A game theoretical analysis of economic sanction

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A GAME THEORETICAL ANALYSIS OF
ECONOMIC SANCTION[1]

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Abstract

Economic sanction has been widely used and increasingly a popular tool in maintaining peace and political stability in the world. The use of economic sanction, as opposed to the use of military power, to punish target countries have been supported by the Charter of United Nations (UN). Tsebelis (1990) modelled economic sanctions using game theory and found that any attempt to increase the severity of the sanctions was counterintuitive, namely the policy reduced the likelihood of sender country(s) in enforcing economic sanction, however, it did not change the probability of the target country(s) in violating international agreement/law. This paper focuses on the refinement of the sanction game proposed by Tsebelis (1990) to analyse international relations. Recent findings from various studies on the effectiveness of economic sanction have been used to reconstruct the game. In contrast to Tsebelis'(1990) findings, any attempt to increase the severity of economic sanction may reduce the probability of the target country(s) in violating international agreement/law. A similar result was obtained in the case for which the sender country(s) applies any policy in preventing violation of international agreement/law by providing aids, assistances, and incentives to the target country.

Keywords: Economic Sanction, the Sanction/Inspection Games, Mixed Strategy Equilibrium.

JEL Classification: C79, K42, F51

I. Introduction

Economic sanction has been used as a primary tool by the United Nations in order to maintain peace and political stability in the world. The use of economic sanction has been supported by the Charter of United Nations (UN). Any action with respect to threats to the peace will be dealt by the Security Council of United Nations (SCUN) without involving the use of armed forces.[4] The economic sanction may be perceived as an alternative policy to military approach (Baldwin, 2000). Furthermore, the economic sanction has been considered to be more efficient in comparison to a military action in dealing with various violations, breaches, and aggressions (Hufbauer, et. al., 2007:5).

In modern era, the use of economic sanction has increased significantly, however the effectiveness of the policy may be questionable. This phenomenon has been debated for many years among scholars (see O'Connor (1940), Sunderland (1960), Tsebelis (1990), Pape (1997), and Hufbauer et.al. (2007), among others). Tsebelis (1990) argued that from 86 cases of economic sanction, only 33 cases were considered effective. Hufbauer, et. al. (2007) reported that from year 1914 to 2006 there were 174 economic sanction cases and only about 34 percent of those were considered effective.

Modelling of economic sanction may be conducted by using either decision theory or game theory. Tsebelis (1990) argued that economic sanctions is better being analysed using game theory on the ground that the probabilities of success and failure in committing a violation are affected by the interactions of rational players. Indeed a country is not a human, however, any decision to violate/follow international law/agreement by a country have been made by rational players which can be modelled

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[4] United Nations, *Charter of the United Nations*, Chapter VII, Article 41

as a representative agent. Tsebelis (1990) concluded that any attempt to increase the severity of economic sanction was counterproductive since the target country's behaviour may not be affected; however the policy adversely affected the intensity of the sender country to implement the sanction.

This paper aims to refine the sanction game proposed by Tsebelis (1990). The concept of the sanction game is discussed in section 1. The refinement of the sanction game is presented in Section 2. Empirical evidence from various studies will be used to reconstruct the game especially in determining the payoffs. The impacts of increasing the severity of economic sanction are presented in section 3. Any attempt to increase the severity of economic sanction is going to reduce the probability of the sender country to enforce economic sanction. The impact of the policy to the target country's violation behaviour may not be easily determined. The probability to violate international agreement/law may increase, decrease, or remain the same depending on the marginal net benefits of the policy to the sender country.

In the last section, alternative policies which may be used to substitute economic sanction will be discussed. Instead of increasing the severity of economic sanction, the sender country may reduce the target country's violation behaviour by providing aids to improve the target country's economic development. The results show that the implementation of this policy is going to reduce both probabilities in violating international agreement/law and in enforcing economic sanction.

