China and Japan’s Dispute over the Senkaku/Diaoyu Islands: A Study from a Game Theory Perspective

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Abstract

This paper applies the game theory method to analyze the dispute between China and Japan over the Senkaku/Diaoyu Islands. Most existing studies focused on using qualitative analysis to approach this issue, so this paper attempts to make a contribution to the literature through formal modeling. Two game models are established in this paper. The static simultaneous model includes China and Japan as the two direct players in the game and defines the actions as non-military initiatives. This model also takes into account the influence of United States and concludes that the dynamic changes of the US-China relations will have an impact on the Japan’s risk perception of taking actions. The second model is a sequential game based on the US-China-Japan security triangle. Different from the static simultaneous model, the U.S. is a direct player in this sequential game and it will decide whether to provide military assistance to Japan in a warfare. The equilibrium outcomes indicate that the U.S.’s military assistance to Japan will affect China’s calculation of taking military actions to solve the dispute. The two models demonstrate the complexity of the US-China-Japan triangle over the Islands dispute and the subtle influence of the U.S. on the geopolitics in East Asia.
Background of the Senkaku/Diaoyu Islands Dispute

The Senkaku/Diaoyu Islands dispute refers to the territorial dispute between China and Japan over several uninhabited islands in the East China Sea. These uninhabited islands are located approximately 120 nautical miles northeast of Taiwan, 200 nautical miles east of China mainland and 200 nautical miles southwest of the Japanese island of Okinawa (Pan, 2016). The total area of the Islands is about 6 square kilometers (Pan, 2016). Although the Senkaku/Diaoyu Islands are uninhabited, it contains rich oil, natural gas, and fishing resources. In 1969, the Economic Commission for Asia and the Far East of the United Nations Economic and Social Council reported that the continental shelf of the East China “might contain one of the most prolific oil and gas reservoir of the world, possibility comparing favorably with the Persian Gulf.” (ECAFE, 1969) According to the Law of the Sea at that time, the jurisdiction of continental shelf is determined by the theory of natural prolongation, which means that the owner of the Senkaku/Diaoyu Islands will have access to a large area of the continental shelf embedded with rich resources (Lee, 1987). Furthermore, under the United Nations International Convention on the Law of the Sea, the Exclusive Economic Zone (EEZ) of a nation stretches 200 nautical miles from that nation’s continental shelf or to the median line between the nations. (United Nations Convention on the Law of the Sea, 1982). Therefore, if either China or Japan possesses the Islands, it will be equivalent to expanding its “territory” for fishing and exploitation of natural resources by 200 nautical miles. The abundance of natural resources and massive strategic value are essential factors for the two countries’ strong stances on the ownership of the Islands.

From China’s point of view, its sovereignty over the Senkaku/Diaoyu Islands rests on solid historical evidence. China claims that the Senkaku/Diaoyu Islands were first discovered
by the ancient Chinese dating back to the Ming dynasty (Swaine, 2013). Chinese officials and scholars have demonstrated that the earliest written record about Senkaku/Diaoyu Islands is in a marine book titled ‘Voyage with the Tail Win’ which was finished in the early 15th century (Zhong Hua Shu Ju, 2000). In addition, the official documents and maps finished in Qing dynasty have clear and specific descriptions of the Islands, placing Senkaku/Diaoyu Islands under the jurisdiction of Taiwan which belongs to the territory of Qing (Ren, 2016). The Islands had been under Chinese sovereignty until 1895, when China (Qing dynasty) and Japan signed the Treaty of Shimonoseki which ceded Taiwan to Japan (Osti, 2013). The Treaty states that “the island of Formosa (Taiwan), together with all islands appertaining or belonging to the said island of Formosa should be ceded to Japan” (The Japan-China Treaty 1895). Since Japan is the defeated country in the World War II, the Potsdam Declaration prescribes that it should relinquish the possession of the Formosa Islands together with all the other islands appertaining or belonging to it (Potsdam Declaration, 1945). As China and Taiwan have similar claims that the Senkaku/Diaoyu Islands were included in the islands appertaining to Formosa in both the Japan-China Treaty and the Potsdam Declaration, China should have the sovereignty of the Senkaku/Diaoyu Islands because China claims the sovereignty over Taiwan (Osti, 2013).

However, from Japan’s perspective, there is no sovereignty issue of the Senkaku/Diaoyu Islands because the Islands belonged to no party prior to Japan’s possession in 19th century (Moore, 2014). The Japanese Meji government annexed the Islands as part of Okinawa in 1895 (Osti, 2013). Therefore, the Islands are not appertaining or belonging to Formosa in the Treaty of Shimonoseki (Moore, 2014). In addition, Japan argues that China’s sovereignty claim of the Islands is weak due to the fact that China has never obtained the
actual control of the Islands since 1895 (Ramos-Mrosovsky, 2007). On the contrary, Japan has been effectively controlling the Islands since 1972 when the United States turned over its administrative rights of the Islands to Japan according to the Okinawa Reversion Treaty (Wiegand, 2009).

