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A Game Theory View of the Relationship Between the U.S., China and Taiwan

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June 2007

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        The Taiwan Strait issue has been a major concern for those interested in the foreign policy of the United States. For quite some time, the peaceful solution to the Taiwan Strait issue has been a joint objective of the U.S., China and Taiwan. In 1962, the Cuban Missile Crisis between the Soviet Union and the U.S. almost brought about a destructive nuclear war. However, the U.S. applied a brinkmanship strategy that ended the crisis peacefully. Brinkmanship is one of the more interesting applications of game theory. I will apply game theory and analyze possible results of a brinkmanship strategy in the context of the present Taiwan Strait situation. I will use this idea and other examples to illustrate how game theory might be applied to understand the Taiwan Strait issue.

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**A GAME THEORY VIEW OF THE RELATIONSHIP
BETWEEN THE U.S., CHINA AND TAIWAN**

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Submitted in partial fulfillment of the requirements for the degree of

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A GAME THEORY VIEW OF THE RELATIONSHIP BETWEEN THE U.S., CHINA AND TAIWAN

ABSTRACT

The Taiwan Strait issue has been a major concern for those interested in the foreign policy of the United States. For quite some time, the peaceful solution to the Taiwan Strait issue has been a joint objective of the U.S., China and Taiwan. In 1962, the Cuban Missile Crisis between the Soviet Union and the U.S. almost brought about a destructive nuclear war. However, the U.S. applied a brinkmanship strategy that ended the crisis peacefully. Brinkmanship is one of the more interesting applications of game theory. I will apply game theory and analyze possible results of a brinkmanship strategy in the context of the present Taiwan Strait situation. I will use this idea and other examples to illustrate how game theory might be applied to understand the Taiwan Strait issue.

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LIST OF ACRONYMS AND ABBREVIATIONS

DoD	Department of Defense
DPP	Democratic Progressive Party
ICBM	Intercontinental Ballistic Missile
IISS	International Institute for Strategic Studies
INF	Intermediate-Range Nuclear Forces
IRBM	Intermediate-Range Ballistic Missile
JFK	John F. Kennedy
KMT	Kuomintang
MRBM	Medium-Range Ballistic Missile
NMD	National Missile Defense
PRC	People's Republic of China
ROC	Republic of China
SLBM	Sea-Launched Ballistic Missile
SLCM	Sea-Launched Cruise Missile
SRBM	Short-Range Ballistic Missile
SSBN	Nuclear-Powered Ballistic Missile Submarine
TRA	Taiwan Relations Act
U.S.	United States
USSR	Union of Soviet Socialist Republics

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I.   INTRODUCTION

After the defeat of the KMT (Kuomintang) by the Communist Party of China in the Chinese civil war in 1949, the PRC (People's Republic of China) was founded in Beijing by the Communist government, and the government of the ROC (Republic of China) was forced to retreat to Taipei. From then on, both sides of the Taiwan Strait entered into a protracted dispute. The PRC government claimed Taiwan was a renegade province and insisted Taiwan was an indivisible part of China.

In Taiwan, advocates exist for three separate options: keeping the status quo, declaring Taiwan's independence, and promoting reunification with mainland China. The PRC has never renounced the possible use of force in resolving the Taiwan Strait issue. Meanwhile, the United States recognizes only one China and considers the PRC the sole legitimate government of China.[1] However, based on the Taiwan Relations Act (TRA), the U.S. is committed to "resist any resort to force or other forms of coercion that would jeopardize the security, or the social or economic system, of the people on Taiwan."[2] Furthermore, although the U.S. opposes Taiwan's independence, it preserves the option of intervening in the Taiwan Strait conflict should there be an invasion by the mainland.[3]

Despite longstanding tension in the Taiwan Strait, a peaceful solution has been declared the joint objective of the U.S., China and Taiwan.[4] In this study, I will use game theory to analyze possible results of different strategies among Taiwan, the U.S. and China given the present situation in the Taiwan Strait. One of the more interesting applications of game theory involves brinkmanship. In 1962, the Cuban Missile Crisis between the Soviet Union and the U.S. almost brought about a destructive nuclear war. However, a "brinkmanship" strategy by the U.S. ultimately resulted in the crisis

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[1] Bush: US supports 'one-China' policy, China Daily News, November 16, 2005, available at: http://www.chinadaily.com.cn/english/doc/2005-11/16/content_495224.htm (last accessed March 2007).

[2] SEC. 2 (b)-(6), Taiwan Relations Act, 1979.

[3] Brett V. Benson and Emerson M. S. Niou, Comprehending Strategic Ambiguity: U.S. Security Commitment to Taiwan, available at: http://www.duke.edu/~niou/teaching/strategic%20ambiguity.pdf (last accessed April 2007).

[4] Questions and Answers on the Taiwan status, April 28, 2003, available at: http://www.taiwanadvice.com/ques2ans.htm (last accessed April 2007).

ending peacefully. I will use this idea and other game theory approaches to illustrate the possible contribution of game theory applications to the peaceful resolution of the Taiwan Strait issue.

The main research questions that will be explored are: (1) Under what conditions would mainland China be likely to attempt a military conquest of Taiwan? (2) Under what conditions would the U.S. (and its allies) be likely to intervene in the Taiwan Strait conflict? (3) What is the likely result of a mainland Chinese invasion of Taiwan? What factors would help explain the outcome? (4) What are some avenues to a peaceful resolution of the Taiwan Strait issue?

The remainder of this study is organized as follows: Chapter II reviews the background of the Taiwan Strait issue. Chapter III introduces the game theoretic methodology, which will be applied in this study. Chapter IV analyzes the results of using game theory methods to understand the Taiwan Strait issue. Chapter V concludes this thesis and offers policy recommendations for the future management of the Taiwan Strait issue.

II.   BACKGROUND

A.   THE HISTORY OF THE TAIWAN STRAIT ISSUE

The Taiwan Strait issue has been a major concern for those interested in foreign policy in the U.S., since the end of the Chinese civil war in 1949 when China was divided in two. The PRC controls the mainland, and the ROC rules Taiwan. In 1950, the U.S. Seventh Fleet was sent to the Taiwan Strait to end any immediate possibility of invasion of Taiwan by mainland China. This was the first time the U.S. helped defend Taiwan. Later, in the Taiwan Strait crises of 1954-55 and 1958, the U.S. supplied ammunition to support Taiwan.[5] In 1971, the ROC was replaced by the PRC as the sole representative of China recognized in the United Nations. In 1979, the U.S. established formal diplomatic relationships with the PRC and broke off formal relations with the ROC. In the same year, the U.S. and Taiwan drew up the Taiwan Relations Act (TRA), which is the only formal document stating a U.S. commitment to protect Taiwan from attack by mainland China. All arms procurement agreements between the U.S. and Taiwan are based upon this Act.

In the Taiwan Strait crisis of 1995-96, the PRC conducted a series of missile tests in the waters surrounding Taiwan. The intention was to send a message to the Taiwanese electorate that voting for Lee Teng-hui in the first direct Taiwanese Presidential election risked a war with the PRC. The aircraft carrier USS Nimitz passed through the Taiwan Strait in 1995 as a signal of support for peaceful relations in the Taiwan Strait, and two other carriers followed in 1996.[6] This was the first time U.S. warships had passed through the Taiwan Strait since the U.S. broke formal relations with Taiwan. Whether or not the PRC ended its military exercises as a result of U.S. actions, the U.S. nevertheless sent a very strong signal to the PRC regarding any possible invasion of Taiwan.