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II. The Sanction Game

Tsebelis (1990) modelled the interaction among countries in imposing economic sanction as a 2x2 game played simultaneously by representative agents and the game is called the sanction game. The row player represents target country, while the column player represents sender country. The target country may choose one of the two strategies available, namely to violate or not to violate international agreements/laws.[5] On the other hands, the sender country may also choose one of the two strategies namely to impose sanction or not to impose sanction. The sanction game is presented in a normal form game as follows:

Game 1: The Sanction Game

Sender Country

		sanction	*not to sanction*
Target	*Violate*	a_1, a_2	b_1, b_2
Country	*Comply*	c_1, c_2	d_1, d_2

Whereby: $b_1 > d_1$, $d_2 > c_2$, $c_1 > a_1$, and $a_2 > b_2$

Sources: Tsebelis (1990)

The sanction game does not have pure strategy Nash Equilibrium, implying that there is no player who chooses a particular strategy with probability equal to 1. Nevertheless, the game has mixed strategy equilibrium. Suppose the target country chooses to violate with probability x and the sender country chooses to enforce with probability y, then the mixed strategy equilibrium of the game is as follows:

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[5] The agreements may be applicable for two countries (bilateral) or more than two countries (multilateral).

$$x^* = \frac{d_2 - c_2}{a_2 - b_2 - c_2 + d_2} \quad \text{and} \quad y^* = \frac{d_1 - b_1}{a_1 - b_1 - c_1 + d_1}$$

In order to increase the compliance of the target country, the sender country may pursue two alternative policies. First, the sender country may increase the severity of economic sanction to the sender country. Tsebelis (1990) incorporate this notion by changing the payoffs from a_1 to a'_1, whereby $a'_1 > c_1$. Second, the sender country may offer incentives to the target country in order to persuade the target country to comply the sender country's desires. In this circumstance, Tsebelis (1990) modelled that the payoffs change from to, whereby. Tsebelis (1990) reported that in both scenarios, the results were counterintuitive, namely the probability of the sender country in implementing the sanction decreased, whereas the tendency of the target country to violate would not change.

Indeed, Tsebelis' (1990) pioneer approach in adopting game theoretical approach to analyze international sanction should be acknowledged and appreciated. Nevertheless there are several caveats which can be noted in Tsebelis' (1990) model. First, the outcome (not violate, sanction) may not be realistic in real world. Given the target country choose 'not to violate', would it be any impact on the target country whether or not the sender country chooses either 'sanction' or 'not to sanction'? In fact, the sender country does not have any justification to sanction the target country since the target country chooses 'not to violate'.

Second, Tsebelis (1990) modelled the phenomena in international relation by using the sanction game with aggregated payoffs. Each cell of the payoff matrix reflects

the net benefits which have been arisen from the combination of two strategies chosen by two players simultaneously. The use of aggregated payoffs does not permit us to trace the elements of benefits and costs which formulate the net benefits in each cell of the payoff matrix. Consequently, as long as the aggregated payoffs have been used in the model, any attempt to change either the severity of the sanction or the incentive for not to violate the law, the impact of the policy to the process of the change in the elements of benefits and costs is not observable. This may raise a further inquiry on how realistic Tsebelis' (1990) sanction game can be to represent phenomena of economic sanction in the real world.

III.   A Refinement of The Sanction Game

The revised version of the sanction game is a 2x2 game played simultaneously by representative agents, namely the target and the sender countries. It is assumed that the target country is one or more countries which run missions that have tendencies to give a potential threat to the peace of the world.[6] In this case, the missions have been perceived as a violation of international agreement/law or against the principles of the UN (see *Charter of the UN*, Chapter 1, article 1). On the other hands, the sender country is assumed to be a country or international authority (such as SCUN) as the main proposer in the use of economic sanction.

Hufbauer, et. al. (2007:44) argued that the economic sanction tend to be enforced gradually by the sender country. There are several activities which can be pursued by the sender country prior to the implementation of the sanction are: a) investigating the target country's activities, b) reporting the outcome of the investigation to the UN, and c)

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[6] There are many cases, however, that this assumption may not necesarily hold, in the sense that the sender country may simply implement economic sanctions to any country which does not comply with the sender country interests.

sanctioning the target country approved by the UN if the target country's activities are proven to be a violation of international agreement/law.[7]

Pradiptyo (2007) refined the inspection game proposed by Tsebelis (1989) in modelling the deterrence effect in criminal justice system by using disaggregated payoffs. In the same manner, in this article, the sanction game modelled by Tsebelis (1990) is going to be reconstructed by using disaggregated payoffs. Empirical findings from several studies will be used to develop the disaggregated payoffs of the game.