Although Japan has maintained effective control of the Islands through the forces of the Japanese Maritime Safety Agency (MSA), China has consistently demanded the return of the Islands, arguing that they traditionally belonged to China and should be returned along with the other territories that were lost in the Second World War (Moore, 2014). There have been several incidents took place between the two countries in terms of using direct or even violent ways to claim the sovereignty of the Islands (Koo, 2009). The major incidents include the first flare-up in 1968-71, the fishing expedition and the 1978 flare-up, the first lighthouse incident in 1990, the second lighthouse incident in 1996, and the 2004-05 flare-up along with rising resource competition (Koo, 2009). The situation became extremely tense in September 2012 when the Japanese government nationalized three of the disputed islands from the Kurihara family who had been the Japanese “private owner” of the Islands. Ironically, the purpose of the Japanese central government to purchase the Islands is to block the nationalists represented by activist Tokyo governor Shintaro Ishihara from acquiring the islets (Perlez, 2012). It joined the bidding and announced a successful purchase of the islets for nearly $30 million on September 12, 2012 (Perlez, 2012). This resulted in a huge reaction in China with protests in more than 50 cities (Johnson & Shanker, 2012). In many cities, people burned Japanese cars and damaged Japanese stores; they organized anti-Japan demonstrations, during which they argued for the return of the Islands (Voice of America, 2012). At the beginning of February 2013, the situation was regarded as the most serious for Sino-Japanese relations in
the post-war period in terms of the risk of a militarized conflict (BBC, 2013). The escalation of violent protests forced the Chinese government to intervene by calling for “rational patriotism” and expressing strong revulsion to the violence, which eventually quieted down the violent demonstrations (Johnson & Shanker, 2012). On the Japanese side, the citizens appeared to show an unusually calm attitude (Ren, 2016). However, some rightest politicians represented by Abe Shinzo demonstrated an antagonistic stance towards China’s massive protests and a strong determination to justify the nationalization of the Islands (Ren, 2016). Abe Shinzo was finally elected as the Premier Minister of Japan on December 26, 2012, marking a commencement of his administration’s tough policy against China (Fackler, 2012).

The United States officially takes a neutral stance on the dispute and advocates seeking peaceful solutions, but it also emphasizes that the Islands fall under the scope of Article V in the Security Treaty between the United States and Japan signed in 1951 (Fravel, 2010). The Security Treaty stipulates the U.S.’s obligation to defend Japan if there is an armed attack in the territories under the administration of Japan (Ren, 2016). It is noteworthy to pay attention to the expression of “administration” instead of “sovereignty”, which indicates U.S.’s neutral position in terms of the belonging of the Islands and acknowledgement of Japan’s actual control over the Islands (Ren, 2016). Furthermore, after the death of Bin Laden and the “Arabic Spring”, the orientation of the U.S.’s global strategy has gradually moved from Middle East to East Asian, which was the so-called “Pivot to Asia” strategy put forward by Hillary Clinton who was then State Secretary during Obama Administration (Clinton, 2011). According to Clinton, the “Pivot to Asia” strategy consists of six components: strengthening bilateral security alliances; deepening America’s relationships with rising powers including China; engaging with regional military institutions; expanding
trade and investment; forging a broad-based military presence; and advancing democracy and human rights (Clinton, 2011). The strategy implies the U.S.’s determination to strengthen its alliance with Japan and contain China’s rising power in the Asia-Pacific region. This shift of foreign policy orientation has influenced Japan’s risk perception of its proactive action towards the Islands, which was demonstrated by the Japanese government’s purchase of the Islands in September 2012. Under the current U.S. administration, though President Trump has consistently emphasized his position of “America First” and implemented the “isolationism-oriented” foreign policy, the U.S. government has never relaxed its attention on China’s rising influence worldwide. In his speech introducing the administration’s National Security Strategy on December 18, 2017, Trump openly stated that China and Russia are main strategic competitors of the U.S. (The White House, 2017). Though viewing China as an advisory has been prevalent in U.S. policy discussions and academia in past decades, this was the first time an incumbent U.S. president declare China as a main strategic competitor in an official occasion. Moreover, the continuous escalation of the trade war between the two countries and the Trump Administration’s policy transition towards China in 2018 have raised the concerns of a New Cold War. Along with the development of China’s national power and the country’s proactive engagement with the rest of the world, the geopolitical competition between China and the U.S. could bring new dynamic to the triangular relations over the Senkaku/Diaoyu Islands dispute.

In contrast to the intensive territorial dispute, China and Japan have close economic ties; trade and other forms of economic cooperation play important roles for each country’s economic and social development. Since 2008, China has replaced the U.S. to become the largest exporting market for Japan (Moore, 2008). In addition, Japan’s cumulative investment
in China reached $84 billion in June 2012 (Xinhua, 2012). Moreover, due to the aging population and long-lasting low economic growth, the Japanese government debt surged to 193% of GDP in 2010, indicating its large dependence on Chinese economy in order to maintain solvency (Trading Economics, 2010). The Islands dispute has caused a negative impact on the bilateral economic relationship. During the protests in China, several Japanese companies operated in China were shut down temporally in reaction, which incurred huge losses in output (Hook & McLannahan, 2012). For instance, Nissan Motor Corporation lost $250 million during the week of suspension (Kubota, 2012). The continuous degradation of the bilateral relationship prompted the decision makers of the two countries to seek strategic solutions to get rid of this negative cycle.

