Resolving Conflicts and Strengthening International Relations with Investment: Game Theory Approach

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Abstract. Today, investors pay more attention to the international concept of investment than ever before. In addition, countries intend to use their domestic capital to fulfill domestic goals and prevent capital outflow as much as possible. The present article, while referring to objective examples of international relations, has tried to provide a different answer to the important question of "economic cooperation in the form of international investment while maximizing" by using game theory. The main question is whether investment at the international level can avoid war and build? For this purpose, by using game theory and game design between governments and investors as the main openers, three different modes have been discussed. To this end, in section one a state where two countries are indifferent has been considered. The second state includes two competing (enemy) countries, and in the third state, three countries are assumed, one being competitor and the other indifferent. In the second section, first a situation where two countries are indifferent to each other is considered. Then, in the second case, two countries are considered to be rivals (enemies), and in the third case, three countries are assumed: one of them is a competitor and the other is indifferent. Concerning the obtained equilibrium in the three states and for each of the two sections, the main conclusion is that the investor achieves the best consequence (Nash equilibrium) by constituting portfolio and investing in various markets, and the countries achieve the best outcome through cooperation and establishing peace. On the other words, the results of the research in the language of logic (mathematics) confirm the effect of economic cooperation on the development of peace.

Keywords: peace; game theory; static games with complete information; Nash equilibrium.

1. Introduction

The formal academic study of peace emerged in the 1960s and has grown in popularity since [1].

A fundamental question which presents itself immediately is whether there is an effective body of knowledge which can be consolidated into a science of peace [2].

At times our peacebuilding efforts are "an inherently conflictual process" [3].

Despite significant disagreement between peace researchers on a standardized definition of peace, there seems to be overwhelming consensus that "peace" — in all its varied academic conceptualizations — always relates to the social welfare of interacting sentience's [4].

The academic field of peace studies suffers from a lack of ontological clarity, with peace researchers widely disagreeing on how to define "peace" [5].

Researchers in the field of international relations, especially in the liberal tradition, emphasize the impact of internation-

al economic cooperation such as trade and investment on the expansion of peace and prevention of war-making.

Peace is discussed, interpreted, and referred to in way that nearly always disguises the fact that it is essentially contested [6].

Gittings believes that the concept of peace will always remain an open Issue [7]. The concept of peace has been under discussion in peace research from its start [8].

One of the topics of interest is to examine the possibility of economic cooperation such as trade and mutual investment despite political and military disagreements as well as the impact of such cooperation on establishing peace and preventing war. In this regard, various scholars, especially in the liberal tradition, seek to test the possibility of establishing trade relations despite differences in other fields as well as studying the side effects of economic cooperation on stability and peace of countries [9].

The interesting point is that "there are serious opponents to the economic context of peace and the impact of international trade and investment on avoidance of war." Indeed, contrary to liberalism's view on that a free economy can prevent war and guarantee the stability of peace; the realists do not consider the liberal economy as an obstacle to war, rather see it as a trigger of war. Marxists also consider liberal economy as inherently prone to levying war and according to them, despite the capitalist system, world peace and security is always at risk [10].

To fight for peace is to fight against direct and structural violence [11]. This necessitates creating a sustainable just peace that is inclusive, empowering, and deconstructs unjust cultural, economic, political, and social structures as well as facilitating reconciliation processes so that people can heal from the traumatic consequences of colonialism [12].

In today's world, where threats, sanctions, and conflicts have become an inte-gral part of human life, the analysis of issues related to war and peace has become one of the main challenges of not only political but also economic, cultural, and other studies. Therefore, avoiding the possible start of any war requires the use of different knowledge and sciences, so that by means of them, we can reach a favorable point that, while maintaining interests, does not get involved in war and its consequences.

The main question and purpose of this research is "Can economic cooperation in the form of international investment prevent war and reduce political tension?".

The main hypothesis of this research is to examine the existing perspectives in the field of international economic cooperation from the perspective of liberalism and Marxism, which results the model under study confirms. In this paper, by presenting a static game, the investigation of international economic cooperation and its effect on the scene of international relations (peace) will be discussed; where conflicting interests of investors and governments (countries) are modeled, and its equilibrium position is identified.

This paper is organized in four sections. After introduction, in the 2nd part of the study, literature review has been presented. The methodology in 3rd section and results with two states and three subdivisions presented in 4th section and the 5th and final section includes conclusion and recommendations.

2. Literature Review
2.1. The importance of international economic cooperation
The scholars and researchers, epically in liberal tradition, believe that the political conflicts are not an unsolvable obstacle to economic cooperation between conflicting countries. On the other hand, they even claim that such cooperation reduces military conflicts. This group provides an example of the increasing coop-

eration between China and Taiwan that has taken place in the real world. None of the concerns described by pessimists has been able to prevent the cooperation of two countries and China is now the largest trading partner of Taiwan. The important point is that the commercial cooperation of two parties seriously increased after 2001 financial crisis as a result of the influence of the Taiwanese business community in their country, and Taiwanese officials had no choice except to reform their view of economic cooperation with China.