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[5] First Taiwan Strait Crisis, Wikipedia, available at: http://en.wikipedia.org/wiki/First_Taiwan_Strait_Crisis (last accessed April 2007) and Second Taiwan Strait Crisis, Wikipedia, available at: http://en.wikipedia.org/wiki/Second_Taiwan_Strait_Crisis (last accessed April 2007).

[6] Third Taiwan Strait Crisis, Wikipedia, available at: http://en.wikipedia.org/wiki/Third_Taiwan_Strait_Crisis (last accessed April 2007).

B.   THE PRC'S STANDPOINT

In recent years, the PRC has not stopped threatening Taiwan with armed force. In February 2000, China published a White Paper[7] which asserted that China will never renounce the use of force in the Taiwan Strait. China threatens to use force against Taiwan under the following four conditions:

1.   If Taiwan declares independence.

2.   If Taiwan is invaded or occupied by a foreign country.

3.   If Taiwan develops nuclear weapons.

4.   If Taiwan refuses peaceful reunification through negotiations (which have been postponed indefinitely).[8]

In March 2005, the "Anti-Separation Law" was passed by the third conference of the 10th National People's Congress of the PRC. This law formalized the PRC's longstanding policy of using military force against Taiwan. According to a recent Pentagon report, China has more than 700 ballistic missiles aimed at Taiwan.[9] Moreover, China has increased its military budget rapidly in recent years in a bid to replace the U.S. as the preeminent power in the Far East.

C.   TAIWAN'S STANDPOINT

In Taiwan, there are two main political coalitions: The Pan-Blue Coalition and the Pan-Green Coalition. The Pan-Blue Coalition is led by the KMT (Kuomintang) and asserts that the ROC is not part of the PRC, and adheres to the "one China" principle. This means the ROC is the only China and this is the basis for political communication with the PRC. In contrast, the Pan-Green Coalition, which mainly consists of the DPP (Democratic Progressive Party), argues that Taiwan and China are two different countries and that the people of Taiwan have the right to decide their own future. The DPP won the 2000 and 2004 Taiwanese Presidential elections, causing some tense relations between China and Taiwan. This may have influenced the passage of the "Anti-Separation Law" in mainland China. Nowadays, the political

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[7] Taiwan Affairs Office and Information Office of the State Council of the People's Republic of China, "The One-China Principle and the Taiwan Issue," February 21, 2000, available at: http://taiwansecurity.org/IS/White-Paper-022100.htm (last accessed April 2007).

[8] Political status of Taiwan, Wikipedia, available at: http://en.wikipedia.org/wiki/Political_status_of_Taiwan (last accessed April 2007).

[9] Political status of Taiwan, Wikipedia, available at: http://en.wikipedia.org/wiki/Political_status_of_Taiwan (last accessed April 2007).

circles in Taiwan still argue over the issue of "independence or reunification." However, according to a public opinion survey of Taiwan's Mainland Affairs Council as seen in Figure 1,[10] nearly forty percent of Taiwanese are in favor of keeping the status quo and postponing the decision; approximately twenty percent of them want to keep the status quo indefinitely; only two percent of Taiwanese prefer to unify with China as soon as possibly, and only six percent would rather choose independence as soon as possibly. Most Taiwanese still feel the PRC's hostility toward Taiwan. As seen in Figure 2,[11] about sixty percent of Taiwanese think the PRC government is hostile to the ROC government, and more than forty percent think it is hostile to Taiwanese people. This could make it very difficult to achieve the immediate reunification, which the PRC insists upon.
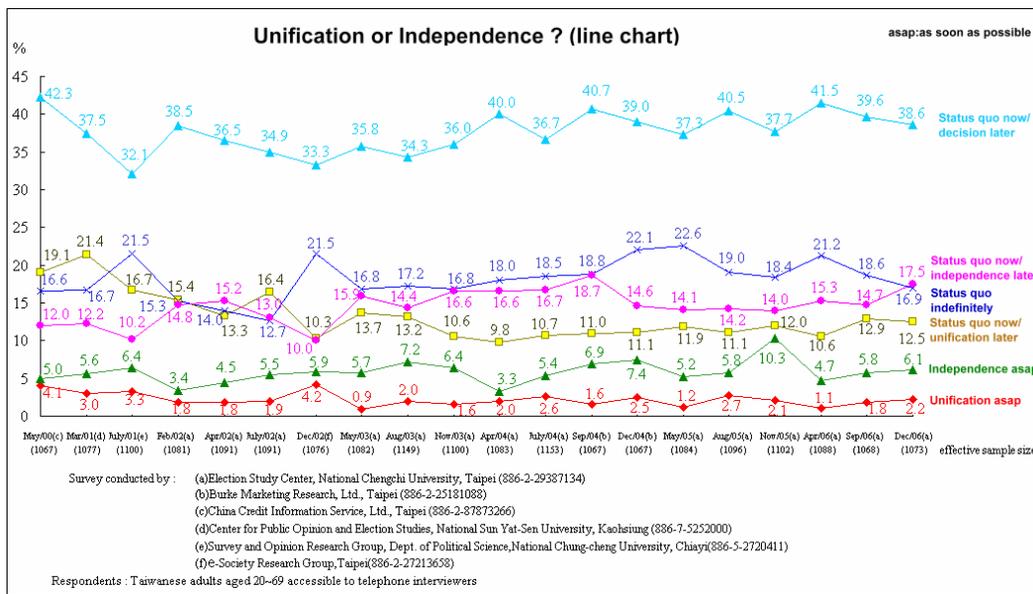
Figure 1.   Public Opinion on Cross-Strait Relations in Taiwan

10 Mainland Affairs Council, Public Opinion on Cross-Strait Relations in the Republic of China, available at: http://www.mac.gov.tw/english/index1-e.htm (last accessed April 2007).

11 Mainland Affairs Council, Public Opinion on Beijing's Hostility toward ROC, available at: http://www.mac.gov.tw/english/index1-e.htm (last accessed April 2007).
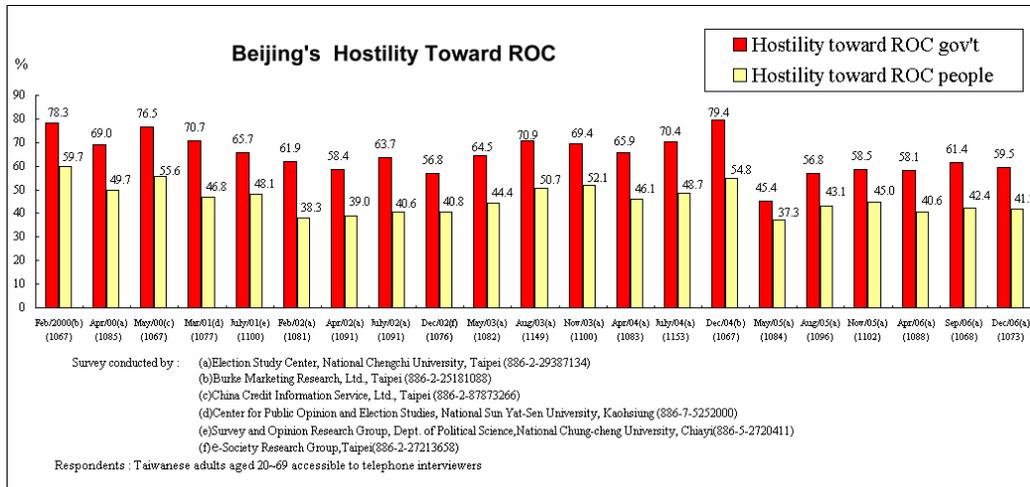
Figure 2.   Public Opinion on Beijing's Hostility toward ROC in Taiwan

D.   THE U.S. STANDPOINT

There are currently two different opinions regarding Taiwan's strategy in the U.S.[12] The first is "strategic transparence," that is, to tell Taiwan and China clearly that if mainland China invades Taiwan without any provocation, the U.S. will come to its defense. However, if military action by the PRC was provoked by Taiwan's actions, then the U.S. would refrain from assisting Taiwan.