A few scholars conducted studies on the Islands dispute (e.g., Chung, 2007; Fravel, 2010; Gries, Steiger & Wang, 2016; Koo, 2009; Moore, 2014; Pan, 2007; Valencia, 2007; Wiegand, 2009); the next section provides an analytical summary for two articles (Togo, 2014; Zhang & Guo, 2015), which constitute the conceptual and methodological foundation for this paper. Togo (2014) analyzes the Islands dispute under the paradigm of three general theories of international relations: realism, liberalism, and constructivism. Zhang and Guo (2015) construct a static game theory model to simulate the interactions between China and Japan.

**Literature review**

1. Analyzing the dispute based on the general theories of international relations

   (1) The article’s highlights

   Togo (2014) employs the framework of three international relations theories (realism, liberalism, and constructivism) to analyze the Senkaku/Diaoyu Islands dispute. From the realist’s perspective, China’s strong reaction after the Japanese government’s nationalization
of the Islands demonstrates its determination to claim its sovereignty which is the most essential interest for a nation state. Since September 2012, China has used various ways to strengthen its claim. As Japan has had effective control of the Islands since 1972 and asserted that there is no dispute in terms of the sovereignty of the Islands, China’s strategies and actions have successfully converted the sovereignty issue back to the “controversial” status, which is considered as an incremental gain of its interest (Togo, 2014). On Japan’s side, as China has announced to “accumulate concrete evidence” of implementing actual control of the Islands, it meant that China could advance its territorial claim through increasing physical presence on the Islands, instead of solely pursuing peaceful negotiations with Japan.

According to the logic between threat and deterrence of the realist approach, Abe Shinzo’s administration has taken measures to strengthen Japan’s control over the Islands and changed the interpretation of Article 9 of the constitution in order to allow Japanese Self-Defense Forces to exert the right of collective self-defense (Togo, 2014). In addition, the Japanese government has also enhanced its allied relationship with the U.S., aiming to use the influence of the U.S. in the region to deter China’s potential military actions (Togo, 2014).

From the realist point of view, the U.S. has potential to maximize its self-interest over the Islands by striking a strategic balance between deterrence and detachment (Togo, 2014). On one hand, the U.S. does not allow unlimited power expansion of China in East Asia and obtain the ownership of the Islands. On the other hand, it does not want to be entangled into a long-term conflict with China on this dispute (Togo, 2014). In other words, the strategic calculation of the U.S. on the Islands dispute is to take advantage of the allied relationship with Japan to contain China’s expansion and use detachment to remind Japan that the U.S. does not want to see it to change the status-quo either (Togo, 2014). In my simultaneous game
model which will be introduced in the next section, I will take the changing dynamics of the US-China relations into account and investigate how it will affect the Nash Equilibrium of the game.

From the liberalism’s perspective, Togo (2014) argues that China and Japan should seek solutions for their dispute based on the principle of the international law. But he also acknowledges that the positions of the two countries are far apart and difficult to be reconciled based on the common ground of international law developed after the World War II (Togo, 2014). Japan’s claim of sovereignty is based on its assertion that the Japanese government took administrative control of the Islands three months before the Treaty of Shimonoseki. In addition, the San Francisco Peace Treaty and the Reversion of Okinawa gave Japan administrative rights over the Islands after the second World War (Togo, 2014). On China’s side, its position on international law rests on the 1943 Cairo Declaration which stipulates that “all the territories Japan has stolen from the Chinese, such as Manchuria, Formosa, and the Pescadores, shall be restored to the Republic of China.” (Cairo Declaration, 1943). In addition, as mentioned earlier, the Potsdam Declaration further prescribed Japan’s obligation to return those territories to China (Potsdam Declaration, 1945). Therefore, Japan’s occupation of the Islands violates the above two Declarations which are regarded as the foundational agreements in the Post World War II era. As the references the two countries use are not on the common ground, it is extremely difficult for them to solve the dispute based on the principle of rule of law (Togo, 2014).

Different from realism and liberalism, constructivism takes national identity or nationalism into account. As China’s economic power is rising rapidly in the late 1970s, more and more Chinese people want the government to demonstrate more strength on the Islands
dispute (Togo, 2014). Furthermore, since the atrocities of Japanese army during the anti-Japanese war have deep-rooted impact on Chinese nationalism, it is not difficult to understand the Chinese people’s huge reaction towards the Japanese government’s acquisition of the Islands (Togo, 2014). Togo (2014) argues that the rising nationalism has become one of the most important determinants of the Chinese government’s policies towards Japan.

(2) Merits
The most significant merit of Togo’s article is that it provides a thorough analysis of the Islands dispute from three different perspectives focusing on power, law and emotion respectively. The detailed discussion of the structural differences between China and Japan in terms of the foundation of their sovereign claims indicate the complicated nature of the dispute. In addition, the analysis of the triangular game among China, Japan and the U.S. partially reveals the factors contributing to the long-lasting stability and absence of militarized conflicts of the dispute. Another highlight of the article is that it points out that the lack of mutual trust between China and Japan has led to a prisoners’ dilemma over the dispute. Since both governments are influenced by the rising domestic nationalism, it is extremely hard for them to make compromise on this issue. Moreover, this prisoners’ dilemma is Pareto suboptimal for its detrimental impact on the economic growth and implementation of structural reform in both countries.