This new approach facilitated the trade cooperation and withdrew the political conflicts (however, the conflicts were not totally solved). As a conclusion it can be said that the trade relations between Taiwan and China expanded while the political conflicts still remained. However, the principle of trading is apparently a major step in international relations that has been absent in the past decades. Therefore, it can be concluded that economic cooperation can be real and possible despite the political conflict. This can contribute to peace and stability and reduce conflicts. As discussed, economic cooperation is possible even in the event of political conflicts and some historical examples have also been provided. As far as now, with developments in industry and transportation, the Issue of distance as an obstacle in business and trade has lost its traditional role; the countries do not worry about trade dependency as they were in the past.

According to liberal school, war is an exceptional phenomenon, and the principle of cooperation dominates the human community. Human being is speculative and usually sees his profits in cooperation. Likewise, war is the product of some deviations in human nature including ambition. Individuals pursue and compete for their own interests; however, on the other hand, individuals have many common interests which make them fulfill their obligations to society and social cooperation, both domestically and internationally. If people come to this realization that they could have common beneficial interests not only within states but also across international borders, they will avoid war and conflict [13].

If countries are unable to continue business and trade because of barriers or high tariffs, they will try to earn some of the assets that they had not previously obtained through trade, through non-peaceful means such as war. In such situation, the ground for development of militarism in the international arena will be provided [14].

On the other hand, the democratic peace theory also had its dissidents since its inception and has been widely criticized on both theoretical and empirical grounds [15].

Realist, Marxist, and power-transition's scholars of international relations argued from different perspectives that it was convergence of interests and policy, rather than norms and institutions, which created a relative peace among Western democracies in the post-WWII era [16].

If interdependency is associated with open or free economic systems, the countries will realize that their development depends on business and trading. This freedom forces them to rely on interdependency and expand it [17].

A tremendous amount of attention is paid to whether or not joint democracy precludes wars within dyads [18].

Countries that have a permanent share in each other's economies have come to this conclusion that favorable trade relations increasingly move them away from resorting to military means to promote international status. The closed economic system or lack of economic freedom has also reverse effect [19].

There are good reasons to believe that while there is certainly peace among democracies, it may not be caused by the democratic nature of those states [20].

The simple implementation of a democratic form of government does not prevent nations from making war on one another [21].

The results support the "capitalist peace" argument and suggest that, within the developing world economic development leads to interstate peace, whereas democracy does not [22].

In this paper, the international economic cooperation and its effect in international relations (peace) will be studied by presenting a static game as whether economic cooperation in form of international investment could prevent war and reduce political tension? The present study seeks to give a scientific answer to this Issue utilizing "Game theory".

2.2. Using Game Theory

Morbee & Proost [23] used game theory approach to study the market power of Russia in European gas market based on Cournot competition. The results of their study indicated that the market power of Russia in European gas market is so limited and in addition to European countries, Russia is also concerning about its uncertainty. For European countries, buying gas from other suppliers, though at a higher price, looks better because they do gas trade in a safer environment.

Yared [24] in his study presented dynamic theory on war and peace. The results showed that in a long-term period, if the countries are patient enough, the temporary wars could create sustainability (peace) if the war costs are high, and the scores are low.

Popescu & Hurduzeu [25] investigated the energy challenges for Europe in purchasing natural gas from Russia in two states of cooperative and non-cooperative games. The results indicated that the European Union shall reduce its import from Russia and select better options for import.

Horner et al. [26] studied the relation between mediation and peace and designing the mechanism for conflict resolution in international relations. They showed that the uninterrupted communication helps conflict reduction since it enables the conflicting parties to disclose themselves.

Ghalehno [27] in his study investigated the Iran and US strategies in post Post-JCPOA based on game theory. Given the importance of the agreements, obligations and commitments after JCPOA ratification; finally, the results obtained from solving the game through backward method showed that Nash equilibrium in Post-JCPOA would be in form of sanctions relief and mutual adherence to JCPOA commitments.

Salimian & Shahbazi [28] investigated Iran strategy in utilizing common oil and gas resources using game theory approach. Considering common resources, they explained that if there are common resources for utilization, what would be the results of cooperation or non-cooperation. The results indicated that in case of cooperation between countries, it is possible to extract the same resources through less effort as of in case of non-cooperation. Moreover, the higher is the number of countries in a common resource, the less will be the effort of each country. However, in sum, the total effort of countries will be more, i. e., more effort would be wasted.

Kimbrough et al. [29] studied the theories, applications and the conflict of interest and war in economy. They examined the main models of conflict and conflict of interest and showed that in recent empirical literature, the results confirm the theory of conflicts with both laboratory and field data.

Attar et al. [30] studied the nuclear conflict of Iran and 5+1 countries based on game theory. To this end, they considered 2005–2015 time periods and investigated the results through descriptive-analytic

method using game theory. The results indicated that the parties to the conflict used warfare of attrition and brinkmanship in non-cooperative games (these games were based on non-cooperation and confrontation). From 2011 to 2015, because of the parties' failure in fulfillment of their objectives and the continuation of games becoming more difficult, the parties resorted to bargaining games and prisoner's dilemma under the cooperative games.