The second alternative U.S. strategy is "strategic ambiguity." In other words, the U.S. would maintain an enigmatic attitude that leaves both sides of the Taiwan Strait uncertain about U.S. actions. There is some belief this attitude could deter rash actions by both sides.[13]

However, as China increases its military threat to Taiwan, the U.S. has responded by increasing arms sales to Taiwan. According to the TRA, the U.S. can only offer defensive weapons to Taiwan. This causes tense relationships between the U.S. and China. This vicious circle was repeated in recent years. However, a recent 10 billion dollar arms procurement sale from the U.S. has been repeatedly vetoed by

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[12] Rebecca Jimerson, Lawrence Cooper and Corinne Contant, US Policy Considerations – China, Taiwan, and the Pacific Rim, available at: http://www.gwu.edu/~spi/spacemilch3.htm (last accessed April 2007).

[13] Pan Zhongqi, The Dilemma of Deterrence: US Strategic Ambiguity Policy and its Implications for the Taiwan Strait, p. 11, April 2001, available at: http://www.stimson.org/china/pdf/dilemmadeterrence.pdf (last accessed May 2007).

opposition parties in Taiwan's Legislative Yuan.[14] Some U.S. political critics have begun to doubt whether Taiwan has the ability to defend itself against an attack from China.[15]

E.   JAPAN'S STANDPOINT

Japan is a major power in the Far East and one of the most important allies of the U.S., therefore Japan's attitude is critical to the Taiwan Strait situation. The Taiwan Strait is one of the most important sea-lanes for Japan. Japan, like the U.S., recognizes the PRC as the sole representative of China. However, in 1996 the U.S. and Japan signed a joint declaration called the "U.S.--Japan Joint Declaration on Security--Alliance for the 21st Century." This declaration promised a wider security role for Japan and restructured its relationship with the U.S. in dealing with the new realities of the Western Pacific region. In this statement, the U.S. and Japan announced "they would encourage a peaceful resolution of the Taiwan issue through dialogue," and, "made it their common strategic objective."[16] This is the first time that the U.S. and Japan have raised the Taiwan Strait issue to the level of a joint strategy. Meanwhile, the PRC strongly protested this announcement as interference in its internal affairs.[17]

F.   MILITARY POWER COMPARISON

According to the U.S. Department of Defense (DoD) report "Military Power of the People's Republic of China in 2006,"[18] Taiwan is perceived as China's primary military target. Over one third of the PRC's military power is deployed in the area of the Taiwan Strait. In earlier comparisons of the military power of China and

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[14] Taiwanese News, April 11, 2006, available at: http://www.epochtimes.com/b5/6/4/11/n1283814.htm (last accessed April 2007).

[15] Taiwanese News, December 28, 2006, available at: http://tw.bbs.yahoo.com/cgi-bin/ListFrame.cgi?board=weapon&query=%5B%B7s%BBD%5D%A4%A3%ADx%C1%CA%B4N%B5%A5%A6%BA+Buy+or+Die%3F&rf=search&exact=1 (last accessed April 2007).

[16] Japan - U.S. Joint Declaration on Security-Alliance for the 21st Century, the Ministry of Foreign Affairs of Japan, 1996, available at: http://www.mofa.go.jp/region/n-america/us/security/security.html (last accessed April 2007).

[17] China Daily News, February 22, 2005, available at: http://www.chinadaily.com.cn/english/doc/2005-02/22/content_418250.htm (last accessed April 2007).

[18] U.S. DOD's Military Power of the People's Republic of China, 2006, available at: http://www.fas.org/nuke/guide/china/dod-2006.pdf (last accessed April 2007).

Taiwan, it was believed that Taiwan had superior quality, while China had superior quantity. However, because of recent PRC investments in military modernization, Taiwan's quality advantage has been seriously eroded.

China has raised its military budget very quickly in recent years, partly as a result of its rapid economic growth. The PRC defense budget in 2005-06 grew by 20% while that of Taiwan fell by 3% (see Table 1). According to the IISS (International Institute for Strategic Studies), the mainland's 2007 defense budget is about 35 billion U.S. dollars. However, the U.S. DoD believes this number may be multiplied by 3, to around 100 billion.[19] At its current high rate of growth, the Chinese defense budget would match the U.S. defense budget by 2023.

Table 1[20] presents the static counts for the military power of the PRC, ROC and U.S. in 2006. We can see that there is a dramatic imbalance of weapons between the two sides of the Taiwan Strait. This U.S. report suggests Taiwan is experiencing a relative weakening in its self-defense capability. However, a recent 10 billion dollar U.S. arms procurement offer was vetoed by the opposition parties in Taiwan, which could lead to further imbalance in the future. According to this same annual report, China had 250 to 296 launchers with 793 to 916 missiles of seven types including approximately 105 armed with nuclear warheads (see Table 2[21]).

In the PRC's 2004 Defense White Paper, China declared that its nuclear strike forces have two missions: deterrence of a nuclear attack, and nuclear retaliation. China has consistently stated its adherence to a "no first use" nuclear doctrine.[22] However, China is currently capable of targeting its nuclear forces at most regions of the world, including the continental United States.[23] Although China still has a big

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[19] Defense News, March 6, 2007, available at: http://defensenews.com/story.php?F=2602009&C=asiapac (last accessed April 2007).

[20] The Military Balance 2007, IISS, London: Oxford University Press.

[21] WMD around the World, www.fas.org, http://www.fas.org/nuke/guide/china/nuke/index.html (last accessed June 2007.

[22] Annual Report to Congress--Military Power of the People's Republic of China 2006, available at: http://www.ndu.edu/inss/symposia/pacific2006/Gunnesspaper.pdf (last accessed May 2007).

[23] Annual Report on the Military Power of the People's Republic of China, Missile Forces, available at: http://www.defenselink.mil/news/Jun2000/china06222000.htm (last accessed May 2007).

gap compared with the nuclear arms of the U.S. (see Table 3[24]), its nuclear force is sufficient to cause a destructive nuclear war. That is why China is considered a potential threat to the U.S. by the National Missile Defense (NMD) program.[25]

Category	PRC	ROC	US
National(2006)			
Population	1313M	23M	300M
GDP	$2620B	$351B	$13200B
Defense budget	$35.3B	$7.73B	$535B
Growth rate in defense budget	19.7%	-3.0%	8.1%
Armed forced personnel			
Active	2255K	290K	1507K
Reserve	800K	1657K	974K
Land forces			
Main battle tank	7580	926	7620
Armored personnel carrier	3500	950	16008
Artillery	17700	1815	6530
Naval forces			
Submarines	58	4	68
Principal surface combatant	76	33	106
Patrol and coastal combatant	242	71	16
Aircraft carrier	0	0	12
Mine warfare	65	12	24
Amphibious	233	308	369
Logistics and support	163	18	238
Air forces (in Air force)			
Aircraft	2643	479	2658
Missile	4500	No information	41120
Tanker	10	0	589
Helicopter	80	35	205

Table 1.   Military Power Comparison of PRC, ROC and U.S.

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[24] WMD around the World, www.fas.org, http://www.fas.org/nuke/guide/summary.htm, Data from March 2006 (last accessed June 2007).