(3) Limitations
Most of the analysis and discussions in this article are based on narratives, which lacks formal modelling of the interplay among the players involved in this dispute. Since one of the underpinning assumptions of the realism is the rationality of a nation state, using formal models would be helpful to demonstrate the rational calculations of each country when
making decisions. Another limitation of this article is that it solely focuses on international laws when discussing the liberalism aspect of the dispute, while neglecting other dimensions of liberalism. Since an essential difference between liberalism and realism is that the former advocates cooperation (seeking absolute gain) while the latter stresses competition (maximizing relative gain), there is potential room for the two countries to seek peaceful solutions. For example, scholars have discussed the possibility for joint exploitation of the area’s natural resources as an alternative solution for the dispute (Dutton, 2007; Valencia, 2007).

2. Analyzing the dispute based on a static game theory model

(1) The article’s highlights

As one of the initial attempts to investigate the strategic interaction between China and Japan over the Islands dispute using the game theory approach, Zhang and Guo (2015) establishes a static game model to find the outcome of the game under different scenarios. The model assumes each country has two options: taking actions or not. The actions refer to the effective initiatives that can bring the country with tangible or intangible benefits. The authors classified the benefits into two categories: one is the natural resources associated with the Islands ($u_1$), the other is the territorial equity such as maritime domain, continental shelf, EEZ and so forth ($u_2$). They define the utility achieved from taking actions as $U$ which equals to the summation of $u_1$ and $u_2$; they assumed the utility is identical for both countries. On the cost side, Zhang and Guo (2015) consider two scenarios: One country takes actions while the other does not; both countries take actions. The cost of the former scenario is higher than the latter. Based on the above assumptions, the authors draw the game matrix as below:
Matrix 1: China and Japan’s Strategic Moves over the Senkaku/Diaoyu Islands

<table>
<thead>
<tr>
<th>Japan</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actions</td>
</tr>
<tr>
<td>Actions</td>
<td>(U_{R2} - L_{R2}, U_{C2} - L_{C2})</td>
</tr>
<tr>
<td>No Action</td>
<td>(0, U_{C1} - L_{C1})</td>
</tr>
</tbody>
</table>

In this game, U_{C1} and U_{R1} refer to the benefits China and Japan will receive after controlling the Islands. If China takes actions while Japan does not, China’s costs will be L_{C1} while Japan will receive 0 benefits in this situation, and vice versa. U_{C2} is the benefits China will receive if both countries take actions and L_{C2} is China’s corresponding costs. The benefits and costs for Japan is defined symmetrically (denoted by U_{R2} and L_{R2}). The main consideration behind this game matrix is the authors’ assumption that each country’s benefits and costs will depend on whether the “opponent” takes action or not. Since the payoffs are denoted by variables, Zhang and Guo (2015) look into the historical context to examine the choice made by China and Japan in the past. For example, regarding the contrast between China’s quietness and Japan’s proactive action on the Islands prior to 1970s, the authors argue that it was due to China’s stage of economic development and the Chinese government’s prioritization of maintaining a stable relationship with neighboring countries. As a result, the Nash Equilibrium outcome during that period is Japan takes actions while China does not. However, along with China’s rising national power and Japan’s increasing dependence on China’s vast consumer market, China has gradually shifted towards a more proactive policy orientation on the Islands, leading to a new Nash Equilibrium outcome of (Actions, Actions), which implies the risk of militarized conflicts between the two countries.

(2) Merits
Compared to the majority of literatures focusing on narratives, one of the most significant merits of Zhang & Guo (2015) is their use of formal models to investigate the China and Japan’s strategic interactions over the Islands dispute. Their analysis sets up a modelling framework to understand the two countries’ available strategies and constraints on this issue. In addition, the authors consider the variation of each country’s benefits and costs based on different scenarios; the choices made by China and Japan receive empirical support from the historical evidence. From this perspective, it increases the model’s explanatory power with respect to how the changes of the two countries’ relative strengths and the historical context will affect their decisions.

(3) Limitations

One limitation of this article is that the authors does not provide a clear definition for the actions that each country can take. Given the increasing intensity of the dispute, they consider the possibility of a militarized conflict when discussing the Nash Equilibrium outcome. However, if both countries take non-military actions (e.g., oil exploitation), the danger for a militarized conflict will be mitigated. Therefore, we may consider distinguishing non-military actions with military actions, which would be helpful to draw more accurate conclusions. In addition, since Japan currently has the actual control of the Islands, the Japanese government does not have a strong incentive to take military actions in order to obtain resources or other strategic interests of the Islands. Consequently, converting this simultaneous game to a sequential game in which China is the first mover to launch military actions would be more consistent with the contemporary situation of the Islands dispute. The third limitation of this article is that it does not take into account the impact of external forces (e.g., the U.S.) on the strategic choices of China and Japan. As a predominant player on security issues in East Asia,
the US-China relations and the U.S. alliance with Japan can have subtle impact on the equilibrium outcome.