Game 2: The Revised of the Sanction Game

Sender Country

		Enforce	*Not Enforce*
Target *Country*	*Violate*	$B_v - C_v,$ $B_s - C_e - C_c$	$B_v + B_r,\ 0$
	Comply	$B_r,\ \ R_b - C_e$	$B_r,\ R_b$

Where:

B_v : the target country's utility arises from committing a violation of international agreement/law.

C_v : the target country's disutility of receiving direct punishment (e.g. banned from international trade activities).

B_r : positive reputational effects to the target country for not being sanctioned.

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[7] *Ibid*, Chapter 7, Article 41

B_s : the sender country's utility due to the success of the enforcement (indicated by sender's ability in detecting the violations and other positive effects for international society).

R_b : reputational benefits which have been arisen due to enforcing international agreement/law.

C_e : direct costs of enforcement bourned by the sender country (e.g. costs of investigation).

C_c : indirect costs bourned by the sender country in imposing economic sanction (e.g. the loss of potential international trade profit).

From the target country's perspective, the violation of international agreement/law that has been carried out is justified as long as it gives rise to benefits obtained due to the conduct (B_v). In this circumstance, the target country may be able to defend and to keep the mission running from any pressures. Given the target country chose to violate international agreement/law, if the sender country choose 'enforce', the target country is going to receive economic sanction (C_v) and this will be perceived as disutility by the target country.

Another utility will be obtained by the target country is reputational benefits (B_r) which arise if the country has never been sanctioned. The target country may violate the agreements/laws, however, as long as the sender country has not observed the behaviour or the sender country does not mind with it, and then the sender country may not necessarily decide to impose sanction. In this case, the target country will have many accesses in the core of economic cooperation, international political relationship, and the trust that has been given by international society. In contrast, the target country which

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ever been or being sanctioned will only have limited access in the respective international activities.[8]

The utility (B_s) will be obtained by the sender country when the enforcement process was successful. The utility has been indicated by the sender country's abilities in detecting, preventing, and solving any dangerous activities that give threat either to its sovereignty or the peace and political stability of the world. Those abilities give positive effects such as; (1) the security for many countries from the undesirable occurrence that might happen as the consequences from the target country's violation of the agreement/law , (2) the target country will get obstruction, so that it would be harder to violate, and (3) from the historical enforcement that have already been successful, the target country will think many times to repeat its unacceptable conduct, because the probability to be detected again is higher than previously.

Another utility will be obtained by the sender county is a positive reputational benefit (R_b) as they have been able to retain their sovereignty or to uphold the peace for the world as stated by the UN. In this case, the reputational benefit will only be obtained by the sender country, if the target country has not done any violations (or when the sender country chooses payoff c_2 or d_2 and when target choose c_1 or d_1). Although, this reputational benefit will not be obtained when the target country chooses to violate and the sender country chooses not to enforce (or when the target country chooses payoff b_1 and the sender country chooses b_2).

It should be noted that any attempt to enforce economic sanction is costly, which obviously is being bourned by the sender country. It is assumed that the costs of enforcement consist of two elements, namely direct cost (C_e) and indirect cost (C_c) of

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[8] US Government Interagency, *International Crime Threat Assessment*, Chapter 2.

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enforcement. The direct costs of enforcement will be bourned by the sender country soon after economic sanction has been implemented, for instance the investigation costs, the costs in imposing the economic sanction, etc. Hufbauer et. al (2007:108) argued that one of the biggest costs in conducting enforcement is investigation costs.