Anderson & Mukherjee [31] investigated seeking no war, achieving no peace. Their model survey "no war, no peace" situations in a game theoretical framework where two countries are engaged in a standoff over a military sector. They suggested two different pathways. The first is idealistic and based on mutual trust whereas the second is based on deterrence meaning that both countries impose a threat of using armed force against the other country in their respective military doctrines.

Salimian et al. [32] in theoretical research, investigated the role of investment in the equilibrium of international political economy. They designed a game between governments and investors by defining the utility functions of each player. The results indicated that risks and output inside and outside the country is a direct function of external risk and economic power, of course, this relationship is reversed for the investor. Finally, if the hostility degree (ρ) between countries is zero, then the countries will achieve a maximum positive outcome which will increase with the decrease of economic power.

Most studies in field of economy and peace, some of which explained here, utilize game theory to achieve equilibrium in a specific field (mostly oil and gas) and do not generally deal with this Issue in terms of peace. In an effort to fill this gap, the present study deals with this important Issue that how the economy can provide the ground for international peace and to this

end, utilizes game theory. This is the innovation of this study. It is reminded again that the Issue of peace has received very little attention from an economic point of view, and most of the research in this field is from the perspective of political science, and also by the method of game theory (except Salimian et al. [32]), which is an important tool for modeling the conflict of interests, until now, to the financial markets and its role. It has not been addressed in the development of peace.

3. Methodology

The modeling of game theory in international economy, work economy, major economy and general tax becomes general and is now moving towards development economy and economic history. Many of those who make models utilize game theory as it allows them to think as an economist when the pricing theory is not sufficient and responding [33].

Game theory is one of the most important tools in this situation. Game theory seeks to mathematically model and logically solve situations where a number of (more than one) players interact under specific rules, and the desirability of each of them is affected by the behavior or choice of another [34].

Some researchers compare the importance of game theory design to the discovery of the double DNA spirals and often refer to it as "a theory that can explain everything" [35]. In many economic and operations research (OR) situations, the social configuration of the organization influences the potential possibilities of all the groups of agents, and the set of agents is (strictly) hierarchically structured with a unique leader [36, 37].

Before starting to model the game in different ways, it should be noted that the desired model is checked in two modes.

In the first case, countries are assumed to be at the same level economical-

ly. In other words, similar economies, and countries with roughly the same economic power are considered equal in simplicity.

In the second case, it is assumed that the economic power of the countries is not the same and it is assumed that economically the domestic country is weaker than the third country and the third country is also weaker than the rival (enemy) country. Therefore, in this situation, for a weaker economy, it is more important and desirable for the capital to stay inside. Moreover, in all cases, it is assumed that the investor prefers domestic investment to investment in a third country and investment in a third country to investment in a competing firm (when output and risk markets are the same).

As a third assumption, it is assumed that if the investor is willing to invest in a combination of countries, he will invest equally in all of them.

In order to avoid prolonging the discussion, the items of section 3 will be fully explained and interpreted, and in the second case, only the results will be presented.

There are also three strategies for governments in general. Governments can interact with each other (peace), be indifferent to each other, or be enemy to each other and go to war. More explanation about the players' strategy and the consequences will follow.

Now game modeling will be done in different modes and conditions.

First state: Two indifferent countries.

Second state: Two rival/competing countries.

Third state: Three countries (local, third and competing/ rival).

4. Results
4.1. The economic power of the three countries is the same
4.1.1 First state: Two indifferent countries

For the first state, it is assumed that the investor wants to invest in just two indifferent countries. The game will start in this way that the investor first has three options: (1) to invest all his capital in his country (domestic) (*D*), (2) to invest all his capital only in a third (indifferent) country (*T*), (3) to invest its capital both in his country (domestic) and third country (almost equally) (*C*).

At the next stage, the countries could have two options: (1) to collaborate and cooperate with each other (*H*) and (2) to be indifferent to each other (without any cooperation) (*B*). Therefore, the game matrix will be as table 1.

Table 1. **The matrix of game for different investment states and two indifferent countries**

Government				
		Indifferent (*B*)		Cooperation (*H*)	
Investor	Just domestic (*D*)	1	5	2	6
	Just in third country (*T*)	3	1	4	2
	Domestic and in third government (*C*)	5	3	6	4

Source: Researcher's findings

In order to achieve the consequence of each strategy, in matrix form of game between countries and investors, it is first required to rank the priorities of the players. It is noteworthy that the investor will invest in the third government when he earns more profit with lower risk.

The first state is such that the investors just do domestic investment, and the two countries are indifferent (do not cooperate). For this state, the countries will achieve consequence 5 and the investors will achieve consequence 1. This is the worst state for the investors because through investment in other market, they could increase their profit and have better portfolio (less risk).

The second state is such that the investors just invest domestically, and the countries cooperate and interact (peace). This is the best status for the countries in which the countries will achieve consequence 6 and the investors, consequence 2.

The third state is such that the investors just invest in third government while the countries are indifferent, in which the countries will achieve consequence 1 and the investors, consequence 3. This consequence for investors is higher than first and second states on that they have done investment in third government when the output (profit) was higher. This is the worst state for the countries because the whole capital has outflow.