In the next section, I will construct a static simultaneous model and a sequential model based on non-military actions and military actions, respectively. Both models will incorporate the influence of the U.S. on the decision making of China and Japan. From my perspective, combining the baseline model in Zhang & Guo (2015) with new specifications would strike a balance between parsimony and comprehensiveness.

**A simultaneous game among China, Japan, and the U.S.**

Since Zhang and Guo (2015) has established an analytical framework of applying formal modeling to examine the strategic interactions between China and Japan on the Islands dispute, I will use it as the baseline for my simultaneous game model and incorporate the U.S.’s influence in the framework. Before establishing the model matrix, I make the following assumptions:

1. There are three players in the game: China, Japan, and the U.S.. China and Japan make the moves directly; while the U.S. plays an indirect role in influencing Japan’s risk perception of taking actions.

2. Both China and Japan can choose to take actions or not. The actions here refer to non-military actions, such as lighthouse construction, scientific exploration, oil exploitation and so forth. I will construct a sequential game model based on military actions in the next section.

3. If China takes actions while Japan does not, China will receive the benefits denoted as \( U_{c1} \) and pay for the costs of \( L_{c1} \). Since Japan does not take actions in this scenario, its payoff will be \(-U_{j1}\), which is defined as the opportunity costs of not taking actions. In the opposite
scenario when Japan takes actions while China does not, as Japan’s choice of taking actions will be influenced by the U.S.’s policy orientation in East Asia. I use \( \rho \) as a proxy for the Japanese government’s level of risk perception when taking actions. When the U.S. focuses on contain China’s rise (e.g., pivot to Asia), it will strengthen the alliance with Japan, so \( \rho \) will become smaller. On the contrary, when the U.S. is seeking cooperation with China on certain issues (e.g., North Korea nuclear threat), it will strategically place more restrictions on Japan’s space of advancing its interests on the Islands, so \( \rho \) will become larger in this situation. Therefore, Japan’s payoff of taking actions (when China does not) is denoted as \( U_{j1} - \rho L_{j1} \) and China’s payoff will be \( -U_{c1} \).

4. If both countries take actions, China will receive the benefits of \( U_{c2} \) and incur the costs of \( L_{c2} \). Since China’s actions will be counteracted by Japan, \( U_{c2} \) will be smaller than \( U_{c1} \), while \( L_{c2} \) will be larger than \( L_{c1} \). Similarly, Japan’s initial benefits and costs under this scenario will be \( U_{j2} \) and \( L_{j2} \) respectively, with \( U_{j2} < U_{j1} \) and \( L_{j2} > L_{j1} \). After taking the U.S.’s influence into consideration, Japan’s payoff when both countries take actions will be \( U_{j2} - \rho L_{j2} \).

5. If neither country takes actions, the payoff for each will be 0.

Based on the above five assumptions, I draw the game matrix as below:

Matrix 2: A Simultaneous Game between China and Japan based on Non-military Actions

<table>
<thead>
<tr>
<th>Japan</th>
<th>China</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actions</td>
<td>No Action</td>
<td></td>
</tr>
<tr>
<td>Actions</td>
<td>( (U_{j2} - \rho L_{j2}, U_{c2} - L_{c2}) )</td>
<td>( (U_{j1} - \rho L_{j1}, -U_{c1}) )</td>
<td></td>
</tr>
<tr>
<td>No Action</td>
<td>( (-U_{j1}, U_{c1} - L_{c1}) )</td>
<td>( (0, 0) )</td>
<td></td>
</tr>
</tbody>
</table>
Since the payoffs are denoted as variables instead of real numbers, the Nash Equilibrium outcome of this game depends on different conditions. Given the assumption that each country has two choices, there are four \((2 \times 2)\) possible Nash equilibrium outcomes. When China takes actions, Japan’s choice will be based on the comparison between \(U_{j2} - \rho L_{j2}\) and \(-U_{j1}\). In other words, when \(U_{j2} - \rho L_{j2} > -U_{j1}\) (or \(\rho < \frac{U_{j1} + U_{j2}}{L_{j2}}\)), Japan will counteract with China’s actions. When China does not take actions, Japan will still take actions as long as \(U_{j1} - \rho L_{j1} > 0\) (or \(\rho < \frac{U_{j1}}{L_{j1}}\)). Therefore, when \(\rho < \min \left(\frac{U_{j1} + U_{j2}}{L_{j2}}, \frac{U_{j1}}{L_{j1}}\right)\), Japan’s equilibrium strategy is taking actions regardless of China’s choice. On the contrary, when \(\rho > \max \left(\frac{U_{j1} + U_{j2}}{L_{j2}}, \frac{U_{j1}}{L_{j1}}\right)\), Japan will not take actions no matter which move China chooses. This is due to the Japanese government’s high level of risk perception when the US-China relations is on the rise. On China’s side, when Japan takes the action and \(U_{c2} - L_{c2} > -U_{c1}\), China will also take actions. If Japan does not take actions but \(U_{c1} - L_{c1} > 0\), taking actions will still be a rational strategy for China. However, when the above two conditions do not hold, China’s choice will be the opposite. Based on the above analysis, I list the four Nash Equilibrium outcomes and their corresponding conditions below:

<table>
<thead>
<tr>
<th>Outcome (Japan, China)</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actions, Actions</td>
<td>(\rho &lt; \min \left(\frac{U_{j1} + U_{j2}}{L_{j2}}, \frac{U_{j1}}{L_{j1}}\right))</td>
</tr>
<tr>
<td></td>
<td>(U_{c2} - L_{c2} &gt; -U_{c1})</td>
</tr>
<tr>
<td></td>
<td>(U_{c1} - L_{c1} &gt; 0)</td>
</tr>
<tr>
<td>No action, Actions</td>
<td>(\rho &gt; \max \left(\frac{U_{j1} + U_{j2}}{L_{j2}}, \frac{U_{j1}}{L_{j1}}\right))</td>
</tr>
<tr>
<td></td>
<td>(U_{c2} - L_{c2} &gt; -U_{c1})</td>
</tr>
<tr>
<td></td>
<td>(U_{c1} - L_{c1} &gt; 0)</td>
</tr>
<tr>
<td>Actions, No action</td>
<td>(\rho &lt; \min \left(\frac{U_{j1} + U_{j2}}{L_{j2}}, \frac{U_{j1}}{L_{j1}}\right))</td>
</tr>
<tr>
<td></td>
<td>(U_{c2} - L_{c2} &lt; -U_{c1})</td>
</tr>
<tr>
<td></td>
<td>(U_{c1} - L_{c1} &lt; 0)</td>
</tr>
<tr>
<td>No action, No action</td>
<td>(\rho &gt; \max \left(\frac{U_{j1} + U_{j2}}{L_{j2}}, \frac{U_{j1}}{L_{j1}}\right))</td>
</tr>
<tr>
<td></td>
<td>(U_{c2} - L_{c2} &lt; -U_{c1})</td>
</tr>
<tr>
<td></td>
<td>(U_{c1} - L_{c1} &lt; 0)</td>
</tr>
</tbody>
</table>
We can draw two major implications from the four Nash Equilibrium outcomes and their conditions. First, Japan’s choice of taking actions or not depends on its risk perception of the costs, which is influenced by the U.S.’s policy orientation in East Asia. When the primary objective of the U.S. is to contain China’s rise or the US-China relations is negatively affected by certain incidents, the risk for Japan to take actions will be reduced, which would encourage the Japanese government to take proactive actions on the Islands. However, when the cooperation between the U.S. and China occupy the mainstream of the bilateral relationship, it will increase the difficulty for Japan to take actions. This security triangle demonstrates the subtle but influential role of the U.S. on this territorial dispute. Second, China’s decision is mainly based on the cost-benefit analysis. When the benefits outweigh costs, the Chinese government will take actions to strengthen its sovereign claim of the Islands. However, we need to notice that the benefits and costs of China’s moves are not static, instead, they are changing continuously along with China’s national power and the geopolitical environment in the region. As discussed in Zhang and Guo (2015), when China was in the initial development stage before 1970s, the costs of taking actions could be larger than the benefits ($U_{c2} - L_{c2} < U_{c1} - L_{c1} < 0$), so keeping a low profile was a rational choice during that period. However, as China’s comprehensive power has reached a new level, the government has paid more attention to strengthen its maritime sovereignty, which would facilitate the modernization process and enhance its influence in global affairs. As a result, the benefits of taking actions has gradually outweighed its costs, increasing incentives for the Chinese government to make a transition from reactive assertiveness to implementing proactive strategies on the Islands dispute. This shift of China’s strategy has been illustrated by the
establishment of the East China Sea Air Defense Identification Zone and the regular cruise navigation surrounding the Islands.

A sequential game among China, Japan, and the U.S.

In this section, I will establish a sequential game model based on the US-China-Japan triangle but focus on military actions. As mentioned above, since Japan currently has actual control of the Islands, China will be the first mover when it comes to the military initiative. In contrast to the prior simultaneous model in which the U.S. inserts its influence in an indirect way, this sequential game will incorporate the U.S. as a direct player. As the game theory assumes rationality of the players, an essential principle of player’s interaction is to “look ahead and reason backward” (Dixit & Nalebuff, 1993). In our context of the Islands dispute, this principle of backward induction means that each country can foresee the outcome in this sequential game and make a decision that is the best response to the other players’ moves.

Before setting up this game, I make the following assumptions:

1. As the first mover, China has two options: taking military action or leaving the situation as the status quo. Japan is the second mover of the game and it has the same two options as China. If both China and Japan choose the military option, the U.S. will decide whether to provide military assistance to Japan.

2. If China takes military action and Japan does not, China will acquire the entire Islands and receive the benefit of $U_{c1}$ and pay for the cost of $L_{c1}$. In this scenario, Japan will lose its current control of the Islands, so its payoff will be $-U_{j1}$ which is the opportunity cost of not taking military action.