The indirect costs of enforcement (C_c) will be bourned by the sender country as its potential gains from trade and also gains from international relation decrease as the sanction is imposed. Hufbauer et. al. (2007:109) argued that one of the worst things that might happen from imposing economic sanction is the loss of potential profit that should be earned by both sides if the sanctions would have not been imposed. It is assumed in the model that prior to the imposition of the sanctions; the relationship between the sender and the target countries was good, especially in the core of economic cooperation. After imposing the economic sanctions their relationship was obstructed and perhaps there is a possibility that the good relationship will be vanished.

Consider q be the probability of the sender country to enforce the economic sanction. If the expected outcomes to violate exceed the expected outcomes to comply, therefore the best response for target is as follows:

$$(B_v - C_v)q + (B_v + B_r)(1 - q) \geq B_rq + B_r(1 - q)$$

$$B_v \geq q(C_v + B_r)$$

The same thing happens to the sender, whether they want to enforce or not. Consider p be the probability that the target will violate. The best response will be obtained as follows:

$$(B_s - C_e - C_c)p + (R_b - C_e)(1 - p) \geq 0p + R_b(1 - p)$$

$$B_s p \geq C_e + C_c p$$

> **Propotition 1.1:** The target country is going to violate if the utility to conduct such activity dominates the expected disutility of serving direct punishment (economic sanction) and the expected loss of reputational $[B_v \geq q(C_v + B_r)]$.
>
> **Proposition 1.2:** The sender country is going to enforce if the expected benefits of enforcement dominates the expected costs which may incurred due to enforcement $[B_s p \geq (C_e + C_c p)]$.

Similar to Tsebelis' (1990) model, the game above does not have pure strategy nash equilibrium. Therefore the mixed strategy equilibrium is presented as follows:

$$p^* = \frac{C_e}{B_s - C_c} \qquad (1)$$

and

$$q^* = \frac{B_v}{C_v + B_r} \qquad (2)$$

Equation (1), p^* represent the probability of target country to violate. In equilibrium, given the level of punishment (i.e. C_e), the probability to violate is positively correlated to sender country's direct costs of enforcement (C_e), but it is the reverse it's net benefit $(B_s - C_c)$.

Equation (2), on the other hand, q* represent the probability of sender country to enforce. In equilibrium, the probability to enfroce is positively correlated to target's utility to violate (B_v), but it is the reverse of the target's miseries in serving economic sanction $(C_v + B_r)$.

IV.   Increasing Severity of Economic Sanction

Empirical evidence of increasing the severity of economic sanction can be found in many cases. Barber (1979) argued that the policy has been implemented as the impacts of the initial economic sanctions imposed were not strong enough to reduce violation activities conducted by the target country. There are several empirical evidences to support the notion of increasing the severity of economic sanctions.

In year 2004, President George W. Bush extended the duration of economic sanctions that has been imposed by the USA to Myanmar. Although the aim of the policy primarily was to weaken the government of the target country, this decision however leads to the high degree of human rights violation in Myanmar.[9] A similar case was found in Sudan as the economic sanctions had been tighter and the period of sanctions had been extended. Similar to Myanmar, violation of human right tend to be high in Sudan, especially in the Daftur area.[10] The economic sanctions against Iran are the most severe compare to the previous examples. From 2006 to 2008, the severity of economic sanction has been increased three times; however, Iran still upholds the policy about uranium enrichment.[11]

In general, the policy to increase the severity of economic sanctions can pursued from three different strategies: 1) increasing the burden of economic sanction (for instance by extending the duration of economic sanction or adding some other restriction

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[9] *US Government to Tighten Economic Sanctions against Myanmar* (2007),
http://www.unmultimedia.org/radio/english/detail/38716.html,
(Visited, 18 July 2009).
[10] *US Sanction on Sudan and the Gun Arabic Exemption (1997)*
http://www1.american.edu/TED/gumarab.htm, (visited, 18 July 2009)
[11] Jentleson (2007), *Sanction Against Iran: Key Issues*, The Century Foundation, New York

in the content of economic sanction). In this analysis, it is assumed that, by increasing the burden of economic sanction, the sender country will focus on imposing the direct sanctions. 2) The sender country may only focus on imposing the indirect sanctions by announcing to the international society about the loss of the target country's reputation as a consequence to regard to their behaviour. In this case, the sender country does not increase the direct sanction, but obviously, they increase indirect sanction that more likely to be a social punishment. 3) The combination of both strategies above.