The fourth state is such that the investors just invest in third government and the countries interact with each other (peace). For this state, the countries will achieve consequence 2 and the investors, consequence 4.

The fifth state is such that the investor does investment both in his government (domestic) and in third government, and the countries are indifferent. The consequence of this state for investor is considered as 5 and for countries as 3.

The sixth state is such that the investor invests both inside government and in third government and peace is established. The consequence for investor in this state is 6 and for the countries is 4. This is the best state for investor because better portfolio is created, and the peace is established.

The set of the strategies of two players is as follow:

$$S_{investor} = \{D, T, C\}$$
$$S_{goverment} = \{H, B\}. \tag{1}$$

The combination of the strategies of two players is also as follow:

$$S = S_{investor} \cdot S_{goverment} =$$
$$= \begin{Bmatrix} (D, H), (D, B), (T, H), \\ (T, B), (C, H), (C, B) \end{Bmatrix}. \tag{2}$$

The consequences of game for investor (I) and government (G) can be logically ranked as follow:

$$U_I(D, H) = 2, \quad U_G(D, H) = 6$$
$$U_I(D, B) = 1, \quad U_G(D, B) = 5$$
$$U_I(T, H) = 4, \quad U_G(T, H) = 2$$
$$U_I(T, B) = 3, \quad U_G(T, B) = 1$$
$$U_I(C, H) = 6, \quad U_G(C, H) = 4$$
$$U_I(C, B) = 5, \quad U_G(C, B) = 3.$$

Some games have this main feature that for some or all of the players, the selection of one strategy is completely preferred to selection of all his other strategies since the consequence of this strategy for that player is more favorable than other strategies and more. It is normal that the player shall select the favorable strategy regardless of the strategies that the other players select. This strategy is so called dominate strategy and other strategies of that player are called dominated strategies. If in a game, each player has dominated strategy, it is normal for them to select it. Therefore, the combination of the strategies constituted from the dominate strategy of the players is called dominate strategy equilibrium [38, 39].

In Table 2, the game equilibrium is shown.

Table 2. **Solving matrix of game and finding Nash equilibrium (investor and two indifferent countries)**

		Government			
		Indifferent (*B*)		Cooperation (*H*)	
Investor	Just domestic (*D*)	1	5	2	6
	Just in third government (*T*)	3	1	4	2
	Domestic and in third government (*C*)	5	3	6	4

Source: Researcher's findings

In this game, the cooperation strategy (peace) dominates the indifferent strategy for the government, i. e., regardless of the selection of the other player (investor), the government always selects cooperation since it yields higher consequence.

The dominate strategy for the investor is domestic investment and investment in third government (regardless of the selection of the other player); therefore, anyway, he selects it and achieves higher consequence.

Concerning the obtained results which is Nash equilibrium of the game, it is observed that the equilibrium consequence happens in (*C, H*), which is the game equilibrium. As previously mentioned, in Nash equilibrium, deviation from the related consequence is to the benefit of no player, assuming that other players are not deviated from the played strategy in Nash consequence.

4.1.2 Second state: Two rival/ competing countries

Here, it is assumed that the investor intends to invest just in two rival countries (enemy). The game starts in this way that the investor first has three options: (1) to invest all his capital in his government (domestic) (*D*), (2) to invest all its capital only in the rival government (enemy) (*E*), and (3) to invest its capital both in his government (domestic) and rival government (almost equally) (*C*).

At the next stage, the countries could have two options: (1) to collaborate and cooperate with each other (i. e., peace is established) (*P*) and (2) do not collaborate (i. e., to enter war) (*W*). Therefore, the game matrix will be as Table 3.

Table 3. **The matrix of game for different investment states and two rival countries**

		Government			
		Cooperation (peace) (*P*)		Non-cooperation (War) (*W*)	
Investor	Just domestic (*D*)	4	6	1	4
	Just enemy (*E*)	3	2	2	1
	Domestic and in enemy (*C*)	6	5	5	3

Source: Researcher's findings

In the matrix game between countries and investors, the priorities of the players should be ranked to achieve the consequence of each strategy. As far as in normal situation, no government is willing to enter war (because of its consequences), the best consequence for the countries is cooperation (peace). It should be noted that the in-

vestor invests in the rival government (enemy) when he achieves more profit with less risk.

The first state is such that the investors just do domestic investment and cooperation (peace) is established, which is the best consequence for countries. The countries achieve consequence 6 and the investors achieve consequence 4. This consequence is somehow low for investors as they could both increase their profit and have better portfolio (less risk) through investment in another market.

The second state is that the investors just do domestic investment and the countries do not interact (war). In this case, the countries will achieve consequence 5 and the investors will achieve consequence 1. This consequence is the worst state for investors since they achieve both high risk and low profit.

The third state is such that the investors just invest in competing (enemy) government and the countries interact with each other (peace). In this state, the countries will achieve consequence 2 and the investors, consequence 3. This consequence is higher than first and second states for investors as they have done investment in competing government when the output (profit) is higher. Consequence 2 for government is for this reason that although all capital is outflow from the government, the peace (cooperation) is established.