3. If a war takes place and the U.S. does not provide military assistance to Japan, the probability of China winning will be $p$, so the probability of Japan winning will be $1-p$. 
4. If China wins the war through military action, it will claim ownership of the Islands and receive the benefit of $U_{c1}$ and pay for the cost of $L_{c1^*}$ ($L_{c1^*}$ is larger than $L_{c1}$ due to Japan’s defense). If China takes military action but loses the war, it will receive 0 benefits and suffer $L_{c1^*}$ in losses. The benefits and costs for Japan winning or losing the war is defined symmetrically: $U_{j1}$ and $L_{j1^*}$ if winning the war, while $L_{j1^*}$ if losing.

5. If the U.S. decides to provide military assistance to Japan, the likelihood of China to win the war will reduce to $\theta$ ($0 < \theta < p$); correspondingly, the probability of Japan’s winning will rise to $1 - \theta$.

6. Since the U.S. views China as a challenger to its traditional position in East Asia, the U.S. will receive the benefit of $U_{u1}$ if Japan wins the war aided by its military support, the cost of U.S.’s support is denoted as $L_{u1}$. On the contrary, if Japan loses the war despite obtaining assistance from the U.S., the payoff of the U.S. will be reduced to -$L_{u1}$ (zero benefits for this outcome). Regarding the rest of the possible outcomes without the U.S.’s intervention, both the benefits and costs of the U.S. will equal to 0. The only exception is when both China and Japan choose to leave the situation as status quo, the payoff of the U.S. in this case will be $U_{u^*}$. As mentioned in the prior text, the U.S.’s strategic objective over the Islands dispute is to maximize its interest through striking a balance between China and Japan. Consequently, leaving the situation as status quo matches its top preference.

7. If China doesn’t take military action but Japan chooses this option, China’s payoff will be -$U_{c1}$ which is the opportunity cost of not taking the military action. On the other side, Japan’s payoff will be $U_{j1} - L_{j1}$; the cost ($L_{j1}$) is due to the consequence of negative reputation and possible revenge from China.
8. China’s payoff will be \(-U_{c1}\) if the status quo is retained; however, Japan will gain \(U_{j1}\) if the situation does not change because of its current controls of the Islands.

Based on the above eight assumptions, I set the ranking of the three countries’ preferences and respective payoff for each outcome, which are listed in Table 2-4.

Table 2: Preference Ordering for China

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Outcome</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Obtain ownership of the Islands through winning the war regardless of the U.S. military assistance</td>
<td>(U_{c1} - L_{c1})</td>
</tr>
<tr>
<td>2</td>
<td>Leaving the situation as status quo</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Lose the war against Japan regardless of the U.S. military assistance</td>
<td>(-L_{c1})</td>
</tr>
</tbody>
</table>

Table 3: Preferences Ordering for Japan

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Outcome</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leaving the situation as status quo</td>
<td>(U_{j})</td>
</tr>
<tr>
<td>2</td>
<td>Obtain ownership of the Islands through winning the war against China regardless of the military assistance from the U.S.</td>
<td>(U_{j1} - L_{j1})</td>
</tr>
<tr>
<td>3</td>
<td>Lose the war against China regardless of the military assistance from the U.S.</td>
<td>(-L_{j})</td>
</tr>
</tbody>
</table>

Table 4: Preferences Ordering for the U.S.

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Outcome</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leaving the situation as status quo</td>
<td>(U_{u})</td>
</tr>
<tr>
<td>2</td>
<td>Provides military assistance to Japan and Japan wins the war</td>
<td>(U_{u1} - L_{u1})</td>
</tr>
<tr>
<td>3</td>
<td>Japan wins or loses the war without the assistance from the U.S.</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Provides military assistance but Japan loses the war</td>
<td>(-L_{u1})</td>
</tr>
</tbody>
</table>

Based on the above assumptions and the payoffs for each country, I draw a sequential game tree (Figure 1) to find the equilibrium outcome under different conditions.

Figure 1 is about here

In this game, China moves first by deciding whether to take military action or keep the status quo. Then Japan will make its decision based on China’s move; it can choose to respond by military means or not. If there is a militarized conflict between the two countries,
the U.S. will make the decision on whether to provide military assistance to Japan. Following the principles of establishing a sequential game, I listed all of the possibilities in the game tree. If the U.S. chooses to provide military assistance to Japan during the war, we can calculate the expected payoff for each country since the probability for China’s winning the war will be $\theta$. As shown in Figure 1, the expected payoff for the three countries will be $(\theta U_{c1} - L_{c1*}, U_{j1} - \theta U_{j1} - L_{j1*}, U_{u1} - \theta U_{u1} - L_{u1})$. On the contrary, if the U.S. chooses to sit aside, the expected payoff will change to $(p U_{c1} - L_{c1*}, U_{j1} - p U_{j1} - L_{j1*}, 0)$. Since the U.S. will not obtain benefits and incur costs in this scenario, its expected payoff is 0. Based on the principle of backward induction, the U.S. will compare its two expected payoffs for each scenario and make the decision. If $U_{u1} - \theta U_{u1} - L_{u1} > 0$ (or $\theta < \frac{U_{u1} - L_{u1}}{U_{u1}}$), the U.S. will provide military assistance to Japan, and vice versa. Therefore, in the node of the U.S., there are two possible outcomes with their corresponding payoffs.