[25] National Missile Defense, Background, Federation of American Scientists, available at: http://fas.org/spp/starwars/program/nmd/ (last accessed May 2007).

Inventory	Launcher	Missiles	Estimated Range
DF-5/CSS-4 ICBM	20	20	8,460+ km
DF-4/CSS-3 ICBM	10-14	20-24	5,470+ km
DF-3/CSS-2 IRBM	6-10	14-18	2,790+ km
DF-21/CSS-5 MRBM Mod 1/2	34-38	19-50	1,770+ km
JL-1 SLBM	10-14	10-14	1,770+ km
DF-15/CSS-6 SRBM	70-80	275-315	600 km
DF-11/CSS-7 SRBM	100-120	435-475	300 km
JL-2 SLBM	Developmental		8,000+ km
DF-31 ICBM	Developmental		7,250+ km
DF-31A ICBM	Developmental		11,270+ km
Total	250-296	793-916	

Table 2.   Missile Forces of the PRC, 2006

Category		US	PRC
Weapons	Stockpile	9,962	200
	Deliverable	5,735	145
ICBM	Number	500	20
	Warheads	1,050	20
	Type	MM II : 0 MM III: 500 MX PK: 0	DF-5A: 20
SRBM, IRBM, MRBM	Number		73
	Warheads		73
	Type		DF-3A: 16 DF-4: 22 DF-21: 35
SLBM	Number	336	12
	Warheads	2,016	12
	Type	Trident-I: 0 Trident-II: 2,016	JL-1: 12 JL-2: 0
	SSBN	Ohio: 14	
Strategic Bombers	Number	115	
	Warheads	1,955	
	Type	B-2: 21 B-52: 94	
Theater Weapons	Number		
	Warheads	500	40
	Type	B61-3/4 bombs: 400 Tomahawk SLCM: 100	No information

Note: ICBM: Intercontinental Ballistic Missile; SRBM: Short-Range Ballistic Missile; IRBM: Intermediate-Range Ballistic Missile; MRBM: Medium-Range Ballistic Missile; SLBM: Sea-Launched Ballistic Missile; SSBN: Nuclear-Powered Ballistic Missile Submarine; SLCM: Sea-Launched Cruise Missile

Table 3.   Nuclear Power Comparison of US and PRC

III. METHODOLOGY

A. BACKGROUND

A pioneering paper entitled "A Game Theory View of Military Conflict in the Taiwan Strait" by Raymond E. Franck and Francois Melese applies game theory in the context of the Taiwan Strait. The objective of the two sides of the Taiwan Strait issue should be to find a win-win solution, not to continue playing a zero-sum or negative sum game. Therefore, it is important to investigate strategic moves between the PRC and Taiwan that could point the way towards a peaceful future, balancing military force with communication and commercial interests.

In "The Strategy of Conflict," Dr. Schelling explains: "The deterrence concept requires that there be both conflict and common interest between the parties involved; it is as inapplicable to a situation of pure and complete antagonism of interest as it is to the case of pure and complete common interest."[26] The present relationship between the U.S., China and Taiwan satisfies these conditions. Although the U.S. has recognized the "one China" policy, its policy is still constrained by the Taiwan Relations Act. Moreover, China and Taiwan are among the most important trading partners of the U.S. Even though current political relations between China and Taiwan might be considered hostile, China and Taiwan have cooperated very closely in business activities in recent years (see Table 4[27]). Therefore, we know there are elements of both conflict and common interest among these three parties. On this basis game theory can be a useful tool to help understand the role of threats and promises as they apply to the Taiwan Strait issue.

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[26] Thomas C. Schelling, The Strategy of Conflict, p. 11.

[27] Taiwan Bureau of Foreign Trade: http://cus93.trade.gov.tw/english/FSCE/FSC0011E.ASP (last accessed June 2007.

COUNTRY NAME	TOTAL TRADE(re-imports & re-exports included)		
	RANKING	AMOUNT	SHARE (%)
CHINA	**1**	**76,590,504,462**	**17.949**
JAPAN	2	62,583,675,380	14.667
UNITED STATES	3	55,024,582,918	12.895
HONG KONG	4	39,261,330,306	9.201
KOREA, REPUBLIC OF	5	22,153,550,709	5.192

Table 4.   Statistics of Top 5 of Value of Exports and Imports by Country in Taiwan

B.   GAME THEORY

Formal game theory was invented by John von Neumann and Oskar Morgenstern in 1944. It involves "the study of the ways in which strategic interactions among rational players produce outcomes with respect to the preferences (or utilities) of those players."[28] Game theory has been used extensively in analyzing psychology, philosophy, sociology, politics, economics, and so on. In addition, game theory is used to study international relations, especially the balance of power between antagonistic countries. Professor Schelling has a penetrating observation in his book about using game theory in conflicting international relations: "it is the employment of threats, or of threats and promises, or more generally of the conditioning of one's own behavior on the behavior of others, that the theory is about."[29]

Game theory can be divided into two categories: zero-sum games and non zero-sum games. There is no clear reason to use zero-sum games since this assumes the relations of two players are purely conflicting. In reality there exists a complicated mix of collaboration and confrontation among the U.S., China and Taiwan. Therefore this study will focus on "nonzero-sum games" in the hope of finding a way to maximize benefits for both sides of the Taiwan Strait.

C.   BRINKMANSHIP

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[28] Stanford Encyclopedia of Philosophy, March 10, 2006, available at: http://plato.stanford.edu/entries/game-theory/#Mot (last accessed April 2007).

[29] Thomas C. Schelling, The Strategy of Conflict, p. 15.

"At midday, and again in the early evening of October 16, 1962, John F. Kennedy called together a group of his closest advisers at the White House. Late the night before, the CIA had produced detailed photo intelligence identifying Soviet nuclear missile installations under construction on the island of Cuba, some ninety miles off the Florida coast; now the President and his men confronted the dangerous decision of how the United States should respond.

Secretary of Defense Robert McNamara outlined three possible courses of action for the President: "the political course of action" of openly approaching Castro, Khrushchev, and U.S. allies in a gambit to resolve the crisis diplomatically, an option that McNamara and others considered unlikely to succeed; "a course of action that would involve declaration of open surveillance" coupled with "a blockade against offensive weapons entering Cuba"; and finally "a military action directed against Cuba, starting with an air attack against the missiles. "Much of the conversation that day centered on the military option, and the hazardous unknowns of Soviet retaliation decisions including the possibility of nuclear escalation." I don't believe we have considered the consequences," McNamara told the President. "I don't know quite what kind of a world we live in after we've struck Cuba, and we, we've started it.... How, how do we stop at that point?" Thankfully, the Kennedy administration never had to answer that extraordinary question. Ultimately, President Kennedy chose to initiate a naval blockade against Soviet ships carrying missile equipment. His strategy proved successful; the Soviets withdrew the missiles and nuclear war was averted."[30]

The Art of War by Sun Tzu said: "The ability to subdue the enemy without battle is a reflection of the ultimate supreme strategy."[31] This means exploring ways so that we do not have to waste unnecessary casualties and can reach a mutually agreeable outcome. That is the reason why JFK decided to do whatever he could to avoid an invasion of Cuba. Brinkmanship is one of these methods and can be an inexpensive, if risky, alternative to fighting actual wars. It is the strategy of pushing a dangerous situation to the brink of disaster in order to achieve the most advantageous

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[30] The Cuban Missile Crisis, 1962, The 40th Anniversary, The George Washington University, 2nd Edition, New York: The New Press, 1998, available at: http://www.gwu.edu/~nsarchiv/nsa/cuba_mis_cri/declass.htm (last accessed May 2007).