The fourth state is such that the investors just invest in the competing government (enemy) and the countries do not interact (war). In this state, the countries will achieve consequence 1 and the investors will achieve consequence 2. This is the worst state for the countries since the capital has outflow, in one hand, and the war will happen, on the other hand. Consequence 2 is considered for the investor in this state since despite the war, the investor is ensuring that part of his capital will be preserved (whether inside government or in the competing government).

The fifth state is such that the investor does both domestic and foreign investment (in competing government) and peace is established. This is the best state for the investor since he will constitute a bigger portfolio (less risk) and achieve higher profit. The consequence of this state is considered 6 for investors and 5 for countries.

The sixth state is such that the investor does both domestic and foreign investment (in competing government) and war does exist. The consequence of this state is 5 for investors and 3 for countries. The reason why consequence 5 is considered for investor is that he has at least invested part of his capital inside government (helping the development of local economy) compared to fourth state.

The set of strategies of two players is as follow:

$$
\begin{aligned}
S_{investor} &= \{D, \mathrm{E}, C\} \\
S_{goverment} &= \{P, W\}.
\end{aligned}
\tag{3}
$$

The combination of the strategies of two players is also as follow:

$$
S = S_{investor} \cdot S_{country} =
$$
$$
= \begin{Bmatrix} (D, P), (D, W), (E, P), \\ (E, W), (C, P), (C, W) \end{Bmatrix}.
\tag{4}
$$

The consequences of game for investor (I) and government (G) can be logically ranked as follow:

$$
\begin{aligned}
U_I(D, P) &= 4, & U_G(D, P) &= 6 \\
U_I(D, W) &= 1, & U_G(D, W) &= 4 \\
U_I(E, P) &= 3, & U_G(E, P) &= 2 \\
U_I(E, W) &= 2, & U_G(E, W) &= 1 \\
U_I(C, P) &= 6, & U_G(C, P) &= 5 \\
U_I(C, W) &= 5, & U_G(C, W) &= 3.
\end{aligned}
$$

The game equilibrium is shown in Table 4.

Table 4. **Solving matrix of game and finding Nash equilibrium (investor and two competing countries/enemies)**

		Government			
		Cooperation (peace) (*P*)		Non-cooperation (war) (*W*)	
Investor	Just domestic (*D*)	4	6	1	4
	Just in third government (*T*)	3	2	2	1
	Domestic and in third government (*C*)	6	5	5	3

Source: Researcher's findings

In this game, the cooperation strategy (peace) dominates the non-cooperation (war) strategy for the government, i. e., regardless of the selection of the other player (investor), the government always selects cooperation since it yields higher consequence.

The dominate strategy for the investor is domestic investment and investment in third government (regardless of the choice of the other player and the dominant strategy for the investor is investment both inside government and in competing (enemy) government (regardless of the choice of the other player). Therefore, he will select it and achieve higher consequence.

Concerning the result, which is Nash equilibrium of game, it is observed that the equilibrium consequence happens in (*C, P*) and this is Nash equilibrium of the game. As previously noted, in Nash equilibrium, deviation from the related consequence is not to the benefit of any player assuming that other players are not deviated from the played strategy in Nash consequence.

4.1.3 Third state: Three countries (local, third and competing/ rival)

For this state, it is assumed that the investor could do investment in his government, third and competing countries. The game starts in this way that first the investor will have 7 options:

1) to invest all his capital in his government (*D*).

2) to invest all his capital just in third government (*T*).
3) to invest all his capital just in competing (enemy) government (*E*).
4) to invest his capital in both his government and third government (of the equal ratio) (*DT*).
5) to invest all his capital in his government and competing government (of equal ratio) (*DE*).
6) to invest all his capital in third and competing countries (of equal ratio) (*TE*).
7) to invest his capital in his government, third and rival countries (of equal ratio) (*DTE*).

At the next stage, the countries could have two choices: (1) to interact with each other (in other words, peace is established) (*P*); (2) to be indifferent (*B*); (3) do not interact (in other words, to enter war) (*W*).

Therefore, the matrix of the game will be as Table 5.

In the matrix form of the game between countries and investors, the priority of players should be ranked in order to achieve the consequences of each strategy. As far as in normal condition, no government is willing to enter war (concerning its consequences for countries), the best consequence for the countries will be cooperation (peace). It should be noted that the investor will invest in other countries (third and enemy) when earn more profit with less risk.

Table 5. **The game matrix between different states of investment and three countries**

	Government					
	Cooperation/Peace (*P*)		Indifferent (*B*)		Non-cooperation/ war (*W*)	
Just domestic (*D*)	3	21	2	20	1	11
Just third government (*T*)	6	13	5	12	4	3
Just enemy (*E*)	9	5	8	4	7	1
Domestic and Third (*DT*)	12	19	11	18	10	10
Domestic and enemy (*DE*)	15	15	14	14	13	6
Third and enemy (*TE*)	18	8	17	7	16	2
Domestic, third and enemy (*DTE*)	21	17	20	16	19	9

Source: Researcher's findings

The first state is such that the investors just do domestic investment and peace is established which is the best consequence for the countries. In this state, the consequence for the countries will be 21 and for the investors 3. This consequence is low for the investors as they could both increase their profit and have better portfolio (less risk) by investing in the market of other countries.

