THE GAMING AMONG CHINA, THE PHILIPPINES AND THE US IN THE SOUTH CHINA SEA DISPUTES

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Abstract

The South China Sea (SCS) has recently received much attention from the world due to the intensifying territory disputes in this region. The SCS not only has great potential reserve in resources such as oil and natural gas, but also is of strategic importance according to its geographic location. These two characteristics have made the SCS a hotspot with disputes and conflicts not only among the states neighboring the SCS, such as some of the ASEAN states and China, but also captured the attention from the external powers like the US. Therefore the main research question of this thesis is: **How do the main players (China, the Philippines, and the US) game in the South China Sea dispute?**

With its rapid economic development over the years, China has demonstrated its increasing national interest in maritime, especially in SCS. The reasons are of several folds. Firstly, the SCS has been discovered with great potential reserve in natural resources, which can provide China with additional resources for its increasing demand for energy. Secondly, SCS is the most important sea route for oil transportation from Africa and Middle East to East Asia. Thus China has strong motivation to secure its energy "life-line" to support its economic development. Thirdly, SCS is strategically important for the Chinese navy to break through the "sea-wall" of the first island chain, so that more strategic depth can be acquired if the Chinese navy can reach out to the Pacific.

With the increase of its comprehensive national power in recent years, China is obviously in an advantage position when disputes or conflicts occur with other states such as the Philippines and Vietnam. The US, on the other hand, would like to maintain its control and leadership in the Pacific, including the SCS. The US is not willing to see an ever-increasing power from the East and let China take control over SCS. The US' interest in Asia-Pacific is to balance the power in this region and the free navigation in SCS, so that no state becomes a dominating power over this region. Therefore, the US adopts a "Rebalancing" policy in Asia-Pacific in recent years. For example, the US clearly states its support for the Philippines and Vietnam in the SCS disputes in order to counteract the power of China.

As the interest from different states could be conflicting and overlapping as in many cases, disputes among them occur. If we consider the dispute as a game and each state as a player, questions arise as "What strategies can each player take? What is the possible outcome of this dispute?"

This thesis tries to analyze the current SCS dispute by using the Game Theory. A sequential gaming model with complete and perfect information is constructed. Classical theories in international relations (IR) such as Realism and Liberalism are used to analyze the possible strategies and the corresponding payoffs of each strategy for each player. Finally, a sub-game Nash Equilibrium (NE) is deduced which can be regarded as an acceptable strategy for each player in this game. The general finding by using the Game Theory together with the classical IR theories is that it is best to keep the current situation in SCS not changed.

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Contents

Front Page Illustration (Global Fire Power, 2013)

Abbreviations

ASEAN	Association of South East Asia Nations
CCP	Chinese Communist Party
CIA	Central Intelligence Agency
CIS	Commonwealth Independent States
CNOOC	China National Offshore Oil Cooperation
EIA	US Energy Information Administration
EU	European Union
IEA	International Energy Agency
IR	International Relations
NE	Nash Equilibrium
PLA	People's Liberation Army
SAS	South China Sea
TCF	Trillion Cubic Feet
UNCLOS	United Nation Convention of the Law of the Sea
US	United States

Figures and Tables

1 Introduction

The South China Sea, which is a part of the West Pacific Ocean, is a marginal sea surrounded by Mainland China, the Taiwan Island, the Philippine Islands, Sunda Islands and the Indo-China Peninsula (shown in Figure 1). The surrounding countries and states are: China, Vietnam, Malaysia, Singapore, Indonesia, Brunei and the Philippines. This area includes hundreds of small islands, rocks and reefs, with the majority located in the Paracel and Spratly Island chains (EIA, 2013). Most of the islands are partially submerged while some of them are permanently under water, so it is not suitable for human habitation. Only during the fishing season the fishermen from the neighboring states will have a short stay and make a living on these islands.

Figure 1 Map of the South China Sea (EIA 2013)

Because of the discovery of large potential storage of oil and natural gas beneath the seabed and the growing strategic importance of the sea line, the SCS has received an increasing attention as an important strategic political region in the recent decades.

1.1   Resources, the sea-lane and the interests of the major powers

It is believed that there is a large reserve of oil and natural gas beneath the seabed of SCS, which is one of the key reasons why territorial disputes taking place in this region. According to the statistics given by the Ministry of Land and Resources of China in 2012, the number of discovered oil field in SCS is around 10 with an area of 852,400 km^2, which approximately covers half of the total area. In this report the author referred the SCS as "the second Persian Gulf" for its abundant reserve of natural resources (Li, 2012).

US Energy Information Administration (EIA) offered a group of more detailed data of the potential oil and gas reserve in this region. In its South China Sea Report it mentioned "…EIA estimates there to be approximately 11 billion barrels (bbl) of oil reserves and 190 trillion cubic feet (tcf) of natural gas reserves in the South China Sea. These numbers represent both proved and probable reserves, making them closer to a high-end estimate."(EIA, 2013) The increasing needs of natural recourses from the major powers like the US, China, and Japan, made the SCS become the hotspot of disputes.

Beside the rich reserve of energy, the SCS is also a significant political strategic region. It lies between the Pacific and Indian Ocean, is the major sea routes that combines East Asia and other parts of the world, such as India, the Middle East, Africa and even Europe. China has an important interest in securing its navigation on the SCS due to the fact that over 70 percent of China's crude oil import passes through the SCS annually (EIA, 2013). Japan's situation is more typical. Japan's oil-sufficiency rate is 0.3 percent due to its geographic factors (EIA, 2012), which means its resource consumption almost totally relies on importation from Middle East and some other main oil-suppliers by using the SCS sea route. In this context, the SCS has been the Japan's "Maritime Lifeline". Therefore Japan has a strong will to secure its energy-line in the SCS. That is a main reason why this area's dispute received great attention not only from the regional countries in the SCS, but also from the states outside of the region.

1.2   Claim for territorial sovereignty and conflict

As a water area with long history, the South China Sea was given its first name as "Southern Sea" in China's Zhou Dynasty (1046-771 BC). Chinese fishermen started

fishing activities since China's Song Dynasty (960-1279 AD) (Wu, 2012). For thousand years this region maintains peaceful until the scientists discovered the rich potential resources beneath the SCS seabed during the Cold War period. In April 1969 two geographical scientists, K. O. Emery and his partner Hiroshi Niino, published a paper named *Sediments of the Gulf of Thailand and Adjacent Continental Shelf*, firstly pointed out that there is a huge storage of oil and gas under the South China Sea (Wu, 2012). Since then the territorial disputes in the region began to intensify. Generally speaking, the history of the territorial disputes in SCS is the history of the discovery on its potential natural resources as well as its strategic positions.

Although in July 2011, ASEAN and China made an agreement about drafting a set of guidelines which would help resolve the disputes in this region, the Sino-Philippines relationship still went intense in 2012 because of the Scarborough Shoal/Huangyan Island dispute.

Figure 2 and

Table **1** present the claims made in the SCS from different states. It is shown that China (including Taiwan) and Vietnam both claimed the sovereignty over most part of the SCS, including Paracel Islands as well as the Spratly Islands. The Philippines, Malaysia and Brunei claimed the sovereignty over certain part of the Spratly Islands. As to substantial control over these islands, Vietnam controls 22, China 14, the Philippines 11 and Malaysia 10. Taiwan controls one, Itu Aba/Taiping Island, which is the largest island (1.4km. in length and 0.4 km. in width) (CIA 2007:583).

Figure 2 Claims Made in the South China Sea (VOA 2012)

State	South China Sea	Spratly Islands	Paracel Islands
Brunei	UNCLOS	No formal claim	No
China	All[1]	All	All
Indonesia	UNCLOS	No	No
Malaysia	UNCLOS	3 islands	No
Taiwan	All[1]	All	All
The Philippines	Significant portions	8 islands	No
Vietnam	All[1]	All	All
[1] **Excluding buffer zone along littoral states (calculations for buffer unknown)**			

Table 1 Claims Made in the South China Sea (EIA 2013)

1.3   Research Question

As mentioned above, it is believed that the SCS has a huge storage of natural recourses; meanwhile it is also a unique and significant geostrategic hotspot. These two characteristics have made this region an arena of gaming among the neighboring states around SCS such as the Philippines and China as well as the external powers like the US, each of which has its own interests and concerns. These interests and concerns from different players could be conflicting and overlapping in some aspects, but may be cooperating in other aspects. So in some cases it seems to be a zero-sum game, while in other cases it can be regarded as a win-win game. The main research question in this paper is:

How do the main players (China, the Philippines, and the US) game in the South China Sea dispute?

And this main question will be answered by using the following sub-questions:

a. What characteristics of the South China Sea caused the disputes among the neighboring states and captured significant attention from the external powers like the US?

b. What are the core interests and basic concerns from the main players in this area?

c. What strategies should each player take in this dispute?

2   Methodology

The main objective of this thesis is to present the dispute taking place in the South China Sea, and analyze the gaming among the core players. The thesis will start with the theoretical discussions on Realism, Liberalism and Game Theory in Chapter Three, then conduct the analysis by specifying the following aspects: the unique characteristics of the South China Sea, including rich resource reserve, significant strategic position, and a Asian perspective concerning sovereignty; China and the US' interest and concerns in this region. At the last part of the analysis a gaming model is created to calculate the payoffs of each player's strategic moves and provide a strategic solution by using the Game Theory.

2.1   The Choice of Theories

This thesis selected three theories as Realism, Liberalism, and Game Theory concerning security dilemma, interdependence and choice of strategy to create my theoretical framework. Realism assumes a typical nation profile seeking for its interests and concerns, while indicates the formulation of a tensional international situation when the other nations have competing and conflicting pursuits. The Liberalism treats the international relation in a more optimistic manner, arguing that the mutual dependence of nations would facilitate the formulation of common interests and promote collaboration. Both the Realism and Liberalism are typical international relation theories, which are frequently used in analyzing international political issues. Game Theory, which is widely applied in economic fields, is a study of strategic choices based on mathematical models of interdependence and conflict between players. The discussion of the three theories is followed by a sub-section concerning the comparison of Realism and the Game Theory. This sub-section aims to explain the possibility of using Realism in the gaming model.