[31] Sun Tzu on the Art of War, available at: http://www.kimsoft.com/polwar.htm (last accessed April 2007).

outcome. In other words, "The practice, especially in international politics, of seeking advantage by creating the impression that one is willing and able to push a highly dangerous situation to the limit rather than concede."[32] This concept was first introduced during the Cold War to analyze the tense relationship between the U.S. and the Soviet Union. The most notable example of brinkmanship is the Cuban Missile Crisis in 1962 between the Soviet Union and the U.S. which is mentioned above. These two superpowers developed highly sophisticated weapons that threatened the other side.

The strategic calculations of both sides did not exclude deadly first strikes to paralyze the other side. Therefore, to shorten the warning time and achieve their objectives, both sides deployed their nuclear missiles on the closest territory to that of the opposing side. In 1961, the U.S. started deploying fifteen Jupiter IRBM (intermediate-range ballistic missiles) nuclear missiles in Turkey, which directly threatened cities in the western sections of the Soviet Union, including Moscow because of its 1500 mile range and its flight time of about sixteen minutes. Later Soviet missiles were deployed in Cuba to retaliate, the first time Soviet missiles were moved outside the USSR.[33] However, both sides clearly understood that the other had the ability to undertake a deadly first blow and did not want to bring about a destructive nuclear war. Accordingly, they agreed to withdraw their missiles at the same time and the crisis ended in a peacefully. The Cuban Missile Crisis especially emphasized the danger of nuclear war between the two superpowers. They began to consider how to avoid a similar crisis after the Cuban Missile Crisis. For example, they set up a "hot line" communication system between Washington DC and Moscow to let leaders negotiate to prevent another such crisis from resulting in warfare.

There are two essential conditions to achieve a credible nuclear deterrent. The first one is the possession of nuclear weapons; the second is persuading the other side that there are circumstances under which we would use those nuclear weapons. If a country only has nuclear weapons and the other side does not believe they have the resolve to use nuclear weapons, it is not a credible deterrent. Because the U.S. is a

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32 American Heritage Dictionary, 4th Ed. 2000.

33 Cuban Missile Crisis, Wikipedia, available at: http://en.wikipedia.org/wiki/Cuban_Missile_Crisis (last accessed April 2007).

democratic country, autocratic countries might not believe the U.S. would really use nuclear weapons. The former Soviet Union is an example. Before the Cuban Missile Crisis, the former Soviet Union did not think the U.S. was capable of using nuclear weapons, until it started the shooting sequences of nuclear bombs. If the U.S. had not provided that signal, then the Soviets might have thought the U.S. feared nuclear war to such an extent that they could do whatever they liked. Therefore, the application of a brinkmanship strategy involves steps that include raising the possibility of a crisis and leading the crisis to the edge, hoping to convince the rival to give in. The key to brinkmanship is that "threats must be credible." Meanwhile, if the threat is excessive or provides insufficient deterrence, then it may not be credible.[34]

In sum, brinkmanship is an artificial creation of the risk of war. However, "staking everything on a single throw" can give the enemy incentives to make the situation even more dangerous; events can easily get out of control if this policy is not used carefully.

Today China, Taiwan and the U.S. constantly express their opinions on the Taiwan Strait issue through public statements to test the policies and wills of the other side. If one of the parties were to cross a line that triggered a similar response, brinkmanship might apply once again. The U.S. and the PRC who both have nuclear arms might use brinkmanship to avert the conflict. This will be an especially important topic for this study. Table 5 offers a comparison between the "Cuban Missile Crisis" and the "Taiwan Strait Issue." There are some similarities between these two cases. Therefore we can explore the impact of a similar strategy to the one used in the Cuban Missile Crisis in the case of the Taiwan Strait.

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[34] Francois Melese and Diana Angelis, Deterring Terrorists from Using WMD: A Brinkmanship Strategy for the United Nations, December 2004.

Analyses	Cuban Missile Crisis	Taiwan Straits Issue
Geography	Cuba is a small and peripheral country of the U.S.	Taiwan is a small and peripheral country of China.
International relations	The U.S. had more support from other countries while Cuba was more isolated.	China has more support from other countries while Taiwan is more isolated.
Military power	The U.S. has its own national defense industry. Cuba relied on the military aid from the former Soviet Union	China develops its national defense industry speedily. Taiwan partly relies on arms sales from the U.S.
Leaders' thought	Although some U.S. high-ranking military officers advocated attacking Cuba, the government used the brinkmanship strategy to force the former Soviet Union to withdraw the missiles in Cuba.	Some high-ranking military officers advocate attacking Taiwan, and the PRC government drew up the Anti-Separation Law to rationalize the possible attacks on Taiwan in the future.
The relationship among three parties	The former Soviet Union used Cuba to check and curb the U.S.	The U.S. uses Taiwan to check and curb China

Table 5.　　Comparisons between "Cuban Missile Crisis" and "Taiwan Straits Issue"

D.　　STAG HUNT

In game theory, the "stag hunt" is a type of nonzero-sum game in which two players can cooperate with or betray the other player. If both hunters decide to wait for stags, they could cooperate to catch the stags. However, if a hare passes by, they could give up waiting for stags and chase the hare. Without help from the other one, a hunter could get nothing. Therefore, they may both change their mind to chase after hares. That is, each hunter must choose an action without knowing the choice of the other. In this game, as in all game theory, the only concern of each individual player is maximizing his own payoff, without any concern for the other player's payoff.[35] However, when both players have strong mutual trust, they can create the maximum total benefit.

As in Figure 3, when both hunters have patience to wait for stags, and trust the other player will do the same, they will enjoy the maximum payoffs and we assume this payoff is 4. However, in this waiting process, if one of them is distracted by a

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[35] Stag Hunt, Wikipedia, available at: http://en.wikipedia.org/wiki/Stag_hunt (last accessed April 2007).

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passing hare, he maybe chooses to chase after this hare for a payoff of 3. In this case, the other hunter only gets a payoff of 0, that is, he will end up with nothing. Moreover, if both hunters are distracted by a passing hare and give up waiting for stags, they will both get the payoffs 3. In this situation, although the payoff is lower if both hunters get hares, there is also less risk that they get nothing. Formally, a stag hunt is a game with two pure Nash equilibrium.[36] Although the payoff superior Nash equilibrium is (Stag, Stag), it will be very attractive for both hunters to adopt the risk superior Nash equilibrium and give up the stag to chase after hares. In the next section, we adopt the Stag Hunt game to explain the tension in the Taiwan Strait.

China

	Stag	Hare
Stag	4, 4	0, 3
Hare	3, 0	3, 3

Figure 3.   Payoff Matrix of Stag Hunt Game

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36 Stag Hunt, Wikipedia, available at: http://en.wikipedia.org/wiki/Stag_hunt (last accessed April 2007).

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IV. ANALYSIS

A. PAYOFFS OF THE GAME IN THE TAIWAN STRAIT

1. Payoff Relations in the Taiwan Strait

Although it seems that the Taiwan Strait is peaceful now, we cannot exclude the possibility of a PRC attack. Today China takes the "peace and fight two hand strategies" to Taiwan. That is, it negotiates and issues threats at the same time. However, extreme Chinese leaders eager for reunification might propose a military offensive, that is, to invade Taiwan without any provocation or threatening speech by Taiwan. While Taiwan will not attack the mainland, a declaration of independence would be a major provocation for China.