The second state is such that the investors just invest domestically, and the countries are indifferent. For this state, the countries will achieve consequence 20 and the investors will get consequence 2. This consequence is low for the investors as, through investing in the markets of other countries, they could both increase their profit and have better portfolio (less risk); on the other hand, the local economy is not related to the other economies.

The third state is such that the investors just invest domestically, and war happens. This is the worst consequence for the investors and the countries will achieve consequence 19 and the investors will achieve consequence 1.

The fourth state is such that the investors just invest in third government and the countries interact (peace). Here, the countries will achieve consequence 9 and the investors will achieve consequence 6.

The fifth state is such that the investors just invest in third government and the countries are indifferent. Here, the countries will achieve consequence 8 and the investors will achieve consequence 5.

The sixth state is such that the investors just invest in third government and the countries do not interact (war). Here, the countries will achieve consequence 7 and the investors will achieve consequence 4.

The seventh state is such that the investors just invest in competing government (enemy) and the countries interact (peace). Here, the countries will achieve consequence 3 and the investors will achieve consequence 9. Relatively high consequence of investors is due to higher profit they earn in the other market.

The eighth state is such that the investors just invest in competing government (enemy) and the countries are indifferent. Here, the countries will achieve consequence 2 and the investors will achieve consequence 8.

The ninth state is such that the investors just invest in competing government (enemy) and the countries do not interact (war). Here, the countries will achieve consequence 1 and the investors will achieve consequence 7. This is the worst state for the countries since both their capital has outflow and they have entered into war.

The tenth state is such that the investor invests his capital both domestically and in the third government and peace is established. The consequence of this state for the investor is considered 12 and for countries as 18.

The eleventh state is such that the investor invests his capital both domestically and in the third government, and the countries are indifferent. The consequence of this state for the investor is considered 11 and for countries as 17.

The twelfth state is such that the investor invests his capital both domestically and in the third government, and the countries do not interact (war). The consequence of this state for the investor is considered 10 and for countries as 16.

The thirteenth state is such that the investor invests his capital both domestically and in the competing government (enemy), and peace is established. The consequence of this state for the investor is considered 15 and for countries as 12.

The fourteenth state is such that the investor invests his capital both domestically and in the competing government (enemy), and the countries are indifferent. The consequence of this state for the investor is considered 11 and for countries as 17.

The fifteenth state is such that the investor invests his capital both domestically and in the competing government (enemy), and there is war. The consequence of this state for the investor is considered 13 and for countries as 10.

The sixteenth state is such that the investor invests his capital both in third and in the competing government (enemy), and peace is established. The consequence of this state for the investor is considered 18 and for countries as 6.

The seventeenth state is such that the investor invests his capital both in third and in the competing government (enemy), and the countries are indifferent. The consequence of this state for the investor is considered 17 and for countries as 15.

The eighteenth state is such that the investor invests his capital both in third and in the competing government (enemy), and there is war. The consequence of this state for the investor is considered 16 and for countries as 4.

The nineteenth state is such that the investor invests his capital three countries (his government, third and enemy government) and peace is established. The consequence of this state for the investor is considered 21 and for countries as 15. This state is the best consequence for the investor because he has achieved a big portfolio (low risk) and high output (accessibility to other markets).

The twentieth state is such that the investor invests his capital three countries (his government, third and enemy government) and countries are indifferent. The consequence of this state for the investor is considered 20 and for countries as 14.

The twenty first state is such that the investor invests his capital three countries (his government, third and enemy government) and there is war. The consequence of this state for the investor is considered 19 and for countries as 13.

The set of the strategies of two players is as follow:

$$S_{investor} = \begin{Bmatrix} D, T, E, DT, \\ DE, TE, DTE \end{Bmatrix} \quad (5)$$
$$S_{country} = \{P, B, W\}.$$

The combination of the strategies of two players is also as follow:

$$S = S_{investor} \cdot S_{goverment} =$$

$$= \left\{ \begin{array}{l} (D,P),(D,B),(D,W), \\ (T,P),(T,B),(T,W), \\ (E,P),(E,B),(E,W), \\ (DT,P),(DT,B),(DT,W), \\ (DE,P),(DE,B),(DE,W), \\ (TE,P),(TE,B),(TE,W), \\ ((DTE,P),(DTE,B),(DTE,W) \end{array} \right\}. \quad (6)$$

The consequences of game for investor (I) and government (G) can be logically ranked as follow:

$$U_I(D,P) = 3, \quad U_G(D,P) = 21$$
$$U_I(D,B) = 2, \quad U_G(D,B) = 20$$
$$U_I(D,W) = 1, \quad U_G(D,W) = 11$$
$$U_I(T,P) = 6, \quad U_G(T,P) = 13$$
$$U_I(T,B) = 5, \quad U_G(T,B) = 12$$
$$U_I(T,W) = 4, \quad U_G(T,W) = 3$$