 "Sub-game perfect equilibrium" in Game Theory is used to model the game and find out a strategy profile. As for the players, there are 6 nation-states claiming the sovereignty over most or part of South China Sea, including the Philippines, Vietnam, Malaysia, Brunei, Indonesia and China (including Taiwan). Apart from those players, the dispute

in this region is also more or less effected by some other regional or outside powers like the US, Japan, India, Russia and even Australia. As there are too many players in the region, for the simplicity of the gaming model, I will choose three the most typical and important nation-states as players in the model, i.e. China, the Philippines, and the US, each of which representing the most powerful territorial claimer in this dispute, the ASEAN countries, and the most influential external power, respectively. Those three players represent the main characters in the current SCS dispute. I will use this model to analyze the possible strategies of each player, calculate the payoff of different strategies, and try to find out a strategy profile which can maximize the benefits for each player.

2.2   The Collection of Empirical Data

The collection of empirical data is one of the most important tasks during my thesis. In this thesis, I use both qualitative and quantitative data in order to achieve a further understanding of current situation. Basically, the data source is dependent upon the authoritative documents in terms of research papers, reports released by the governments and international organizations, such as statistics from the US Energy Information Administration Report, the CIA World Factbook, etc. As the political situation is getting intensive recently, I also focus on some statistics on each state's military strength, which are useful in analyzing each state's consideration to the conflict. Besides, as a native Chinese speaker, I also collect both English databases and works from Chinese researchers, which gives me a quite different perspective in my research.

3 Theories

This chapter aims to construct a theoretical framework for the subsequent analysis. Three theories, i.e. Realism, Liberalism and Game Theory are applied to explain the main question mentioned in the first chapter.

3.1 Motivation of Theoretical Selection

Realism is the most classic and widely applied theory when analyzing international affairs, especially in explaining security issues, throughout the development of International Relations. Realists believe the nature of international relations is the competition for power among nation states due to the pursuit of national interests, resulting in the international anarchy, mutual distrust, and security dilemma. Therefore, Realism is suitable to explain the reason why the regional states and outside powers are interested in SCS, as well as the security dilemma and anarchy in this region. This theory will also be used together with Game Theory to discuss each player's strategic preferences concerning national interests.

Liberalism, which emphasizes the mechanisms of economic interdependence, international institutions and democratization, is also a frequently applied theory when explaining international issues. Liberalists believe that the dispute between nation states can be addressed by conventions and peace talks rather than military conflicts due to the interdependence, especially economic interdependence with co-benefits. This theory can be applied to explain the possibility of conventional settlement of the SCS dispute because of the economic interdependence between China and ASEAN states. Furthermore, it can be used to analyze the influence of economic factors to each player's strategic choices (such as economic ties between the players) in the gaming model.

Although Game Theory is more frequently used in economic studies, it also can be applied in international relations to analyze the behaviors and the corresponding gains/loss (called the payoff in Game Theory) of different players. It tries to figure out a strategic profile which can be considered as the best response to other players'

strategies. The Game Theory can help nation states to make strategic decisions based on mathematical modeling and quantitative analysis. The SCS dispute can also be modeled as a game, and the involvers are modeled as players. It is possible to create a gaming model, calculate each player's payoff depending on their strategic preferences, and figure out a strategy profile which satisfies the Nash Equilibrium (NE). Although SCS dispute has received much attention all over the world and has been extensively studied, there are a few studies analyzing the SCS dispute using the Game Theory. Due to its significance in strategic decision-making studies, it is worth trying to apply Game Theory in this thesis.

3.2 Realism

Realism, as one of the dominating theories in IR studies, has played a key role in explaining international affairs in nation centric terms. Classical Realism, which is mainly focused on international anarchy, state centric, national interests, power and survival philosophy, was put into political practice in the US and Europe up to postwar period. Structural Realism (also referred to as Neorealism), represented by the study of Kenneth Waltz, is more focused on analyzing IR issues in a structural way. It emphasizes that the nation states are the primary actors in international affairs and the paradox and conflict among nation states are due to the anarchy of international system. However, Structural Realism shares some basic assumptions and perspectives with Classical Realism, which includes:

- Nation states are the primary actors in international affairs.
- International anarchy is a common social formation.
- National interest, instead of moral and international law, is the key factor determining nations' foreign policies. The core interest of nation states is the pursuit of power and security.
- Rational policies are usually adopted when nation states deal with international issues.
- The best way to maintain international peace is the balance of power among nation states.

3.2.1   National Interest

As mentioned previously, national interest is the key factor that determines nations' foreign policies. For classical realists, the national interest is the basic guide of responsible foreign policy: it is the moral idea that must be defended and promoted by state leaders. For Waltz, however, the national interest seems to operate like an automatic signal commanding state leaders when and where to move (R. Jackson and G. Sørensen, 2007: 78). National interest contains security concerns, economic benefits, as well as cultural power.

However, a state's national interest may change gradually. It is always defined by the power of that state. As a state's national strength grows, it will expand its interest, which may appear in the form of demanding more territory and changing the existing international/regional order.

Basically, the territorial dispute in South China Sea was caused by the overlapping of national interest among the involving states. A state's position and policy in this dispute is mainly determined by its national interest. The analysis part of this thesis will try to depict a landscape of each of the main involvers' national interest in SCS, and explain what policies they should make in this game based on national interest.

3.2.2   Security Dilemma

According to Realism, the consequence of the international anarchy is that nation states will regard security as top priority. In an anarchic international society, nation state has the willing to strengthen itself (such as military power) as much as possible in order to secure itself. However, this will cause distrust and panic among its neighbors. As a response, its neighboring states also have to strengthen their power to secure themselves. Therefore, a military competition such as arm race will emerge in this region and it is not easy to cool down. This is called the security dilemma. An American scholar J. Herz (1950: 157) pointed out that the security dilemma is primarily referring to the self-help attempts of states to maintain their security due to the mutual distrust and fear between them in a chaotic international setting. In the pursuit of the security the states tend to increase their military expenditure and develop arms to improve their security status, which could lead to the rising insecurity from others. It may end up with an endless arms race. On the belief that survival and security is on the top priority of a nation state's agenda, Realists believe that balance of power is the best way to maintain

peace. Weaker states can form alliance with a stronger state, in order to meet their survival needs.

The current situation in Southeast Asia can be partly explained using the security dilemma. The significant development of China, both economically and militarily, breaks the power-balance in this region and causes distrusts and worries among the neighbors. In order to balance the power in this region, Southeast Asia states are somehow willing to let the US get involved in this dispute in order to counteract the increasing power of China, especially those states having territorial disputes with China.

3.3 Liberalism

The Theory of Liberalism, which has its roots in traditional Western political and economic thoughts, is closely connected with the emergence of modern liberal states. It is also considered as one of the dominating theories in analyzing international issues. Apart from Realism, Liberalist's studies mainly focus on the mechanisms of economic interdependence, international institutions, and democratization, but less attention on security factor in analyzing international relations. They emphasize the effects and influence of economic interactions and international institutions in dealing with international affairs. They believe that the dispute between nation states can be addressed by conventions and peace talks instead of military threats and conflicts, due to the interdependence between the nation states, especially economic interdependence with co-benefits and co-interests.

3.3.1 Interdependence

Liberalism has its roots in globalism, which can be represented by the economic interdependence of nations. The study of interdependence emerged at the Cold War period, as the economic relation was strengthened and non-governmental organizations like international institutions and transnational companies have played a more important role in international relations. Robert Keohane and Joseph Nye focus on the study of international and transnational relations, concerning the two core characteristics of interdependence in the book *Power and Interdependence*, i.e. sensitivity and vulnerability. Vulnerability interdependence is more important in providing power resources to actors; with effective alternatives, sensitivity effects can

be overcome. Vulnerability can take on a strategic dimension, as less vulnerable states can impose costs on others by exploiting their sensitivity. Sensitivity can also pose problems for leaders of pluralistic political systems, when interdependence harms domestic groups that will subsequently clamor for protection from the government (Keohane and Nye, 2011: 32). According to Gerhard Mally, interdependence may best be defined as a "complex transnational phenomenon", which involves "multi-dimensional, multi-sectional patterns of interactions" between nations, which result in "enhanced mutual sensitivity or vulnerability". "Multi-dimensional", to Mally, indicates a global, regional, and continental scope of impact, while "multi-sectional" implies that a broad spectrum of political, environmental, economic, technical, and sociocultural activity is involved. It is a complex phenomenon, since it is both objective and subjective; interdependence may be a physical reality and/or a subjective acknowledgement of mutual dependence (Papp, 1978).

The phenomenon of interdependence can be applied as a factor in describing the relations among the involvers in SCS dispute. For example, on one hand, the economic interdependence and co-benefits between the Philippines and China may pull the two parties back to the table with peace talks. On the other hand, this interdependence can also be used as a "strategic weapon". As the Philippines are more sensitive to the economic interdependence than China, the Philippines will bear more pressure if the economic link between the two starts weakens or even breaks.

3.4   Game Theory

Game Theory is commonly used in the study of selecting strategies when dealing with competition, conflict and crisis. It aims at how to find the best strategy profile by using mathematics under the assumption that all players are rational players.

As a theoretical framework with a scientific approach, Game Theory and international relations have been influencing each other since the publication of The Theory of Games and Economic Behavior by von Neumann and Morgenstern (1944), which is usually considered to be the first systematic and extensive formal analysis of social interactions (Correa, 2001). However, it still experiences a great debate in IR studies with classical theories.

3.4.1   The Second Debate

The second debate of IR theoretical paradigm, which took place between Realism and Behavioralism in 1950s, was a debate of methodology. Realism as a classic, dominating school has been challenged, while the challenger is Behavioralism with a scientific approach. Behavioralism emphasizes the importance of obtaining and analyzing of quantitative data and scientific methodology in IR research, highly praises the scientific theories including Integration Theory, Game Theory and Communication Theory, meanwhile criticizes the inaccuracy of Realist's method in IR studies. At the end of this debate M. Kaplan gave a summary, concluding:

 "The general arguments that have been employed include these among others: that politics involves purpose in a way that physical science does not; that scientific knowledge is applicable to facts, but understanding, wisdom, or intuition are required for areas where human purpose is involved; that those pursuing scientific models tend to mistake their models for reality; that scientific method requires high precision and measurement and there fore is incapable of coping with the most important elements of international politics; and that the practitioners of scientific method can never be sure that they have not left something out of their model." (Kaplan, 1966)

Kaplan gave us a clear description of different focuses and limitations of the two theoretical thinking in IR studies. In this thesis, we use both Realism and Game Theory to analyze the considered problem, with the purpose of viewing the same question from different perspectives.