Figure 4 shows the payoffs to both sides of the Taiwan Strait when they take the different strategies- To attack (declare independence) or to preserve the peace. The column side represents the Chinese choices and the row side represents the Taiwanese choices.

If Taiwan declares its independence and China attacks, the payoffs for Taiwan and China is a_{11} and b_{11} respectively. If Taiwan declares its independence but China still holds the peaceful strategy, Taiwan gets payoff a_{12} and China gets b_{12}. If China attacks while Taiwan keeps peace, the payoff for Taiwan is a_{21} and China gets b_{21}. If China and Taiwan both choose peace, they receive payoffs a_{22} and b_{22} respectively.

From the Taiwanese perspective, if China attacks, Taiwan would rather declare its independence seeking international sympathy and support, than to do nothing. Therefore a_{11} will be greater than a_{21}. However, if China holds to the peaceful strategy, Taiwan would rather keep peace than declare independence. Therefore a_{22} will be greater than a_{12}. In conclusion, $a_{11} > a_{21}$; $a_{22} > a_{12}$.

On the other hand, from a Chinese perspective, if Taiwan announces independence first, China prefers to attack in retaliation. Therefore b_{11} will be greater than b_{12}. However, if Taiwan holds to the peaceful strategy, China would rather keep peace too. Therefore, b_{22} will be greater than b_{21}. In conclusion, $b_{11} > b_{12}$; $b_{22} > b_{21}$.

Since there are two Nash equilibrium in the matrix of cross-Strait relations (Independence, Attack) and (Peace, Peace), this is an example of a stag hunt game.

China

	Attack	Peace
Independence	b_{11} a_{11}	b_{12} a_{12}
Peace	b_{21} a_{21}	b_{22} a_{22}

Taiwan

Note: $a_{11} > a_{21}$; $a_{22} > a_{12}$

$b_{11} > b_{12}$; $b_{22} > b_{21}$

Figure 4.   Payoff Matrix of Cross-Strait Relations

2.   Payoff with Attacking Probabilities Relations in the Taiwan Strait

Suppose the probability China chooses the aggressive strategy of attacking Taiwan is P_f, and that of choosing a peaceful strategy is $(1-P_f)$. Suppose also that the probability Taiwan seeks independence is P_i, and that the probability is chooses peace, the status quo, is $(1-P_i)$. Now we can generate a new payoff matrix of cross-Strait relations as in Figure 5.

In this matrix, If China starts attack and Taiwan declares independence in response, or Taiwan announces independence then China attack in response, the payoff of Taiwan and China is A_{11} and B_{11} respectively. If Taiwan announces independence but China still holds to the peaceful strategy, Taiwan gets payoff A_{12} and China gets B_{12}. If China starts attack while Taiwan keeps peace, the payoff of Taiwan is A_{21} and China gets B_{21}. If China and Taiwan can perceive that keeping peace is the best strategy for both of them, they will get the payoffs are A_{22} and B_{22} respectively. Combining with the payoffs of cross-Strait relations in Figure 4, we can get $A_{11}= P_i P_f \times a_{11}$, $A_{12}= P_i(1-P_f) \times a_{12}$, $A_{21}=(1-P_i)P_f \times a_{21}$, $A_{22}=(1-P_i)(1-P_f) \times a_{22}$, and $B_{11}= P_f P_i \times b_{11}$, $B_{12}= (1-Pf)Pi \times b12$, $B_{21}=P_f(1-P_i) \times b_{21}$, $B_{22}= (1-P_f)(1-P_i) \times b_{22}$. For

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example, if it is certain that Taiwan will declare independence and China will attack then $P_i=P_f=1$ and $A_{11}=a_{11}$ and $B_{11}=b_{11}$ while every other value in the matrix is zero, which indicates that this is indeed what is expected to happen (Independence, Attack).

Now we will investigate the conditions under which both sides of the Taiwan Strait believe keeping peace is the best strategy, so no matter what strategy is taken by the other side, they will still want to keep peace. In other words, from the Taiwanese perspective, A_{21} will be greater than A_{11}, and A_{22} will be greater than A_{12}. From the Chinese perspective, this requires that B_{12} will be greater than B_{11}, and that B_{22} is greater than B_{21}.

Expanding these expressions by the values in Figure 5, we can get the new inequalities as follows:

$A_{21} > A_{11}$

$(1-P_i)P_f \times a_{21} > P_i P_f \times a_{11}$

$a_{21}P_f - (a_{11}+a_{21}) P_i P_f > 0$.........(Inequality 1)

$A_{22} > A_{12}$

$(1-P_i)(1-P_f) \times a_{22} > P_i(1-P_f) \times a_{12}$

$a_{22} - (a_{12}+a_{22}) P_i - a_{22}P_f + (a_{12}+a_{22}) P_i P_f > 0$..........(Inequality 2)

$B_{12} > B_{11}$

$(1-P_f)P_i \times b_{12} > P_i P_f \times b_{11}$

$b_{12}P_i - (b_{11}+b_{12}) P_i P_f > 0$..........(Inequality 3)

$B_{22} > B_{21}$

$(1-P_i)(1-P_f) \times b_{22} > P_f(1-P_i) \times b_{21}$

$b_{22} - (b_{21}+b_{22}) P_f - b_{22} P_i + (b_{21}+b_{22}) P_i P_f > 0$..........(Inequality 4)

For these inequalities to hold both sides of the Taiwan Strait must perceive keeping peace is the best strategy for cross-Strait relations, that is, both the probabilities P_i and P_f are very small, and both the payoffs a_{22} and b_{22} are relatively large. In inequality 1, because the value of $P_i \times P_f$ is close to zero, so the value of $(a_{11}+a_{21}) \times P_i P_f$ is very slim too. Therefore it is reasonable to suppose that $a_{21}P_f$ will be greater than $(a_{11}+a_{21}) \times P_i P_f$. The similar inference is in inequality 3. In inequality 2, because the payoff a_{22} is relatively large but both P_i and P_f are slim, it is reasonable to assume that $[a_{22} - (a_{12}+a_{22}) P_i - a_{22}P_f + (a_{12}+a_{22}) P_i P_f]$ is still greater than zero. The similar inference is in inequality 4.

Under these conditions, there is a dominant-strategy solution with the outcome (A_{22}, B_{22}). That is, both sides of Taiwan Strait would try their best to keep peace. In this condition, cooperation is the best way for both sides. In this case, the cross-Strait relations are like a reverse Prisoner's Dilemma.[37] The challenge is to ensure that in reality these conditions are met.

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[37] Prisoner's Dilemma, Wikipedia, available at: http://en.wikipedia.org/wiki/Prisoner%E2%80%99s_dilemma (last accessed June 2007).

<table>
<tr><th></th><th>P(Attack)=P_f</th><th>P(Peace)=(1-P_f)</th></tr>
<tr><td>P(Independence)
=P_i</td><td>B_{11}

A_{11}</td><td>B_{12}

A_{12}</td></tr>
<tr><td>P(Peace)
=(1-Pi)</td><td>B_{21}

A_{21}</td><td>B_{22}

A_{22}</td></tr>
</table>

Taiwan

Note: $A_{11}= P_i P_f \times a_{11}$

$A_{12}= P_i(1-P_f) \times a_{12}$

$A_{21}= (1-P_i)P_f \times a_{21}$

$A_{22}= (1-P_i)(1-P_f) \times a_{22}$

$B_{11}= P_f P_i \times b_{11}$

$B_{12}= (1-P_f)P_i \times b_{12}$

$B_{21}= P_f(1-P_i) \times b_{21}$

$B_{22}= (1-P_f)(1-P_i) \times b_{22}$

Figure 5.   Payoff Matrix Combined with Attacking Probabilities in Cross-Strait Relations

3.   An Extensive Form Approach to Potential Payoffs in the Taiwan Strait

To conform to the expressions: $a_{11} > a_{21}$; $a_{22} > a_{12}$ and $b_{11} > b_{12}$; $b_{22} > b_{21}$ in Figure 4, we assume the payoff matrix of cross-Strait relations as Figure 6.[38]

Given the assumed values in Figure 6, the tree structure in Figure 7 represents expected payoffs. Column 1 represents the original payoffs for Taiwan and China. According to the expressions in Figure 5, if both the probabilities are 0.2 for China and Taiwan to declare its independence, we will get the payoff as Column 2. With the probabilities of attack and independence for both sides equal to 0.8, the payoffs will be given by Column 3.