A. Scenario I: Increasing the Burden of Economic Sanction

Suppose the sender country decides to increase the burden of economic sanction. Regarding to the revised of sanction game, it is assumed that there is a positive correlation between this policy and indirect cost to impose economic sanction (C_c), so that the indirect cost increased as the burden of economic sanction increased. We obtain the new equation as follows:

$$a'_1 = B_v - C'_v$$

$$a'_2 = B'_s - C_e - C'_c$$

Where: $C'_v > C_v$, $C'_c > C_c$, and $B'_s > B_s$.

B. Scenario II: Increasing the Loss of Reputational Effect

The second policy that can be pursued by the sender country is to increase the loss of reputational effect (B_r) bore by target that currently imposed with economic sanction (C_v). This policy become the target country's new problem, because despite the ability to increase the severity of economic sanction, there always be will small number of countries which want to maintain the relationship with the target country. In other words,

the target country will have difficulties in accessing any relationships or cooperation with international society and boards.

From the sender country's perspective, this policy will also worsen the relationship with the target. Hufbauer et. al (2007:109) argued that good bilateral economic cooperation will be obstructed due to the loss of reputation suffered by the target country. As the result, the indirect cost faced by the sender will also increase (C_c).

This policy will change the payoffs for b_1, c_1, d_1, and a_2 as follows:

$$b'_1 = B_v + B'_r$$

$$c'_1 = d'_1 = B'_r$$

$$a''_2 = B''_s - C_e - C''_c$$

Where: $B'_r > B_r$

C. Scenario III: Applying Both Approach

Although in the real world, the policy tends to be implemented simultaneously. Any attempt to increase the severity of economic sanction covers direct sanction and indirect sanction. For instance, in the case of Myanmar, Sudan, and Iran, the increasing severity of direct sanction (extend the duration of sanction) is also included the indirect sanction (loss reputational effect for those countries).

According to the revised of sanction game, the sender country attempt to increase the severity of economic sanction is going to modify C_v and B_r simultaneously. From this modification there will be adjustment to both players' payoffs as follow:

$$\hat{a}_1 = B_v - \hat{C}_v$$

$$\hat{b}_1 = B_v + \hat{B}_r$$

$$\hat{c}_1 = \hat{d}''_1 = \hat{B}_r$$

$$\hat{a}_2 = \hat{B}_s - C_e - \hat{C}_c$$

Where: $\hat{C}_v > C_v,\ \hat{B}_r > B_r,\ \hat{B}_s > B_s,\ \hat{C}_c > C_c,$

and $\hat{C}_c = C'_c + C''_c$

The new matrix game after we modified the payoffs as an attempt to increase the severity of economic sanction as follows:

Game 3: The Revised Sanction Game

(The Policy to increase Severity of Economic Sanction)

Sender

		Enforce	*Not Enforce*
Target	*Violate*	$B_v - \hat{C}_v,$ $\hat{B}_s - C_e - \hat{C}_c$	$B_v + \hat{B}_r,\ 0$
	Comply	$\hat{B}_r,\ R_b - C_e$	$\hat{B}_r,\ R_b$

From the new matrix game above we obtain the new equilibrium:

$$p'^* = \frac{C_e}{\hat{B}_s - \hat{C}_c} \quad (3)$$

$$q'^* = \frac{B_v}{\hat{C}_v + \hat{B}_r} \quad (4)$$

Up to this point, the results suggest that:

Proposition 2.1: Any attempt to increase economic sanction will reduces the sender's probability to enforce ($q'^* < q^*$).

Proposition 2.2: Any attempt to increase economic sanction resulting three possible probability of the target to violate, when it is assumed:

$$(B^{\wedge}{}_s - C^{\wedge}{}_c) > (B_s - C_c) \rightarrow p'^* < p^* \ and$$

$$(B^{\wedge}{}_s - C^{\wedge}{}_c) \leq (B_s - C_c) \rightarrow p'^* \geq p^*$$

V. Alternative Policy to Prevent Violation

It has been analysed above that any attempt to increase the severity of economic sanction will not necessarily reduces the target country's likelihood to violate. This argument is supported by scholars [12] that the implementation of economic sanction, including their adjustments, is not effective. The ineffectiveness of economic sanction happened when it is implemented to autocracy countries.