3.4.2   Basic assumptions and elements in Game Theory

Generally speaking, a "game" in Game Theory contains the following essential elements:

1. **Players:** The individuals who make decisions.

2. **Rules of the game:** Who moves when? What can they do?

3. **Outcomes:** What do the various combinations of actions produce?

4. **Payoffs:** What are the players' preferences over the outcomes?

5. **Information:** What do players know when they make decisions?

6. **Chance:** Probability distribution over chance events, if any. (Slantchev, 2009)

The key assumption of a "game" is rationality of players. As an irrational move is irregular and cannot be calculated by mathematic model, the players are assumed rational and payoff-oriented.

3.4.3   Basic Categories of Game

Games can be divided into different categories based on different cases. For example, according to the number of players, games can be divided into Two-play game and N-play game; according to the order of player's movement, games can be divided into Simultaneous Game and Sequential Game.

The most basic division of game is *Cooperative Game* and *Non-cooperative Game*. If there exists an agreement which can regulate the players to be cooperative, it can be referred as a Cooperative Game. Otherwise, if the players can freely choose their strategies with the objective to maximize their own benefits, it is a Non-cooperative Game (Slantchev, 2009).

Games also can be divided into *Zero-sum Game* and *Nonzero-sum Game* depending on different types of payoffs. If one player's loss equals to the other one's gain, it is a Zero-sum Game; otherwise it's a Nonzero-sum Game.

According to the order of each player's action, it can be divided into *Simultaneous Game* and *Sequential Game* (also referred as *Strategic Game* and *Extensive Game*) (Slantchev, 2009). In a Simultaneous Game players should make decisions simultaneously, or the later one is unaware of the earlier one's action. A Sequential Game requires that each player make decision orderly; while the later player' action can be regard as a response to the previous one' decision.

Another division of game is *Complete Information Game* and *Incomplete Information Game*. A Complete Information Game refers to a game of which each player has the complete information of other players' choices and each choice's payoffs; if not, it is an Incomplete Information Game. Furthermore, in a Sequential Game if the later player is aware of the earlier player(s)'s action when taking actions, it is called a *Perfect Information Game*. Otherwise in a Sequential Game, if the later player is unaware of the choices made by the earlier player(s), it is an *Imperfect Information Game*.

The division of Simultaneous Game and Sequential Game, as well as Complete Information Game and Incomplete Information Game is the most common divisions in

modern Game Theory studies (Slantchev, 2009). According to these two divisions, games can generally be divided into four categories: Simultaneous Game with Incomplete Information, Sequential Game with Incomplete Information, Simultaneous Game with Complete Information, and Sequential Game with Complete Information. Based on the current situation in South China Sea and the possible actions from different players, the Sequential Game with Complete Information is the most appropriate gaming model in this thesis. Therefore, we are mainly focused on this category of gaming model.

3.4.4   Nash Equilibrium and Sub-game Perfect Nash Equilibrium

As mentioned in the last section, a Sequential game with complete and perfect information refers to a game which players make strategies orderly, while each player knows the entire process of the game and other players' choices and payoffs.

In a game, a rational player would select the strategy that yields the greatest expected payoff given the other player's strategy. Such a strategy is called a *best response*. A strategy profile is a Nash Equilibrium (NE) if no player has incentive to deviate from his strategy given that the other players do not deviate (Slantchev, 2009). In NE, it is required that each player's strategy is a best response to the strategies of the other players.

In games of finite sequential game with perfect information, there exists a *sub-game perfect Nash equilibrium*. A commonly used technique to find the sub-game perfect NE is to use *backward induction*. It starts from the last stage of the game, determines the last mover's best action at his information set there, and then replaces the information set with the payoffs from the outcome that the optimal action would produce. Continuing in this way, we work upwards through the tree until we reach the first mover's choice at the initial node (Slantchev, 2009). These strategies constitute a NE because each player's strategy is a best response given the other player's strategy. In fact, sub-game perfect NE is a refinement of NE in the sense that it is also a NE for every proper sub-game of the original game (Slantchev, 2009). That is why it is called sub-game perfect NE.
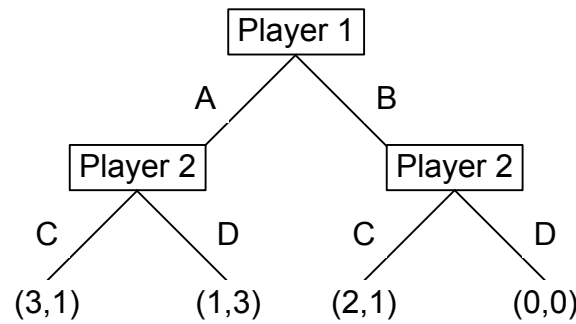
Figure 3 Sample of a Finite Sequential Game with Complete and Perfect Information

Here is an example of finding NE and Sub-game perfect NE. Figure 3 is a sample of a finite sequential game with complete and perfect information. Player 1 firstly takes action, and then turns to Player 2. Player 1 has two strategic choices which refers to A and B, while Player 2's choices are C and D. The numbers on the bottom refer to the payoffs of each player, for example (3, 1) means that Player 1's payoff is 3, while Player 2's payoff is 1.

If we use backward induction and start from the last stage of the game, we will find if Player 1 chooses A, Player 2 definitely will choose D. It is because Player 2's payoff will be higher by choosing D than choosing C. It is Player 2's best response upon player 1's action on A. Likewise, if Player 1 chooses B, Player 2 will choose C. Therefore, {A, D} and {B, C} are NE in this game because they are all best response. Then we roll back to the first stage of the game. Player 1 knows if he chooses A Player 2 will choose D, and then his payoff would be 1. On the other hand, if player 1 chooses B Player 2 will choose C, which results his payoff to be 2. Therefore player 1 will choose B. So the best strategy for player 1 and player 2 is {B, C}, and the payoff in that case would be (2; 1). This strategy profile is the sub-game perfect NE in this game. {A, D} and {B, C} are both NE in this game because no player has incentive to deviate from his strategy given that the other players do not deviate.

3.5   The application of Realism in gaming model

The phenomenon of international conflicts and collaboration sometimes shows the characteristics of gaming. Table 2 gives us a clear landscape of the comparison in major aspects by showing that the primary actors, motivation, external environment, and

objects of study. Realism and Game Theory both regards the primary actors should be rational. Players pursue interests and benefits, so do the nation-states according to Realists. Realism regards the external environment as anarchy and each nation-state is self-interested. In a Non-cooperative game, there is no contract among players so that each player makes decisions only concerning its own payoffs. Realism is frequently applied in explaining international conflicts, while Game Theory mainly deals with conflict and cooperation issues.

Table 2 Comparison of Realism and Game Theory in IR

	Realism	Game Theory in IR
Primary Actors	Rational nation-states	Rational Players (not necessarily nations)
Motivation of Action	Pursuit of Interest	Maximization of Payoffs
External Environment	Anarchy	No contracts among players; each player makes decisions independently (in Non-cooperative Game)
Objects of study	International conflict; sometimes collaboration	Mainly conflict and cooperation among players

In summary, Game Theory and Realism share some common assumptions, perspectives, and ideas, which makes it possible to construct a gaming model of SCS disputes, while analyze each nation-state's payoffs by using Realism.

4   Analysis

The analysis part aims to describe the characteristics of the South China Sea, then analyze China and the US' national interest and some other relevant elements concerning this region. At the last part of the analysis, a gaming model is shown in order to find a Nash Equilibrium which refers to an acceptable strategy for all players (China, the Philippines, and the US).

4.1   The unique characteristics of the South China Sea

The South China Sea, which is a part of the West Pacific Ocean, has recently received much attention from the world due to the intensifying territory disputes in this region. The unique characteristics, such as its great potential reserve in resources as well as its strategic importance, have made the SCS a hotspot with disputes and conflicts among the neighboring states.

4.1.1   Potential Reserve in Resources

With the significant potential reserve of oil and natural gas beneath the seabed, SCS received great attention from neighboring Asian states in recent decades. In April 1969, two geographical scientists, K. O. Emery from University of South California and Hiroshi Niino form Tokyo University of Fisheries, published a paper named *Sediments of the Gulf of Thailand and Adjacent Continental Shelf*, firstly pointed out that there is a huge storage of oil and gas under the South China Sea (Wu, 2012).

As to the precise statistics about the storage of the oil and gas in SCS area, there is no commonly accepted data due to the technical limitations and the tension of the political situation in this region. Both Chinese government and US' research institution offered their estimated data. According to the statistics given by the Ministry of Land and Resources of China in 2012, the number of discovered oil field in SCS is around 10 with an area of 852,400 km², which approximately covers half of the total area. In the offshore area laid three sedimentary basins rich in natural gas with an area of 160,000 km², namely the Northern Bay, the Yingge Sea, and the Hainan Southeast Basin. The

exploited reserve in oil and natural gas in this area are 5.5 billion tons and 12 trillion m^3, respectively. The entire estimated oil reserve in SCS is at least 23 billion tons, with a maximum up to around 55 billion tons; meanwhile the natural gas reserve is around 20 trillion m^3. In this report the author referred the South China Sea as "the second Persian Gulf" for its abundant reserve of natural resources (Li, 2012).

US Energy Information Administration offered a group of more detailed data of the potential oil and gas reserve in this region. In its South China Sea Report it mentioned "…EIA estimates there to be approximately 11 billion barrels (BBL) of oil reserves and 190 trillion cubic feet (TCF) of natural gas reserves in the South China Sea. These numbers represent both proved and probable reserves, making them closer to a high-end estimate."(EIA, 2013)

Another group of statistics comes from the China National Offshore Oil Cooperation (CNOOC). According to the studies made by EIA, CNOOC estimated that SCS area holds around 125 billion barrels of oil and 500 trillion cubic feet of natural gas in undiscovered area. Although CNOOC also pointed out their concerns of high cost and technical limitations in prospecting and exploiting the resources in SCS, China's first deep-water drilling platform named "CNOOC 981", which has been put into use on South China Sea since 2012, made it possible for large-scale deep-sea resources exploration.