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[38] Refer to the model in "Thomas C. Schelling, The Strategy of Conflict," p. 210.

Compared to payoffs when both sides take peaceful strategies, payoffs in Column 3 (which are 0.04) are much smaller than those in Column 2 (which are 0.64). This is because both sides raise the probability of attack in Column 3 and makes the hope for peace lower. When the probability of keeping peace is higher, the payoff of keeping peace is higher too. Column 4 is the most ideal condition for cross- Strait relations. When both sides have zero for their independence or attack probability respectively and indeed keep their peaceful strategies, they will both get a maximum payoff. Any action to break peace will lower their payoffs to zero for both sides. Therefore, no matter from the perspective of Taiwan or China, keeping a high probability of peaceful strategies is the best guarantee for getting a high payoff.

China

	Attack	Peace
Independence	0	-0.5
	0	0.5
Peace	0.5	1
	-0.5	1

Taiwan

Figure 6.   Assumed Payoff Matrix of Cross-Strait Relations

	Column1 Original payoffs		Column2 When Pi=.02; Pf=0.2		Column3 When Pi=0.8; Pf=0.8		Column 4 When Pi=0; Pf=0	
	Taiwan	China	Taiwan	China	Taiwan	China	Taiwan	China
P(Attack)=Pf	0	0	0	0	0	0	0	0
P(Peace)=1-Pf	0.5	-0.5	0.08	-0.08	0.08	-0.08	0	0
P(Attack)=Pf	-0.5	0.5	-0.08	0.08	-0.08	0.08	0	0
P(Peace)=1-Pf	1	1	0.64	0.64	0.04	0.04	1	1

TAIWAN — P(Independence)= Pi — China; P(Peace)=1-Pi — China
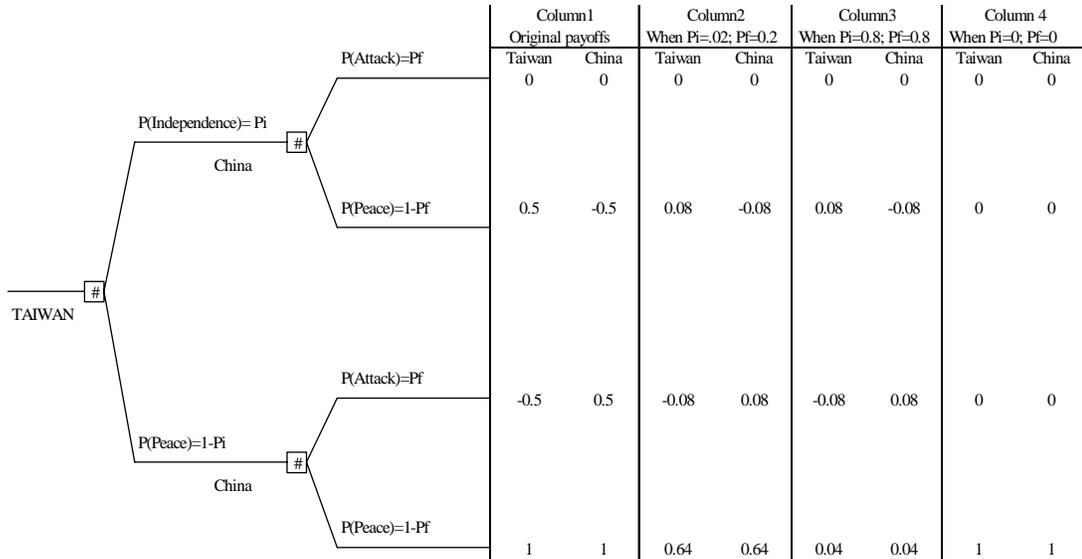
Figure 7.   Assumed Payoff Combined with Attacking Probabilities in Cross-Strait Relations

B.   THE PROBABILITY OF U.S. INTERVENTION

There are two different policies currently discussed by the United States with respect to the Taiwan Strait issue: "strategic transparency" and "strategic ambiguity." In "strategic transparency," the U.S. clarifies when it would intervene in a Taiwan Strait conflict. That is, if China attacks Taiwan, the U.S. would come to its defense. However, were Taiwan to attack first (i.e. declare its independence), the U.S. would refrain from intervention. Following this policy, the U.S. position would involve explicit communication with China and Taiwan and U.S. intervention in a Taiwan Strait conflict would be predictable.

However, in the alternative case of "strategic ambiguity," the U.S. policy would be to maintain an enigmatic posture, which leaves both sides of the Taiwan Strait uncertain about U.S. actions. In this case, the likelihood of a U.S. intervention is hard to assess. We take an example from Schelling's book: "if my neighbor's fruit tree overhangs my yard and I pick exactly all the fruit on my side of the line, my neighbor can probably discern what my proposal is, and has a good idea of what he has acquiesced in for the future if he does not retaliate. But if, instead, I pick that

same amount of fruit from both sides of the line haphazardly or pick some amount that is related, say, to the size of my family, he is less likely to perceive just what I have in mind. (He may also be more obliged to resist or retaliate if I pick only part of the fruit on my side of the line than if I pick it all, since I have failed to demarcate the limit of my intentions.)"[39]

In this example, picking only part of the fruit on my side of the line is more likely to cause retaliation from the neighbor than that if I picked it all. Why? An uncertain approach may turn out to be more harmful than a clear stand. What the U.S. wants is to deter rash actions through ambiguous strategies to keep the balance between the two sides of the Taiwan Strait. Although this strategy could be more politically acceptable to the U.S., it might also lead to difficulties if military hostilities break out in the Taiwan Strait.

Both threats and promises are interwoven between the U.S., China, and Taiwan regarding the Taiwan Strait issue. For the PRC, the Taiwan Relations Act is a threat but it is also a promise because it offers only defensive weapons to Taiwan. In 1991, U.S. General Colin Powell proposed the noted "Powell Doctrine," including eight questions that should be answered before the U.S. takes military action:

1. Is a vital national security interest threatened?
2. Do we have a clear attainable objective?
3. Have the risks and costs been fully and frankly analyzed?
4. Have all other non-violent policy means been fully exhausted?
5. Is there a plausible exit strategy to avoid endless entanglement?
6. Have the consequences of our action been fully considered?
7. Is the action supported by the American people?
8. Do we have genuine broad international support?[40]

The Powell doctrine could provide a framework for U.S. military action in the Taiwan Strait. Both China and Taiwan could interpret both a promise and a threat although they cannot determine the exact probability of U.S. intervention. That is, if

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[39] "Thomas C. Schelling, The Strategy of Conflict," p. 104.