$$U_I(E,P) = 9, \quad U_G(E,P) = 5$$
$$U_I(E,B) = 8, \quad U_G(E,B) = 4$$
$$U_I(E,W) = 7, \quad U_G(E,W) = 1$$
$$U_I(DT,P) = 12, \quad U_G(DT,P) = 19$$
$$U_I(DT,B) = 11, \quad U_G(DT,B) = 18$$
$$U_I(DT,W) = 10, \quad U_G(DT,W) = 10$$
$$U_I(DE,P) = 15, \quad U_G(DE,P) = 15$$
$$U_I(DE,B) = 14, \quad U_G(DE,B) = 14$$
$$U_I(DE,W) = 13, \quad U_G(DE,W) = 6$$
$$U_I(TE,P) = 18, \quad U_G(TE,P) = 8$$
$$U_I(TE,B) = 17, \quad U_G(TE,B) = 7$$
$$U_I(TE,W) = 16, \quad U_G(TE,W) = 2$$
$$U_I(DTE,P) = 21, \quad U_G(DTE,P) = 17$$
$$U_I(DTE,B) = 20, \quad U_G(DTE,B) = 16$$
$$U_I(DTE,W) = 19, \quad U_G(DTE,W) = 9$$

The game equilibrium is shown in Table 6.

Table 6. **Solving game matrix and finding Nash equilibrium (investor and three countries)**

	Government					
	Cooperation/ Peace (*P*)		Indifferent (*B*)		Non-cooperation/ war (*W*)	
Just domestic (*D*)	3	<u>21</u>	2	20	1	11
Just third government (*T*)	6	<u>13</u>	5	12	4	3
Just enemy (*E*)	9	5	8	4	7	1
Domestic and Third (*DT*)	12	<u>19</u>	11	18	10	10
Domestic and enemy (*DE*)	15	<u>15</u>	14	14	13	6
Third and enemy (*TE*)	18	8	17	7	16	2
Domestic, third and enemy (*DTE*)	<u>21</u>	<u>17</u>	<u>20</u>	16	<u>19</u>	9

Source: Researcher's findings

In this game, the strategy of cooperation (peace) is dominant on indifferent and non-cooperation (war) strategies for the government, i.e., regardless of the choice of oth-

er player (investment), it always selects co-operation since it yields higher consequence. Domestic investment and investment in third and enemy countries are dominant for the investor (regardless of the choice of other player); therefore, he selects it anyway and achieves higher consequence.

Concerning the obtained result, that is Nash equilibrium, it is observed that the co-operation consequence happens in (*DTE*, *P*) and this is Nash equilibrium. As previously mentioned, deviation from the related consequence is not to the benefit of any player in Nash equilibrium, assuming that other payers are not deviated from the played strategy in Nash equilibrium.

4.2. The economic power of the three countries is the various
4.2.1 First state: two indifferent countries (advanced economy and weak economy)
According to the previously defined and explained, the results of this part will be presented. In addition, it is reminded again that in order to avoid prolonging the discussion, the final tables (by finding the Nash equilibrium) are presented (Table 7).

The analysis of the results and dominant strategies here is also the same as the interpretation of Table 2.

4.2.2 Second state: two competing countries (the domestic economy is weaker than the enemy's economy)
The results of the Nash equilibrium in the second case where there are two competing countries (the domestic economy is weaker than the enemy's economy) are shown in the Table 8.

The analysis of the results and dominant strategies here is also the same as the interpretation of Table 4.

4.2.3 Third state: three countries (the domestic economy is weaker than the third economy and the third economy is weaker than the enemy's economy)
The results of the Nash equilibrium in the third state are shown in the following Table 9.

Table 7. **Solving the game matrix and finding the Nash equilibrium (investor and two indifferent countries)**

		Government			
		Indifferent (*B*)		Cooperation (*H*)	
Investor	Just domestic (*D*)	1	5	2	<u>6</u>
	Just in third country (*T*)	3	1	4	<u>2</u>
	Domestic and in third government (*C*)	<u>5</u>	3	<u>6</u>	4

Source: Researcher's findings

Table 8. **Solving the game matrix and finding Nash equilibrium (investor and two enemy countries)**

		Government			
		Cooperation (peace) (*P*)		Non-cooperation (War) (*W*)	
Investor	Just domestic (*D*)	4	6	1	3
	Just enemy (*E*)	3	4	2	1
	Domestic and in enemy (*C*)	6	5	<u>5</u>	2

Source: Researcher's findings

Table 9. **Solving the game matrix and finding the Nash equilibrium (investor and three countries inside, third and enemy)**

	Government					
	Cooperation/ Peace (P)		Indifferent (B)		Non-cooperation/ war (W)	
Just domestic (D)	3	<u>21</u>	2	20	1	7
Just third government (T)	6	<u>13</u>	5	12	4	3
Just enemy (E)	9	<u>9</u>	8	8	7	1
Domestic and Third (DT)	12	<u>19</u>	11	18	10	6
Domestic and enemy (DE)	15	<u>15</u>	14	14	13	4
Third and enemy (TE)	18	<u>11</u>	17	10	16	2
Domestic, third and enemy (DTE)	<u>21</u>	17	<u>20</u>	16	<u>19</u>	5

Source: Researcher's findings

The analysis of the results and dominant strategies here is also the same as the interpretation of Table 6.

