston. 1997. "US Economic Sanctions: Their Impact on Trade, Jobs, and Wages." Working Papers. Peterson Institute for International Economics.
- Katzman, K. 2012. "Iran Sanctions." CRS Report for Congress.
- Lacy, D., and E.M.S. Niou. 2004. "A Theory of Economic Sanctions and Issue Linkage: The Roles of Preferences, Information, and Threats." *The Journal of Politics*, Vol. 66, No. 1, pp. 25-42.
- Lindsay, J. M. 1986. "Trade Sanctions as Policy Instruments: A Re-Examination." *International Studies Quarterly*, Vol. 30, No. 2, pp. 153-173.
- McDonald, James. 1994. "Supplementing Thucydides' account of the Megarian Decree." *Electronic Antiquity: Communicating the Classics*, Vol. 2, No. 3.

Link: <http://scholar.lib.vt.edu/ejournals/ElAnt/V2N3/mcdonald.html>

- Martin, L. L. 1993. "Credibility, Costs, and Institutions: Cooperation on Economic Sanctions." *World Politics*, Vol. 45, No. 3, pp. 406-432
- Naqvi, N., and F. Wemhoner. 1995. "Power, Coercion, and the Games Landlords Play." *Journal of Development Economics*, Vol. 47, pp. 191-205.
- Osborne, M. J., and A. Rubinstein. 1994. *A Course in Game Theory*. MIT Press.
- Pape, R. A. 1997. "Why Economic Sanctions Do Not Work." *International Security*, Vol. 22, No. 2, pp. 90-136.
- Park, J. S. 2010. Iran and China, in "The Iran Primer; Power, Politics, and U.S. Policy." Robin Wrght. ed. USIP Press Books.
- Torbat, A. E. 2005. "Impacts of the US Trade and Financial Sanctions on Iran." *The World Economy*, Vol. 28, No. 3, pp. 407-434.
- Tsebelis, G. 1990. "Are sanctions Effective? A Game-Theoretic Analysis." *The Journal of Conflict Resolution*, Vol. 34, No. 1, pp. 3-28. (March)
- Wagner, R. H. 1988. "Economic Interdependence, Bargaining Power, and Political Influence." *International Organization*, Vol. 42, No. 3, pp. 461-483.
- Yang, J., Askari, H., Forrer, J., and H., Teegen. 2004. "U.S. Economic Sanctions: An Empirical Study." *The International Trade Journal*, Vol. 28, No. 1, pp. 23-62.

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국문요약

미국은 1990년대 중반 이란의 적극적인 해외투자유치 정책으로 인해 대이란 양자 제재의 효과성이 떨어지자 제3국의 에너지 부문 대이란 진출 및 교역을 막기 위해 해당 분야에서 이란과 경제관계를 맺는 제3국 기업을 제한하는 3자 제재(triadic sanction)를 도입하였다. 이의 대표적인 예로 1996년 미국의 「이란-리비아 제재법」과 2010년 「포괄적 이란 제재법」이 있다.

이 보고서에서는 위와 같은 3자 제재를 ‘triadic sanction’이라고 명하고, 이를 게임이론을 활용하여 분석한다. 특히 1996년 미국의 「이란-리비아 제재법」 통과 후 약 10여 년 동안 실제 제재대상 기업을 처벌한 경우가 거의 없었던 이유를 비반복 게임의 특징을 들어 설명한다.

또한 미국, 이란, 제3국(혹은 기업) 간의 경제의존도를 바탕으로 미국의 제재 시행대상 선정과 제3국의 제재 이행정도를 설명한다. 예를 들어 미국이 이란과 제재대상 분야에서 경제관계를 맺고 있는 여타 기업을 묵인하고 Zhuhai Zhenrong Company를 제재위반 처벌대상에 올린 것은 이 기업을 제재한다고 해도 미국에 거의 피해가 없기 때문이다.

핵심용어: 이란 제재, 3자 제재

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저서 및 논문

'우리나라 다자원조 추진전략과 정책과제,' (공저, 2010) 외

'중동 노동시장 현황 및 우리의 대응: 사우디아라비아와 UAE를 중심으로,' (공저, 2011) 외

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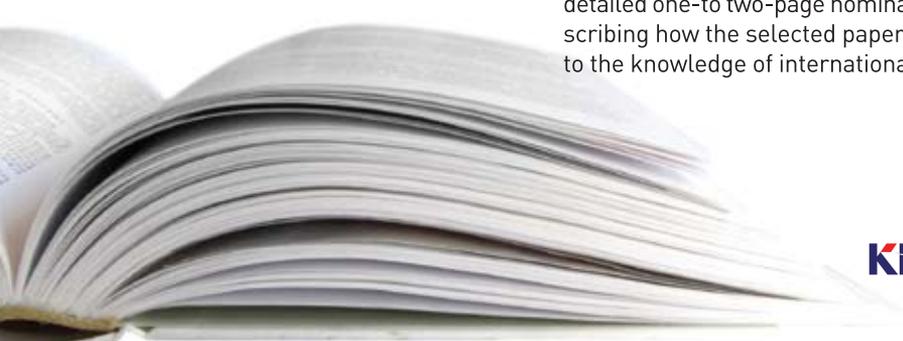
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