In an autocracy country, the leader will only open a limited access in deciding a policy and sometimes the leader likely to sacrifice public interests in order to achieve his/her personal missions. In other words, the country tends to be united easily and strong enough to face the pressure of economic sanction (Bolks and Dina, 2000). To face this problem, an alternative policy should be considered that substitute the policy to impose economic sanction in order to prevent violations.

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[12] For instance: Theresa M. O'Connor (1940), Riley Sunderland (1960), George Tsebelis (1990), Robert A. Pape (1997), and Hufbauer, Schott and Elliot (2007).

One of the policies that can be pursued by the sender country is developing and maintaining good relationship with many countries which have a potential to violate. The sender country may apply this policy through economic cooperation, assistance, or even donation to increase target country's economic development. In this case, good maintenance relationship can be applied to autocracy countries.

Fearon (2008) argued that, many autocracy countries have difficulties in solving economic development problems in comparison to the country that relatively democratic. As a result, this situation may become the sender country's opportunity to prevent any violations.

It assumed that whenever the target country chooses not to violate or their violation has not been detected, therefore the sender will apply this policy to improve target's well being. Back to the revised of sanction game, there are some modifications regarding the payoffs as follows:

Game 4: The Revised of Sanction Game

(The Policy to Prevent Violation)

Sender Country

		Enforce	*Not Enforce*
Target	*Violate*	$B_v - C_v,$ $B_s - C_e - C_c$	$B_v + B_r + B_d,$ $- C_d$
Country	*Comply*	$B_r + B_d,$ $R_b - C_e - C_d$	$B_r + B_d,$ $R_b - C_d$

Where:

B_d : The benefits obtained by the target for their well being

C_d : The cost expended by sender because they helping target's well being

In the case for which the target country choose not to violate or their violation has not been detected, they are entitled to receive aids or assistance (B_d) from the sender country to improve their well being. Nevertheless, the policy will make the sender incurred more cost ($- C_d$). The new equilibrium is given as follows:

$$p^{**} = \frac{C_e}{B_s - C_c + C_d} \qquad (5)$$

$$q^{**} = \frac{B_v}{C_v + B_r + B_d} \qquad (6)$$

Propotition 3: The implementation of alternative policy reduces the probabilities of target to violate (p** < p*) and of sender to enforce (q** < q*).

The implementation of the policy is certainly reduce the probability of the target country to violate. The policy is more effective than the sanctioning policy as the impact of the former is less ambiguous than the impacts of the former. The policy maker do not have to wait for target's offending but they can directly prevent any violations that could be done by the target.

VI. Conclusions

It has been showed that any attempt to increase the severity of economic sanction will result in three probabilities for the target and it depends on sender's benefit-cost ratio. The result shows that the policy to increase severity of economic sanction is not an effective, because there is a chance that the target country will increase their violation after the policy has been implemented.

A different result has been obtained when the sender country implements a preventive policy through good maintenance on the relationship between the sender and the target countries. The sender country may supply assistance to improve the target country well being. As a result, this policy is more certain and effectively in reducing the target country's probability to violate agreements/laws.

From the sender's perspective, any attempt to increase the severity of economic sanction will reduce the probability to enforce. It is assumed, when the sender increase the severity of economic sanction, the target is going to suffer more than prior to the increase in the intensity of the sanction. The sender country is not necessarily prioritising the policy to impose economic sanction as their foreign policy. A similar result has been obtained by the sender country when they attempt to prevent any violation that could be done by the target country. The probability of the sender country to enforce economic sanctions decreases and at the same time the policy is effective in reducing the target country's likelihood to violate agreements/laws. The relationship between the sender and the target is going to improve and the sender country does not necessarily to lose potential benefits when they apply economic sanction or increase the severity of economic sanction.

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