Besides the proven storage of oil and natural gas, it is also reported that there is large reserve of natural gas hydrate, which is considered to be a potential energy resource and a possible substitute of oil, in the SCS area. A Vietnamese geographic scholar Nyuyen Trung (2012) published a paper *The Gas Hydrate Potential in the South China Sea*, which pointed out "… the volume of gas hydrate reservoir is estimated to contain 1.38 x 10^{14} m ^{3}, 1.41 x 1014m^3 and 1.7 x 10^{14}m^3 of methane gas at the standard temperature and pressure." Although the gas hydrate is not yet technically mature, it is capturing the attention as a new kind of energy resource.

Throughout the history of IR, a region with rich resources always evokes disputes and conflicts. With the rapid economic development, China has shown an increasing interest on resources and energy security in order to sustain its development. Therefore China is paying more attention in SCS' resources. The ASEAN states, on the other hand, are trying to find some ways to develop their economy, among which selling resources is the fastest and easiest way. When the interests from different states overlap in this region, the disputes occur.

4.1.2   Strategic Position of SCS

The SCS, which lies between the Pacific and Indian Ocean, is a major sea route that connects East Asia to other parts of the world, such as India, the Middle East, Africa and even Europe. The strategic importance of this sea route is mainly reflected on two aspects: unique geopolitical position and oil transportation.

The SCS lies in between the Pacific Ocean and the Indian Ocean, encompassing an area from the Singapore and Malacca Straits to the Strait of Taiwan. It is the most important sea route connecting East Asia to South Asia, Middle East, Africa, and Europe. It is estimated that one-third of the world's shipping transits through SCS. Taking control over SCS means taking control over the sea route from Malacca Straits to East Asia. Therefore, its unique geopolitical position enables SCS to be of great strategic importance.

Figure 4 Major Crude Oil Trade Flows in SCS (EIA 2013)

Apart from the significant geopolitical position, the strategic importance of SCS is also reflected on the aspect of oil transportation. According to the CIA report on SCS, approximately 14 million barrels of crude oil pass through the SCS area (including Gulf

of Thailand) per day, which accounts for almost one third of global oil movement (EIA, 2013). Figure 4 shows the major crude oil trade flows in this region. Over ninety percent of the entire flow comes from Persian Gulf (the global largest oil supplier), passes through the Strait of Malacca (one of the busiest and most important shipping lanes), finally distributes to the major oil consuming states in East Asia, e.g. China (including Taiwan), South Korea, and Japan. This is not only the shortest but also the most important sea-lane between oil suppliers like African and Persian Gulf, and the Asian markets. The import of oil in most East Asian states depends heavily on this sea-lane. For example, Japan is highly sensitive to the safety in this sea route as over 80% of the oil is imported via SCS (EIA, 2012). As oil is considered to be an important strategic commodity, every state in this region has strong motivations to secure the safety of this sea route. The state that has more influence or even has part or full control over this region would be in an advantageous position when issues or conflicts occur in this region. Therefore the main oil consumers in this region such as China and Japan as well as the external powers such as US play actively in this region due to the importance of its strategic position. As different national interests from different states overlap in this region, conflicts occur.

4.1.3   Sovereignty concerns

There are six states involved in the SCS disputes, which are China (including Taiwan), the Philippines, Vietnam, Malaysia, Brunei, and Indonesia. Among these states, China, the Philippines, and Vietnam are particularly eager with the legal status of sovereignty in SCS. China and Vietnam both claimed the sovereignty over most part of the SCS, including Paracel Islands and Spratly Islands. The Philippines claimed most part of Spratly Islands, and renamed the South China Sea as "West Philippine Sea" (Dizon, 2013).

There are conflicts concerning the sovereignty among the states in SCS. Speaking of the territorial ascription, the ideologies and the ways of thinking in Asian states are quite different from the west. From westerners' perspective, territorial ascription is mainly decided by the outcome of wars, conventions and existing world order. Asians, on the other hand, tend to use historical ownership as a strong argument when claiming their territorial ascriptions. From Asian's perspective, the ascription of certain territory cannot be solely judged by the current occupation, but should be more focused on the historical occupation of that territory (Zhao, 2012).

That is the reason why China emphasizes "Diaoyu Island belongs to China since ancient times" as an incontrovertible argument in Diaoyu/Senkaku Dispute with Japan. Japan, as an Asian state, also stresses the historical ownership of Kuril Islands/Northern Territories on the dispute with Russia. This controversial region used to be a part of Japan's territory, but was taken over by Former Soviet Union in Yalta Agreement after the World War II, which can be regarded as part of the postwar international order. However, the sovereignty of this region still remains controversial between Japan and Russia partly due to the Asian's sense of sovereignty.

The Asian perspective in concerning the territory ascription makes the dispute more complicated. However, it is a factor which should not be neglected when analyzing the SCS disputes.

4.2   China and South China Sea

China claims almost the entire area of SCS. In March 2010, Chinese officials seriously told the US that China would not accept any external interference in the SCS, which is part of China's national "Core Interest". It was the first time that the SCS issue was included as a core national interest comparable to the concern of Taiwan and Tibet (Wong, 2010). China defines its national interests into three levels: Core Interest, Important Interest, and General Interest. China's core Interest refers to basic survival needs and political independence, which including national security, sovereignty and territorial integrity, and sustainable economic development (Wang, 2012).

China regards the SCS as its Core Interest together with Taiwan and Tibet due to several reasons. Firstly, with the rapid economic development, China has an increasing interest concerning energy security in this region. Secondly, controlling the SCS will enable China to have a chance to break through the First Island Chain so that more strategic depth can be acquired if the Chinese navy can reach out to the Pacific.

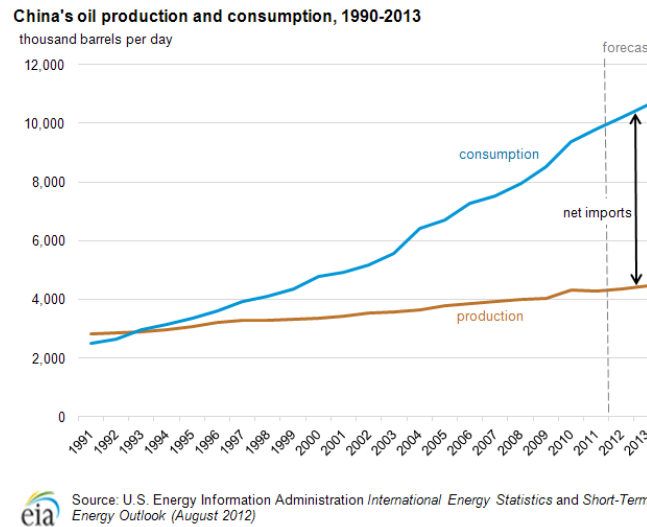### 4.2.1   Energy security interests

Figure 5 China's Oil Production and Consumption 1990-2013 (EIA, 2013)

With the fast economic development, energy security has become an increasingly important issue in China's economic growth. According to Figure 5, China's oil consumption has increased sharply during the last decade, and the domestic production of oil only accounts for a proximately 40 percent of the entire consumption in 2012. Due to the rapid economic growth and limitation of domestic oil production increase, China has become the world's second largest oil importer (see Figure 6). The International Energy Agency (IEA) predicts that the world energy demand will increase by 1.6 percent annually, and the Asian Development states will have the highest growth rate. China's oil demand is expected to grow with an average annual growth rate of 3.4 percent. By 2030, China's crude oil consumption will reach 15.3 million barrels per day, of which 77 percent will be relying on import. China's annual demand for natural gas will reach 169 billion cubic meters, of which 33 percent will be relying on import (IEA, 2012).
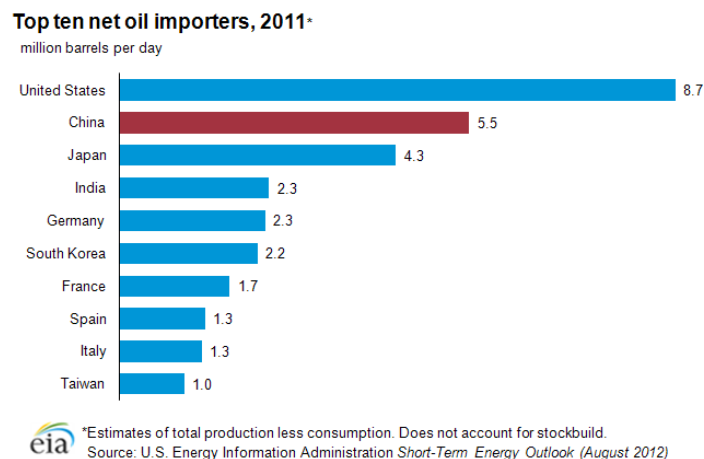

Figure 6 Top Ten Net Oil Importers 2011- (EIA, 2013)

Oil is not only ordinary consuming goods in the global market, but also a strategic commodity which is considered to be of upmost importance to a nation's economy. With the growing dependence of oil import, China concerns more about its energy security, which includes four aspects: diversity of import source, diversity of energy source, safety of transportation, and the increase in domestic production.
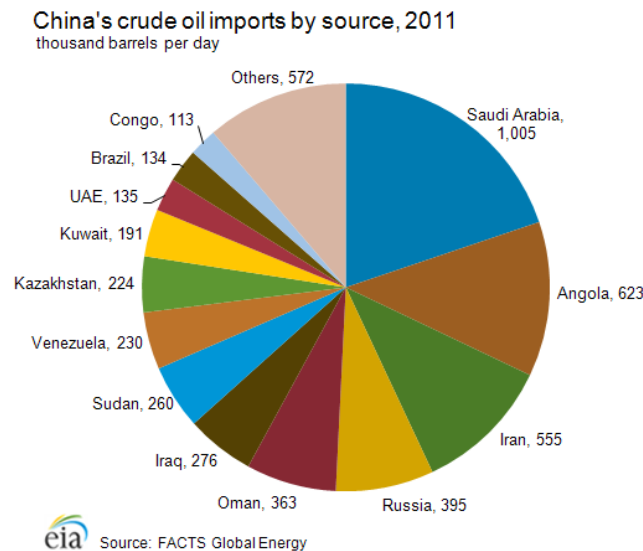

Figure 7 China's Crude Oil Imports by Source, 2011 (EIA, 2013)

From Figure 7 we can clearly see the sources of China's crude oil import, which are mainly suppliers from Middle East and Africa. Middle East states account for approximately 50 percent of the entire imports (2525 tbl/d[1] out of 5076 tbl/d), and African states account for nearly 20 percent (996 tbl/d out of 5076 tbl/d). The rest are mainly from China's neighbors like Russia and Kazakhstan, as well as South American states like Brazil and Venezuela, which only account for 30 percent of the entire imports.