5. Discussion

Concerning the equilibrium achieved in the three states, the main conclusion is that the investor achieves the best outcome (Nash equilibrium) by constituting portfolio and investing in various market and the countries through cooperation and peace. The obtained results are according to the logic and rationality of investors and countries in determining their priorities and their strategies, each of which seeks to maximize their profit. These results confirm the results of Glipin [11], Frieden & Lake [14], Reagan [5], Salimian et al. [33] and are opposite to the results of Rosato [21] and Kimbrough et al. [30].

According to the evidence in the real world and the rationality of investors, it is expected that in the current borderless world (in terms of financial markets and new currencies, etc.) the decisions of these people go beyond the borders of their countries and entire in international markets. The main hypothesis of this research was that financial markets can become the basis for world peace, which was confirmed according to the obtained results.

The results of this research are stated based on certain assumptions and are also considered for a situation in which investors have preferred to invest in their own country to invest in a third country and the third country to invest in a rival country. It is also assumed that the domestic country is economically weaker than the third country and the third country is also weaker than the rival (enemy) country. It is also assumed for simplicity that if the investor wants to invest in two or more countries, he will do so in the same proportion.

6. Conclusion

Nowadays the investors pay attention to the international concept of investment more than any other time as far as the formation of international and global markets and creation of investment opportunities makes investors not limit themselves to local markets. On the other hand, the countries are willing to make local capitals be used in the fulfillment of domestic objectives and to avoid capital outflow as far as possible. In this paper, the game modeling between investors and countries has been done using

game theory and presenting a static game between players.

For this purpose, in the first part, this article deals with countries that have the same power and economic status. First, the state of indifference of two countries, then the state of the enemy (rival), and in the third state, three countries, one of which is a competitor and the other is indifferent, have been considered. Then, in the second part, countries with different economic power are considered. For this purpose, three countries with different economies (weak, medium and strong) have been considered. First, a situation where two countries are indifferent to each other was considered. Then, in the second case, two countries were considered as rivals (enemies) and in the third case, three countries were assumed, and one of them was a competitor and the other was indifferent.

The results for the first state for each two-state showed that Nash equilibrium happens in the cell where the investor has distributed his capital inside the government and in the third government and has not confined himself to the local and domestic market and the countries use peace strategy (cooperation). For the second state, Nash equilibrium happens in a cell where the investor has distributed his capital in his government and in competing government (enemy) and has not confined himself to the local market and the countries use peace strategy (cooperation). For the third case, it happens inside the company in a cell where the investor spreads his capital in all three countries, domestic, third and competitor (enemy) and does not limit himself to the domestic market, and the countries use peace strategy (cooperation).

Concerning the equilibrium achieved in three states, the main conclusion is that the investor achieves the best outcome (Nash equilibrium) by constituting portfolio and investing in various market and the countries through cooperation and peace.

Finally, the importance of the Issue of war and peace in the international arena has always been in the focus of attention of governments and countries. In line with this important intellectual approach from various sciences, they have tried to provide new solutions for global peace and stability and prevention of war and appropriate to the developments of today's world. In the meantime, the field of "economy" has become an important variable in political equations and international relations, especially due to the tremendous and profound changes it has undergone.

The results of the research in the language of logic (mathematics) confirm the effect of economic cooperation on the development of peace, where through the development of international investment, governments achieve peace and, on the other hand, investors achieve the best outcome. Based on this, it is suggested that the governments develop and strengthen the fields of international investment and create global markets, and at the micro level, investors become the foundation of world peace by developing international investment.

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Разрешение конфликтов и укрепление международных отношений с инвестициями: подход теории игр

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Аннотация. Сегодня инвесторы уделяют международной концепции инвестиций больше внимания, чем когда-либо прежде. Кроме того, страны намерены использовать внутренний капитал для достижения своих целей, максимально предотвратив отток капитала. Настоящая статья, обращаясь к объективным примерам международных отношений, пытается дать ответ на важный вопрос экономического сотрудничества в форме международных инвестиций при их максимизации с помощью теории игр. Главный вопрос заключается в том, смогут ли инвестиции на международном уровне избежать войны и созидать? Авторы, используя теорию игр и дизайн игр между правительствами и инвесторами в качестве основных начальных этапов, рассмотрели три различных режима. В первом разделе было рассмотрено состояние, в котором две страны безразличны. Второе состояние включает в себя две конкурирующие (вражеские) страны, а третье состояние предполагает три страны, одна из которых является конкурентом, а другая является безразличной. Во втором разделе сначала рассматривается ситуация, когда две страны безразличны друг к другу. Тогда во втором случае соперниками (врагами) считаются две страны, а в третьем — три страны, одна из которых является конкурентом, а другая безразлична. Что касается полученного равновесия в трех ситуациях и для каждого из двух разделов, основной вывод заключается в том, что инвестор достигает наилучшего результата (равновесие Нэша), формируя портфель и инвестируя в различные рынки, а страны достигают наилучшего результата за счет сотрудничества и установления мира. Иными словами, результаты исследований на языке логики (математики) подтверждают влияние экономического сотрудничества на развитие мира.

Ключевые слова: мир; теория игр; статические игры с полной информацией; равновесие Нэша.

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