From Japan’s perspective, if China takes military action, its decision will be based on a comparison of the payoff between going for war or not. As Japan’s expected payoff of a militarized conflict depends on the U.S.’s decision, there will be two possible payoffs for Japan in the militarized conflict: $U_{j1} - \theta U_{j1} - L_{j1*}, U_{j1} - p U_{j1} - L_{j1*}$. The Japanese government needs to weigh each of those two expected payoff with $-U_{j1}$, which is the payoff of not choosing the military response. Therefore, if $\theta < \frac{2U_{j} - L_{j1*}}{U_{j1}}$ or $p < \frac{2U_{j} - L_{j1*}}{U_{j1}}$, Japan will choose the military option. On the other branch of this game tree, if China does not take the military action, Japan’s calculation for the decision making will be simpler than the former scenario: comparing $U_{j1} - L_{j1}$ against $U_{j1}$. As mentioned earlier, since Japan currently controls the Islands, keeping the status quo is consistent with the government’s top priority. As a result, Japan will not choose to take military action and maintain its highest payoff ($U_{j1}$) in this case.
Using backward induction, China will make the decision between taking military action to claim its sovereign of the Islands or leaving the situation as status quo. Similar to Japan’s case, its decision for the military action will be affected by the U.S.’s choice. If the U.S. decides to support Japan, the Chinese government needs to weigh its expected payoff of $\theta U_{c1} - L_{c1}$ against the payoff of not taking military actions which is 0 (when Japan does not take the military action). Consequently, if $\theta U_{c1} - L_{c1} > 0$ (or $\theta > \frac{L_{c1}}{U_{c1}}$), China will choose the military option. In the absence of U.S.’s assistance to Japan, China’s choice will be based on the comparison between $pU_{c1} - L_{c1}$ and 0. If $p > \frac{L_{c1}}{U_{c1}}$, China will take the military action to resolve the dispute. The construction of these two inequations implies that taking military actions will be a rational choice for China as long as the benefits ($U_{c1}$) it can receive is larger than the costs ($L_{c1}$). In addition, since the likelihood for China to win the war will be reduced in the presence of U.S.’s participation ($\theta < p$), it indicates that China will be more cautious on its military actions and needs to ensure $U_{c1}$ is substantially larger than $L_{c1}$ before implementing this option. This sequential game demonstrates the complicated interactions among the three countries as well as the U.S.’s subtle influence on the decisions making of China and Japan.

**Concluding remarks**

The Senkaku/Diaoyu Islands dispute is one of the most sensitive territorial disputes in East Asia, which is associated with massive political, economic and geographic importance. The surging nationalism in China and the increasing influence of rightest activists in Japan have aggravated the risk of a militarized conflict between the two large powers. On the other hand, the economic interdependence between China and Japan has served as a “cushion” in mitigating the escalation of the dispute. Given the complicated geopolitical circumstance in
East Asia and the huge costs of militarized conflicts, the dispute has been under the status of long-lasting endurance.

Previous scholars have produced extensive research on the Island dispute based on the theories and approaches of international relations. As discussed earlier, Togo (2014) provides a conceptual framework to study the interaction among different players on this issue. Given the complexity of the dispute, scholars can apply different theories (e.g. realism, liberalism, constructivism) and focus on a certain dimension of the dispute. The two models and their assumptions in this paper are mainly based on realism, which stresses the anarchic nature and the pivotal role of power in world politics. Zhang and Guo (2015) lays an analytical foundation of using formal models to look into the interactions among players on the Islands dispute, which provides a baseline for the static simultaneous model in this paper. Considering the countries’ different calculations when it comes to military actions, I constructed the sequential game tree and incorporate the U.S.’s potential military assistance to Japan in the framework. The results indicate the subtle influence of the U.S. on the long-lasting endurance of Islands dispute.

Given the increasingly complicated geopolitical dynamic in East Asia, there are several directions for future research on the Islands dispute. First, as the power of China is expected to continue its rising trend in the next decade, the Chinese government would take more initiative to strengthen its sovereignty claim and protect the completeness of its territory. In addition, under the leadership of Xi Jinping, the orientation of China’s foreign policy has gradually shifted from “reactive” pattern to actively participate in global affairs and propose China’s solutions. Whether this shift of foreign-policy orientation will trigger a higher intensity of geopolitical competition worth careful thinking and thorough analysis.
Furthermore, the surging influence of rightest party in Japan and the new competitive dynamics of the US-China relations under the Trump administration have placed more uncertainty on the Islands dispute. Therefore, it is important for scholars to continuously advance the theories and analytical methods in analyzing the complicated interplay among the players in this strategic game, which would be helpful to draw insightful and effective policy implications.
References


Appendix:

Figure 1: The Sequential Game among China, Japan and the U.S.

```
Military action (M)                                  No action (N)

[Node: Japan] M                               N                                  M                               N

[Node: The U.S.] Assistance

[Node: Nature] (θ)  (1-θ)

China wins (θ) Japan wins (1-θ) China wins (p) Japan wins (1-p)

U_{c1} - L_{c1}, U_{j1} - L_{j1}, U_{u1} - L_{u1}
```

The diagram shows the sequential game among China, Japan, and the U.S., with utility payoffs and probabilities for actions and outcomes.