Although China is trying to reduce the over-dependence of the supply from Middle East and Africa and diversify the sources of oil imports, it is not an easy job. For example, China is strengthening energy cooperation with Central Asian states (Kazakhstan, Kyrgyzstan, and Tajikistan) and have signed several paper works with the three states on constructing gas pipes in 2011 (Xinhua News, 2011). China's considerations are mainly based on the geographic convenience. These three oil suppliers have a long common border with China, which makes the energy transportation economical and safe. However, China's strategic setting in this region mainly faces two challenges:

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[1] Thousand barrels per day

1. The competition from other powers (e.g. Russia and EU). These former Commonwealth Independent States (CIS) used to be Russia's backyard, which makes it difficult for China to exert more influences in this region. EU states, on the other hand, are actively competing in buying oil and gas in order to lower the over dependence on Russian's energy supply (Xiao, 2011). Due to these reasons, Kazakhstan recently promises Chinese government an annual supply of 10 million tons, which is only half of the pipe's designed capacity in transportation (ibid, 2011). China is not a strong competitor for oil in Central Asia.

2. The threat of terrorism. Central Asia is bothered by terrorist activities and religious extremist force like "East Turkistan", therefore has the potential risk of not being able to offer a stable energy supply.

For these two reasons, Central Asia is not an area that can offer China sufficient oil with stability. In South America, although China has established energy cooperation with some states, the amount of imported oil from South America only accounts for 7% of the total imports (EIA, 2013). As the main global suppliers for oil and gas are quite limited, China doesn't have many choices to diversify its suppliers. As a result, China still has to heavily rely on the suppliers from Middle East and Africa. Middle East is world's largest oil supplier, while many African states have close partnership with China. Although China can diversify the suppliers from multiple states in Middle East and Africa, the imported oil from these two regions must go through SCS. Therefore, this sea route of oil transportation will be China's "maritime lifeline" for a quite long time.

China's another major concern in energy is the security of oil transportation. According to Figure 8, Strait of Malacca and SCS is one of China's most important oil transportation routes, as this is the shortest and the most feasible sea-lane connecting Africa, Middle East with East Asia. Over 70 percent of the total oil import goes through SAS into China. It would be devastating to China's economy if the oil route via SCS is cut down. Therefore one of China's top-level interests in this region is to assure the security of oil transportation.

Figure 8 China's Critical Sea Line of Communication (Sulekha, 2010)

Diversifying the usage of different resources and increasing the domestic supply of resources can be the other two approaches to achieve energy security. According to Figure 9, 70 percent of China's energy consumption is coal, which is currently used with low energy efficiency. As the reserve for fossil resource is limited and non-renewable, increasing the production of fossil resource might not be a favorable option. Therefore, improving the efficiency of energy usage and developing new types of energy as a compliment to the traditional fossil energy are of great importance. China is now making efforts on the research and development of new energy and renewable energy such as solar and wind power. However, the use of new energy and renewable energy is still at its early stage. It may take quite a long time before the new techniques become mature and the dependence on traditional fossil energy gets low. China's domestic supply of resources is becoming insufficient for its large energy demand, due to the shortage of fossil resources. There is large reserve of natural resources in SCS. If China can take control in SCS and make use of these resources, it will help China reduce the dependency on energy import to some extent.
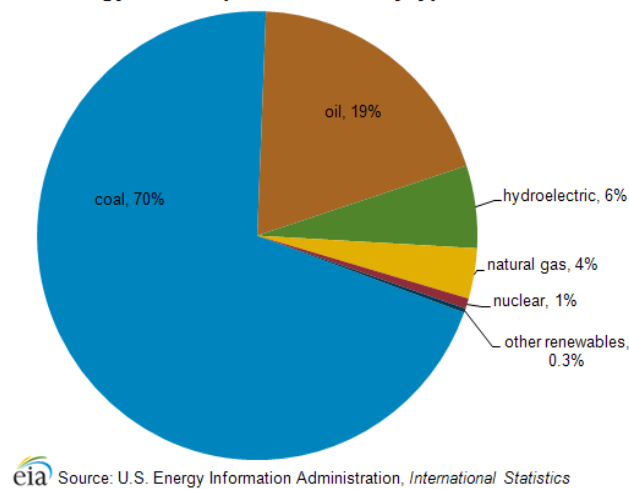
Total energy consumption in China by type, 2009

coal, 70%

oil, 19%

hydroelectric, 6%

natural gas, 4%

nuclear, 1%

other renewables, 0.3%

eia Source: U.S. Energy Information Administration, *International Statistics*

Figure 9 Total Energy Consumption in China by Type 2009 (EIA, 2013)

4.2.2   Strategic Importance: Breaking the First Island Chain

Throughout history, the nations with power are also the nations which can dominate the sea. Holland, Spain, and later Britain all established their hegemony by dominating the sea in history. Even nowadays, maritime power still plays a significant role in a nation's strategic settings. Most of the powerful states have strong control over the sea. For example, the U.S. lies peacefully between the East Pacific and the West Atlantic Ocean; Russia controls part of the Arctic Ocean; India has many harbors diving deep into the Indian Ocean.

With approximately 14,500 km coastline, China has the geographical potential to develop its maritime force in East China Sea and South China Sea. China's strategic turn towards the sea has emerged as one of the most anticipated geopolitical events of the early 21st century (Yoshihara, 2012). However, there exists a limitation if we take a close look at the map of Asia-Pacific. In Figure 10 we can clearly see a chain of archipelagos crossing through East China Sea and South China Sea (the left red line). This island chain contains several islands in South Japan, Taiwan Island, the Philippine Islands, and several small islands in South China Sea. It forms as a "sea wall" disconnecting China to the Pacific. Chinese commentators trace the origins of the island chain concept back to the U.S. strategic thought during the early years of the Cold War. To them, the archipelagic framework was the most concrete expression of American hostility toward the newly founded People's Republic (Ibid, 2012).

Figure 10 First and Second Island Chain (US Department of Defense, 2006)

Due to the US and its allies' military existence in the First Island Chain, China does not have enough strategic depth2 in maritime. With its significant growth in comprehensive national power, China has the willing to break through the First Island Chain and get more strategic depth for its naval power. However, the surrounding states in the East China Sea are Japan, South Korea, and Taiwan, all of which are US' alliance and have relatively strong power, thus making China difficult to break through this island chain. The South China Sea, on the other hand, is a region of ASEAN states with relatively weak power. It is easier for China's naval power to break through the first island chain via this region and finally reach out to the Pacific, for strategic purposes. That is the strategic importance of the SCS in China's strategic concerns.

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2 Strategic depth refers to the distance or space between the front line of a battle and the state's heart area (such as the industrial and production area, capital city, etc.). Generally speaking, strategic depth can be considered as a buffer zone. A state with larger strategic depth wins more time to react when getting involved into conflicts.

4.3   US and South China Sea

The US, as an external power, has great influence on some of the ASEAN states (e.g. the Philippines) involved in the SCS disputes. With the withdraw of its military forces from large-scale counter-terrorist wars, the US gradually shifts its strategic attention back to the Asia-Pacific and adopts a rebalancing policy towards this region. The SCS, as the most important sea route connecting the Pacific Ocean and the Indian Ocean, has a significant position in the US' global strategic settings. Besides, rebalancing the power in this region can be regarded as another reason why the US maintains its focus on the SCS disputes.

4.3.1   US' Rebalancing Policy towards Asia-Pacific

As a global hegemonic state, the US has its global interests, among which the interests in Middle East and Asia-Pacific are of significant importance. The policy of "Rebalancing" in Asia-Pacific was launched by US defense Secretary Leon Panetta in 2012, which demonstrated the US' increasingly focus over this region in the post-counterterrorism era. Although "Defense Secretary Leon Panetta sought to reassure China that the new U.S. strategy to pivot military resources and focus to Asia is not designed to contain China (Griffin, 2012)", "there were still many debates among U.S. officials and intellectuals over how to pacify China's doubts and accusations" (Qian, 2012).

The reasons why the US pivots its focus to Asia are as follows. Firstly, the era of counter terrorist wars has been considered as terminated with the US' troop withdrawal in Iraq and the dead of Bin Laden. Thus, the US now is able to gradually shift its strategic focus to other important regions such as Middle East and Central Asia. Secondly, the rapid development of China has broken the balance of power in Asia, which is not in accordance to the US' interest. The US does not want to see an ever-increasing power from the East and finally becomes a dominating power in this region. The US' interest is to balance the power in the Asia-Pacific so that no one will challenge its leadership in this region. Besides, according to Realism, the raise of nation will cause expansion of its interest. As China has demonstrated an increasing interest in SCS, it causes anxiety among its neighboring states and encourages countermeasures against China. But those ASEAN states cannot confront China alone due to the inferior position of strength. China has broken the "balance" of power in East Asia. Therefore the US needs to "Rebalance"

the power in this region. Specifically, the US will keep the power balance among the involvers in the SCS dispute, according to the US' interest.

4.3.2   US' interest and basic concerns in SCS

Based upon the US government's words and the mainstream scholars' papers, "the interests asserted by the United States in the South China Sea can be distilled to four interests: (1) Respect for international law, (2) Freedom of navigation, (3) Security and stability in the region, and (4) Unimpeded commerce and economic development (Odom, 2011)". However, in this thesis the authors argue that the US' main interest in the SCS is to maintain its hegemonic position.

As a global hegemonic state, the US needs to concentrate on its interest in protecting its hegemonic position. The SCS has its strategic importance in supporting the US' hegemonic interest as SCS is the most important sea route connecting the Pacific Ocean and the Indian Ocean. China has shown strong interest in SCS and the US does not want to lose control over this region. Thus the US is transferring its strategic focus back to the Asia-Pacific.

The US has many oversea military bases, such as Guam in the West Pacific Ocean and Diego Garcia in the Indian Ocean. Guam is the most important military base in the Pacific Ocean with its unique strategic position on the Second Island Chain, and is regarded as the US' "unsinkable aircraft carrier" in Pacific Ocean (Kirk, 2010). Diego Garcia, on the other hand, as the only base in the Indian Ocean, has a unique position among all its oversea bases. The Deputy Defense Secretary of the US, Ash Carter, pointed out the importance of the Indian Ocean on its strategic settings when giving a speech at Harvard. Northeast Asia has always been the center of gravity for American forces, but recently, more forces will be deployed in Southeast Asia and the Indian Ocean area. This is a recognition of the importance of Southeast Asia and South Asia to the region as a whole (Garamone, 2013). The military transportation between these two important military bases must go through the South China Sea. Once the US loses control over this region, its freedom of navigation cannot be secured. As the unblocked connection and transfer between the important oversea military bases is one of the upmost considerations in the US' global strategic settings, the SCS captured the US's attention with the rising power from China in this region.

Besides the strategic interest of the sea route in SCS, the US has another intension to

balance the power in this region, which also serves as a support to its hegemonic position. After the financial crisis in 2008, the emerging markets represented by China are considered to be the main force in driving the world's economy. With its significant growth on both hard and soft power, China is gradually breaking the power balance in this region, which is not in accordance to the US' hegemonic interest. Using the SCS dispute to weaken China's influence and power, therefore rebalancing the power in this region, is US' another motivation to keep its attention on the SCS.

4.4   Gaming Model Concerning SCS Dispute

In this section, the current situation in SCS is modeled using sequential gaming model and analyze the possible strategies of each player and the corresponding payoffs. Finally, a sub-game Nash Equilibrium is deduced which can be regarded as the best strategy for each player in this game.

4.4.1   The Players

Generally, there are three main players in this game: the two parties in the conflict, and the external parties. Each of the players can be referred to China, the Philippines, and the US. The reasons for choosing these three nations in this model are as follows: Firstly, China is the most powerful state among the involvers in the SCS dispute, and also is the state which has most conflicts in SCS with neighboring states. Therefore China[3] should be chosen as one party in the conflict. Secondly, it is appropriate to choose the Philippines as the other party in the conflict, because it is the most active state in the SCS dispute, and also is the state which has the most intensifying relation with China. Thirdly, for the external parties, there are several players such as the US, Japan, Russia and India. Each player has its own interest and shows different influence in the SCS. For the sake of simplicity, we only consider the US, the most influential external player in this game, as the third player. In a nutshell, the three players chosen in this game are: China, the Philippines and the US.

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[3] Due to the fact that Taiwan plays an independence role concerning the SCS dispute issue, "China" here refers to the Mainland China, which do not include Taiwan.

4.4.2   Sequence of the Game and the Strategies

In a sequential game, players act sequentially and the latter player takes action based on the former player's decision. In this model, the Philippines first take an action. Then it turns to China to make a choice. The US is the last player to make decisions. The Philippines has two strategies: {*USE FORCE, SUSPEND*}. If the Philippines choose *USE FORCE*, it will use its military force to prevent China from entering its claimed territory. Strategy *SUSPEND* means that the Philippines will maintain the current situation in SCS. China's strategies are dependent on the Philippines's choice. If the Philippines choose *USE FORCE*, the strategies for China are: {*CALM DOWN, COUNTERATTACK*}. *CALM DOWN* refers to the case that China will do nothing to respond to the Philippines' aggressive actions in SCS. *COUNTERATTACK* means that China will use military force to recover the occupied territory, which may cause war between China and the Philippines. If the Philippines choose *SUSPEND*, there are also two strategies available for China: {*SUSPEND, USE FORCE*}. *SUSPEND* means that China will choose to maintain the current situation in SCS. *USE FORCE* means that China will use its military force to take control over the controversial area. As an external state, the US' choices are dependent on whether there will be escalating military conflicts between China and the Philippines or not. The US' strategies can be: {*MILITARY INVOLVED, NOT INVOLVED*}. *MILITARY INVOLVED* means that the US will get involved as the Philippines' ally if there is a war between China and the Philippines. *NOT INVOLVED* refers to the case that the US will not get involved in the potential Sino-Philippine War. If there will not be a war (under the conditions that China chooses *SUSPEND* or *CALM DOWN*), the US does not need to react. Game ends.

4.4.3   Game Modeling

Game starts with the Philippines' choice. The Philippines has two choices (strategies): {*USE FORCE*, *SUSPEND*}. Let's first assume that Philippine chooses *USE FORCE*. Then the choices for China to react are: {*CALM DOWN*, *COUNTERATTACK*}. If China chooses *CALM DOWN*, the Philippines will practically occupy the contested area. In this scenario, China's power gets weakened and the US does not need to react[4]. Game ends. The payoff to each player in this case is (P1, C1, U1). If China chooses *COUNTERATTACK*, the choices

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[4] One of the US' main objectives to get involved into the SCS dispute, as part of the so called 'Asia-Pacific Rebalance' policy, is to balance the increasing power of China.

for US are: {*MILITARY INVOLVED, NOT INVOLVED*}. If the US chooses *MILITARY INVOLVED*, the payoff to each player is (P2, C2, U2). Game ends. If the US chooses *NOT INVOLVED*, the payoff to each player is (P3, C3, U3). Game ends.

If Philippine chooses *SUSPEND*, China will face two options: {*SUSPEND*, *USE FORCE*}. If China chooses *SUSPEND*, the situation in the SCS will not be changed much (the disputes still exists, however there will be no provoking actions among the involvers to aggravate the current situation). Game ends. The payoff to each player in this case is (P0, C0, U0). If China chooses *USE FORCE* and US has to react with choices {*MILITARY INVOLVED, NOT INVOLVED*} as described in the previous paragraph. And the payoff to each player is (P4, C4, U4) with *MILITARY INVOLVED*, and (P5, C5, U5) with *NOT INVOLVED*. Game ends. Figure 11 shows the extensive form of the presented game model. From the figure, it is obvious that the game is a finite sequential game with perfect information. Therefore, as explained in the Theories Chapter, there exists a sub-game perfect Nash equilibrium of which each player's strategy is the best response to the other players' strategies.
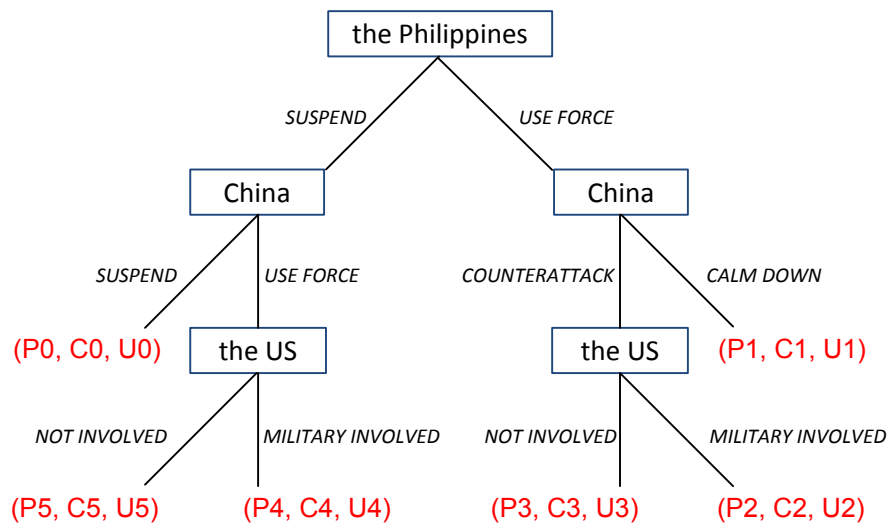

Figure 11 Extensive form of the presented game model

4.4.4 Game Analysis

We can apply the backward induction to find its sub-game perfect Nash equilibrium. Let's start our analysis by first looking at the right branch of the game, which refers to the case that Philippine chooses *USE FORCE*.

Starting from the bottom nodes, the US would choose *MILITARY INVOLVED* if the payoff satisfies U2>U3. Given the US' best response (assume to be *MILITARY INVOLVED*), China can now optimize its own choice between *CALM DOWN* and *COUNTERATTACK*. The choice of *COUNTERATTACK* would generate a payoff of C2 given the US's best response to that choice, while the choice of *CALM DOWN* would generate a payoff of C1. China would choose *COUNTERATTACK* if the payoff satisfies C2>C1. Given China and the US' strategies, the payoff to Philippine with choice *USE FORCE* is determined. Therefore, one NE of this game is *<USE FORCE, COUNTERATTACK, MILITARY INVOLVED>* with payoff (P2, C2, U2), given the conditions that U2>U3 and C2>C1. Using the same approach, we can derive all possible NEs of this game based on different conditions, listed in Table 3.

Table 3 Possible NEs and the corresponding payoff based on different conditions

	Conditions	NE Strategies <the Philippines, China, the US>	Payoff
Case #1	U2 > U3 AND C1 > C2	*<USE FORCE, CALM DOWN, MILITARY INVOLVED>*	(P1, C1, U1)
Case #2	U2 > U3 AND C1 < C2	*<USE FORCE, COUNTERATTACK, MILITARY INVOLVED>*	(P2, C2, U2)
Case #3	U2 < U3 AND C1 > C3	*<USE FORCE, CALM DOWN, NOT INVOLVED>*	(P1, C1, U1)
Case #4	U2 < U3 AND C1 < C3	*<USE FORCE, COUNTERATTACK, NOT INVOLVED>*	(P3, C3, U3)
Case #5	U4 > U5 AND C0 < C4	*<SUSPEND, USE FORCE, MILITARY INVOLVED>*	(P4, C4, U4)
Case #6	U4 > U5 AND C0 > C4	*<SUSPEND, SUSPEND, MILITARY INVOLVED>*	(P0, C0, U0)
Case #7	U4 < U5 AND C0 < C5	*<SUSPEND, USE FORCE, NOT INVOLVED>*	(P5, C5, U5)
Case #8	U4 < U5 AND C0 > C5	*<SUSPEND, SUSPEND, NOT INVOLVED>*	(P0, C0, U0)

4.4.5   Payoff Analysis

From Table 3, it can be seen that the payoff of each strategy is the determining factor in deriving the NE strategies. In this section we analyze and compare the payoffs from different strategies of each player with discussions.

Right branch analysis

We start out analysis from the right branch of the game shown in Figure 11. The US will compare the payoff between U2 and U3 to decide whether it should get involved or not. Table 4 shows the military strength comparisons of the US, China, and the Philippines. According to Table 4, China's total strength on aircraft and navy ship is much stronger than the Philippines'. If the Sino-Philippine War breaks out and the US chooses not to get involved, China will win the war very soon without any doubt. In that case, China will have the following payoffs:

- Domestically: Recover the entire claimed territory, which the government can win more support from its people.
- Strategically: Take control over the SCS transportation route, which has a significant strategic importance.
- Economically: Take control over the natural resources in SCS, which will partly secure the energy demands for China's economic development.
- Militarily: China's navy force will have the chance to break through the First Island Chain, which can result in a significant enhancement of the marine force as it opens a port from SCS to the Pacific.

In a summary, if China takes control over SCS, China will benefit a lot and even becomes a dominating state in Asia-Pacific region. The US' Asia-Pacific Policy is "Rebalancing", which aims at rebalancing the power in Asia-Pacific by making obstacles to China's power development. As a consequence, the US will lose its interests in this region and the trust from its allies if it chooses to do nothing.

If the US gets involved, it will confront with the Chinese Army. According to the overall GFP rank in Table 4, the US Army lies in No. 1, while People's Liberation Army (PLA) lies in No.3. Although the US has some advantage in air and navy forces, the war between the two states would cause unpredictable loss, as the two states are both of top-level military strength.

The two options' benefits are both negative. However, it seems like the US will lose more by choosing not get involved. It would weaken the US hegemony if China takes over the

control in Asia-Pacific, and the US will lose the trust from its allies. The US needs its allies to deploy oversea military bases and to balance the regional power, which will give a strong support on its global hegemony. So even though it will get loss in the war with China, the US is more likely to choose get involved. However, the US will never give a full-scale support to the Philippines, which will be explained in the section of the Philippines' choice.

Therefore, U2>U3, the US will get military involved if the Sino-Philippine War breaks out.

Table 4 Military Strength Comparisons of the US, China, and Philippine (Global Fire Power website, 2013)[5]

	US	China	Philippine
Current GFP Rank[6]	**1 (of 68)**	**3 (of 68)**	**31 (of 68)**
Active Military Personnel	1,477,896	2,285,000	120,000
Total Aircraft Strength	**15,293**	**5,048**	**184**
Serviceable Airports	15,079	497	247
Total Navy Ship Strength	**290**	**972**	**110**
Aircraft Carrier Strength	10	1	0
Submarine Fleet Strength	71	63	0

Then we back to China's choice. It is a perfect and complete information game, so China knows the US will choose *MILITARY INVOLVED* if China choose *USE FORCE*. If China chooses *COUNTERATTACK*, its payoff will be C2. If China chooses *CALM DOWN*, its payoff will be C1. So China's decision is dependent on the comparison between C1 and C2.

If China chooses *CALM DOWN*, the Philippines will practically occupy the contested territory, which is not acceptable from China.

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[5] As the potential war between China and the Philippines, and between China and the US would mainly take place at sea, only the statistics on navy force and air force are listed in the table.

[6] GFP (Global Fire Power) Ranking makes use of over forty factors to determine each nation's Power Index score. It is a general judgment of a nation's military strength.

Firstly and most importantly, it may cause instability of domestic society. The public will be angry about the government's weakness and large scale of demonstrations and protests may breakout. Besides, it may also cause a serial of independence movements in Tibet and Xinjiang. In that case, the Chinese Communist Party (CCP) will have the possibility to lose control over the situation. Therefore, the government will never let it happen.

Secondly, China will lose control over the sea route in SCS, meaning that China can no longer secure its energy lifeline which is critical to China's development. Besides, China cannot farm the abundant resources like oil and gas in SCS if China loses control over this area. SCS has a strategic depth meaning to China. If China loses control over SCS, China will lose the chance to develop its navy force and to break through the First Island Chain. Therefore, the Chinese government has declared that SCS is China's Core Interest, which is one of the upmost national interests. A nation will protect its core interest by all means. As a nation who desires to be a great and responsible power, China will take it seriously if it has declared so.

As the option of choosing *CALM DOWN* is unacceptable to both Chinese government and people if the Philippines chooses *USE FORCE*, China will inevitably choose *COUNTERATTACK* even though China knows that the US will choose *MILITARY INVOLVED* if China takes military actions. From the above analysis, the NE in the right branch is {*USE FORCE, COUNTERATTACK, MILITARY INVOLVED*}.

Left branch analysis

Then we turn to the left branch of the game, which refers to the case that the Philippines chooses *SUSPEND*. Using backward induction, we start from the US' choice by comparing the payoff U4 and U5. The US' choice is highly dependent on the China's choice. If China takes military actions in SCS, the US will respond accordingly. It does not matter too much whether it is China takes military action first or it is the Philippines. The US' strategy is mainly to balance the power among these disputers. Therefore, if China chooses *USE FORCE*, we can assume that the US' strategies and the corresponding payoffs in the left and right branch of the game are the same, i.e., U4 equals to U2, and U5 equals to U3. As explained in the previous paragraph, it is likely that U4 > U5, thus the US would probably choose *MILITARY INVOLVED*.

Then the game rolls back to China's choice. China knows that the US will choose *MILITARY INVOLVED* if China chooses *USE FORCE*, with a payoff of C4. If China chooses *SUSPEND*, the received payoff is C0. China will make its decision by comparing the

payoff between C0 and C4. If China chooses *SUSPEND* under the condition that the Philippines chooses *SUSPEND*, the situation in SCS will remain just like before: Each state claims its territory, and does not take further actions (such as use force) in the overlapping area. Then the US does not need to "rebalance". From China's perspective, keeping the current situation temporarily unchanged would avoid the potential military conflict with the US, of which the result is unpredictable as the two states are both with great military strength. The economy development can continue, and the society will remain stable. Although the dispute still exists, China does not "lose" in this competition. It wins time for a relevant peaceful period for development. On the other hand, if China chooses *USE FORCE*, it might not be a wise choice. Firstly, China will experience severe loss by going into the war. Moreover, the possibility for China to recover the claimed islands in the contested area is limited. The US does not want to see the situation that China breaks the power balance in Asia, so the US will get involved and support its ally to counteract the rising power from China. Secondly, China still needs time to develop its economy and solve the domestic problems before it can be regarded as another "super power". That is presented in China's another core interest as to sustain its economic development. This development requires a relevant peaceful surrounding environment. Initiating the war first is not in accordance with China's interest. However, if the Philippines firstly uses force in the overlapping area, China's counterattack to "protect" its sovereignty is essential. Otherwise, China does not need to start a war and interrupt its rapid development. Therefore, CO > C4, *SUSPEND* is a preferable strategy for China.

So the NE in the left branch is {*SUSPEND, SUSPEND, MILITARY INVOLVED*}.

From the above analysis, the relations among different payoffs can be summarized as: U2 > U3, C1 < C2, and C0 > C2. Based on these conditions, Table 3 can be reduced to Table 5.

Table 5 Possible NEs and the corresponding payoff based on the condition that U2 > U3, C1 < C2, and C0 > C2

	Conditions	NE Strategies <the Philippines, China, the US>	Payoff
Case #2	U2 > U3 AND C1 < C2	*<USE FORCE, COUNTERATTACK, MILITARY INVOLVED>*	(P2, C2, U2)
Case #6	U2 > U3 AND C0 > C2	*<SUSPEND, SUSPEND, MILITARY INVOLVED>*	(P0, C0, U0)

Philippine's choice

Finally, Philippine has to make a choice between *USE FORCE* and *SUSPEND* based on the expected payoff from Table 5. If P2 < P0, the sub-game perfect Nash equilibrium of this game is *<SUSPEND, SUSPEND, MILITARY INVOLVED>*. Otherwise, the sub-game perfect Nash equilibrium of this game is *<USE FORCE, COUNTERATTACK, MILITARY INVOLVED>*.

As mentioned previously, if the Philippines chooses *USE FORCE*, China's best response is *COUNTERATTACK* which means that there will be a war between them. If the Philippines chooses *SUSPEND*, China's strategic preference will be *SUSPEND*, then the SCS will remain the current political situation. Therefore, the Philippines' choice can be expressed as whether it wants a war, or not. This question can be answered in the following two aspects.

1.   Will the US provide a full-scale support?

Generally, a nation will not initiate a war unless it has the confidence to win. Apparently, the Philippines itself does not have the confidence to win this potential war with China. However, as analyzed previously, the US will get involved due to several reasons. If the US provides a full-scale support, the Philippines will have the possibility to defeat China and occupy the claimed islands. In that case, the Philippines will preferably choose *USE FORCE*. On the other hand, if the US tends to avoid direct military conflict with China and just provides some logistic support, the Philippines will have the low chance to defeat China. In that case, the Philippines will choose *SUSPEND*. So the key factor which determines the Philippines' choice is: how much support will the Philippines get from the US in case there is a war?

Firstly, according to Realism, a nation's policy is determined by the goal of pursuing its national interest. Core interest will get the upmost protection, while general interest will get less. Therefore, the question of "how much support will the US offer" can be answered by other questions, i.e., how much interest does the US have in this region? Or, how much importance does the Philippines mean to the US?

The US' global hegemonic position determines its global interests. It has interest in every part of the world, such as Middle East, Central Asia, Europe, Pacific and Atlantic, and East Asia. International terrorism, chaos in the Middle East, poverty and despair in the developing world, and global economic competition have created an international minefield for U.S. leaders (Dowdy, 2012). It is obvious that although SCS has its significant strategic importance, it is only a part of the US' entire global interest. For

example, although the US is gradually adjusting its force back to the Asia-Pacific, Middle East is still one of the most important regions for the US' interest. The US spends a huge amount of money by deploying much of its force in the Middle East to serve its interest. Generally speaking, the importance of the national interest determines how much force will be used to protect it. Although Asia-Pacific is important to the US, the US would not raise its whole power to support the Philippines against China in the potential Sino-Philippine War because it has so much interest in other regions to be concerned.

Secondly, there will be unpredictable consequences if the US provides a full-scale support to the Philippines against China. According to Table 4, the US' GFP rank is No.1 while China ranks No.3. It is a war between the states with the most powerful military strength. No matter who wins, it will bring huge loss to both states. It is foreseeable that after the war the US will not have the capability and power (economically, militarily, and politically) to maintain its global hegemonic position. As a consequence, the US has to strategically retrieve from the rest of the world, thus gradually loses its global hegemony. Meanwhile, new hegemony might rise up during the US' depression. That is not in accordance with the US' interest. Therefore, the US will not sacrifice its global hegemony to protect a regional interest by using its whole power.

Due to these two reasons, the US will not provide a full-scale support to the Philippines if the war breaks out. Thus the Philippines will have little chance to defeat China.

2. Can the Philippines afford the cost of war?

Even though the US will provide full-scale support to the Philippines, the Philippines still is unlikely to escalate the conflict with China into a war. War will cause heavy damage to a state, but how severe the damage will be depends on the power of the state and the location of the war. Apart from that, the recovering capability after the war also differs from state to state. Generally speaking, state with a stronger comprehensive national power (such as military power and economic power) will experience less damage during the war and recover faster after the war compared to the state with weaker comprehensive national power. This is because stronger state has stronger military power, more solid political and economic foundations, larger territory and population, and more stable society than the weaker state. A war may weaken the stronger state, but may destroy the weaker state. The US and China are more determined into war if their core interest is challenged because both the two states have a strong comprehensive national power, which can provide support during the war. However,

weaker state may have the risk of being destroyed if it does not have a strong comprehensive national power.

Another important factor is the increasing interdependence in economy between China and the Philippines. Due to geographic reasons, the two states have a close economic relation both bilaterally and under the ASEAN 10+3 framework. Theoretically, if the economic connection between the two states gets worse due to the intensifying territory dispute, both states will suffer from economic loss because of economic interdependence. However, the Liberalists argue that the interdependence has two characteristics, i.e. sensitivity and vulnerability. The degree of sensitivity and vulnerability in the interdependence is different from state to state, which is shown to be asymmetric in many cases. China accounts for 14.9% of the Philippines' total exports, with shipments amounting to $642.07 million, according to March 2012 data from the National Statistics Office (NSO). That makes China the Philippines' 3rd largest trading partner and its 1st largest if exports from Hong Kong are included. Besides, China takes up 55.6% of the Philippines' greatest export, electronics (Visconti, 2012). The Philippines, on the other hand, is China's 6th largest trading partner in the ASEAN (Zirulnick, 2012). It is obvious that the Philippines' economy is more dependent on China, but not the other way around. It means the Philippines will experience larger economic loss compared to China if the Sino-Philippine relationship gets worse and China takes some economic counter policies. China may experience less loss due to the fact that the Philippines is not China's major energy and raw material supplier nor the capital market. For example, in April 2012 the Sino-Philippines relation got intensified due to the Scarborough Shoal issue. Then China refused to import Philippines' bananas. Many of the bananas have already been destroyed, costing Filipino exporters $760,000 so far (Visconti, 2012). If the Philippines really angers China, there must be more severe economic counters which will makes the Philippines' government to rethink. Therefore, the Philippines may not afford the cost of war even with full-scale support from the US.

When analyzing the Philippines' choice, besides the above mention two bullet points, it is also worth mentioning that the US, the Philippines' most influential ally in SCS dispute, can exert great influence on the Philippines' decision. The main objective of the US' Asia-Pacific Rebalance politic is to keep the current situation in East China Sea and SCS unchanged. In other words, the US aims to keep the disputes in this region with reasonable and controllable conflicts so that the power from different states in this region can be mutually balanced via the disputes. Since the US has many allies in this region, the war or military conflicts between the states in this religion will get the US

involved, which is not in accordance to its interest. Therefore, the US will restrain the Philippines from taking extreme actions that may cause military conflicts.

In summary, the Philippines will choose *SUSPEND* due to the previously mentioned reasons. Then, China's best response is *SUSPEND* to remain the current situation unchanged from the previous analysis. Game ends.

Therefore, the sub-game perfect Nash equilibrium of this game is <*SUSPEND, SUSPEND, MILITARY INVOLVED*> with payoff (P0, C0, U0), which means that in this game, it is better for each party in this conflict to be calm, so that the current situation in South China Sea remain unchanged. The sub-game perfect Nash equilibrium of this game is illustrated in Figure 12.
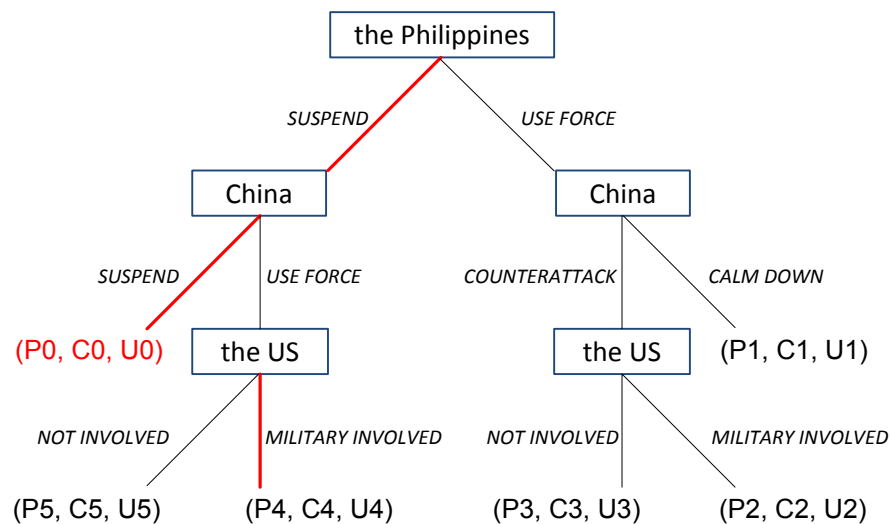

Figure 12 Sub-game perfect Nash equilibrium of this game

5 Conclusion

The SCS not only has great potential reserve in resources such as oil and natural gas, but also is of strategic importance according to its geographic location (e.g. the most important sea route for oil transportation from Middle East to East Asia). These two unique characteristics have made the SCS a hotspot with disputes and conflicts among the states neighboring the SCS, such as the Philippines and China, as well as the external powers such as the US.

The SCS dispute is not a newly emerged issue. Over the years, disagreements among the neighboring states have never stopped, but the frictions are kept at a relatively low level for the last decade until 2012. With its rapid development over the last decade, China has demonstrated an increasing interest in maritime in recent years, such as resources, sea-route security, and its strategic concern for the naval power to break through the island chain. China is expected to be more assertive in the claimed islands and waters in SCS in the coming years. As China is the most powerful state in this region, it is likely that China will be in an advantage position when dealing with maritime disputes with Southeast Asian states and gradually take control over SCS. The US, on the other hand, is not willing to see China's increase maritime control in SCS, which may challenge its control and interest in the Asia-Pacific. The US' interest is to maintain its leadership in the Asia-Pacific, and balance the power in this region. The US does not want to see any state becoming the dominating power over the neighboring states. Therefore, the US adopts a "Rebalancing" policy in the Asia-Pacific in recent years, counteracting the rising power from China. The US plays an important role in SCS dispute as some of the Asian states involved in the dispute are US' alliance. The US' attitude has a great influence for the ASEAN states to challenge China or vice versa.

In this thesis, Game Theory is applied to analyze the current dispute in SCS. Three most representative states are selected as players: the Philippines (the state in the dispute, but with weak power), China (the most powerful state in the dispute), and the US (the most influential external power with the objective to balance the power in this region). The game is modeled as a sequential gaming with perfect information. In a sequential game, players act sequentially and the latter player takes action based on the decision of the former player. For the sake of simplicity, this thesis listed a limited number of

possible strategies for each player and compared the corresponding payoffs of different strategies. Based on the strategy and payoff analysis, the backward induction technique is used to deduce the sub-game perfect Nash equilibrium of this game, which is <SUSPEND, SUSPEND, MILITARY INVOLVED> with payoff (P0, C0, U0) for the Philippines, China, and the US, respectively. It means that the best strategy for the two parties involved in the dispute (i.e. the Philippines and China) is to remain calm, and the external power (i.e. the US) does not need to react. Basically it refers to the case that both the Philippines and China are not willing to take the risk of escalating the dispute and prefer to uphold the overall stability in this region, so that the current situation in SCS generally remains unchanged.

The main novelty of this thesis is trying to analyze the current SCS dispute using the Game Theory. Game Theory is based on mathematical modeling of real games or decision related scientific problems. The analysis of the game is highly dependent on the strategies and the corresponding payoffs, which require to be quantized with high precision such as the numbers or facts. This kind of modeling is ok for engineering or economic problems because it is relatively easier to extract the possible options and measure the corresponding gains/loss from each option. However in politics, human purposes are involved, which is quite hard to be quantized into numbers. As can be noticed, when analyzing the payoffs of different strategies, this thesis is not trying to quantify the payoff into specific numbers, but rather concentrate on the comparisons of the payoff from different strategies. Besides, there are so many varieties or dynamics of human behavior that it is not possible have everything modeled without anything left. In this thesis, although I tried to model the SCS dispute in a most logical way, there still exist quite many drawbacks of the proposed model. For example, the US has a great influence on the Philippines' choice, which is not reflected in the model; As for China's strategies, besides SUSPEND and USE FORCE, China would also like to use the strategy of joint development in the SCS, as the interdependence among the states in this region has increased dramatically. As for the US' strategies, it is not only the options of choosing either MILITARY INVOLVED or NOT INVOLVED. The US has much more flexibility in making its strategies. Therefore, it is difficult to completely model the SCS dispute by using Game Theory. However, if we can simplify the model and make reasonable assumptions, the results we got from mathematical analysis can still be used as a reference for decision makings. In general, Game Theory itself is not sufficient to

make decisions due to its limitations in politics, but it can be used as a tool for us to better understand the problem.

The SCS dispute is a rather complex issue and has been existing for quite long time, and I believe that the dispute over claimed islands and waters between China and other ASEAN states will continue existing. China, as a rising power in the East, has demonstrated its assertiveness over territory integrity and an increasing maritime interest. The rising power from China will inevitably raise anxiety among the neighboring states as well as the external powers such as the US. Although Chinese assertive actions seem to grow in recent years, China is not willing to take the risk of escalating the dispute into server military conflicts. The reasons are of several folds. Firstly, China needs a stable peripheral environment for its economic development. China's foremost priority is still concentrated on economic growth and political stability. Secondly, the US is rebalancing the power in SCS with explicit military support to its alliance as well as establishing security cooperation with other regional powers near SCS such as India. Therefore, China is more willing to take the strategy of "wait", which means that China needs more time to further strengthen its economic and military strength before solving the dispute in SCS.

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