[40] Powell Doctrine, Wikipedia, available at: http://en.wikipedia.org/wiki/Powell_Doctrine (last accessed May 2007).

both sides of the Taiwan Strait do not cross the "line," the U.S. will not intervene in the Taiwan Strait. However, once one side precipitates hostilities, the U.S. could intervene in this conflict.

C.   THE SCENARIO IN THE TAIWAN STRAIT CONFLICT

Applying a game tree to analyze the Taiwan Strait issue, the first level is decided by Taiwan, which has two choices-- keeping the status quo or announcing independence. The second level is decided by the PRC, which has two choices-- keeping the status quo or attacking Taiwan. The third level is decided by the U.S., which also has two choices-- intervening or staying out of the Taiwan Strait conflict.

Assume that if Taiwan maintains the status quo and the PRC attacks Taiwan, the probability of U.S. intervention is P. Alternatively, assume that if Taiwan announces independence and the PRC attacks Taiwan, the probability of U.S. intervention is Q. The probability P is assumed greater than Q because when Taiwan maintains the status quo and China attacks, the U.S. has a more reasonable motive for intervening.

Based on the 80/20 Rule,[41] when the U.S. adopts "strategic ambiguity," we assume P is equal to 0.8 and Q is equal to 0.2. However, if the U.S. selects "strategic transparency," the probability we assume P will equal to 1 and Q will equal to 0.

Based on the 80/20 Rule again and the military power comparison that the U.S. is greater than China and China is greater than Taiwan, we assume the probability of the PRC success when it attacks Taiwan without the U.S. intervention is 0.8. On the contrary, the probability of the PRC successful attack when the U.S. intervene the Taiwan Strait issue is 0.2 because the probability of the U.S. success in intervening is 0.8. Therefore, Figure 8 is the scenario in the Taiwan Strait issue in extensive form when the U.S. adopts "strategic transparency"; Figure 9 illustrates the case of "strategic ambiguity."

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[41] Pareto's Principle - the 80/20 Rule, which means that in anything a few (20 percent) are vital and many (80 percent) are trivial, available at: http://management.about.com/cs/generalmanagement/a/Pareto081202.htm (last accessed April 2007).
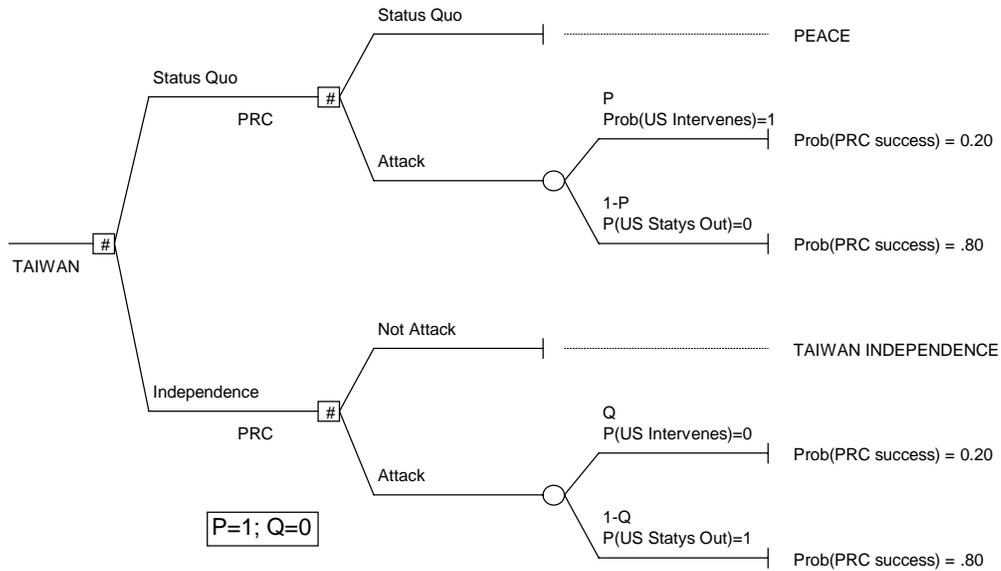
Figure 8.   Scenario in the Taiwan Strait in extensive form when the U.S. has "strategic transparency" policy.
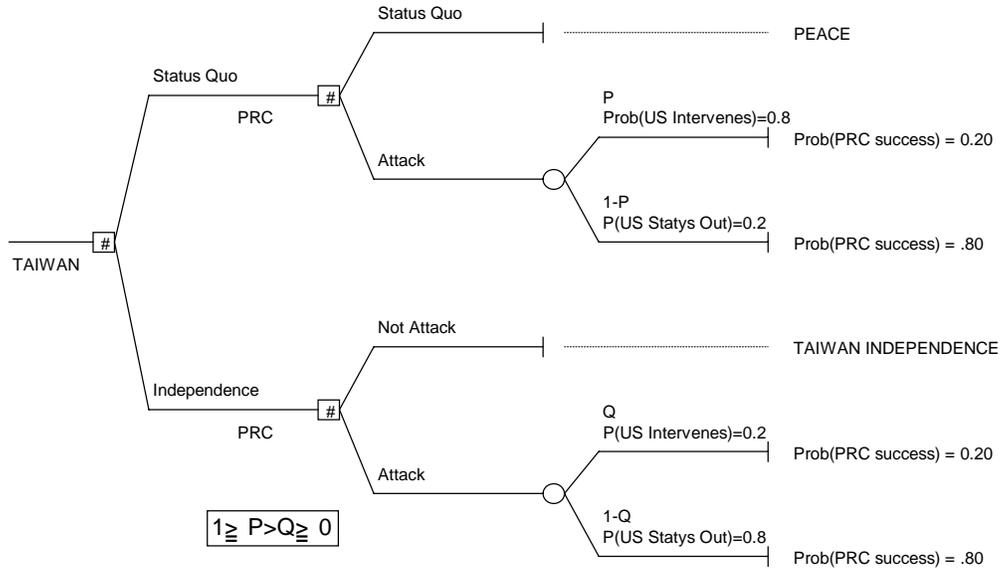

Figure 9.   Scenario in the Taiwan Strait in extensive form when the U.S. has "strategic ambiguity" policy.

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In Figure 8, when the U.S. has a "strategic transparency" policy, there is only one scenario that results in U.S. intervention, that is, Taiwan maintains the status quo and the PRC attacks. In this case, the probability of the PRC's success for attacking Taiwan with the U.S. intervention is 0.2.

Alternatively, in Figure 9, when the U.S. has a "strategic ambiguity" policy, there are two scenarios that could result in U.S. intervention: Taiwan maintains the status quo and the PRC attacks or Taiwan announces its independence and the PRC attacks . The probability of the first scenario is 0.16 (0.8 multiplied by 0.2); the probability of the second scenario is 0.04 (0.2 multiplied by 0.2). Therefore, the total probability of the PRC's success for attacking Taiwan with the U.S. intervention is also 0.2 in this condition when the U.S. takes "strategic ambiguity." Therefore, the probability the PRC obtains its payoff for attacking Taiwan when the U.S. intervenes is assumed constant at 0.2.

Suppose there is a fifty-fifty chance the U.S. chooses "strategic transparency" or "strategic ambiguity." Accordingly, as the probabilities of the U.S. intervention in Figure8 and Figure 9, we can get the probability $[(0.5 \times 1) + (0.5 \times 0.8) = 0.9]$. Therefore, the most likely situation which would result in a conflict between the U.S. and the PRC is where Taiwan maintains the status quo but the PRC attacks Taiwan.

In conclusion, if both sides of the Taiwan Strait can maintain the status quo, the probability of conflict between the U.S. and the PRC will be greatly reduced. To prevent conflict and maintain the status quo is one of the great policy concerns of the U.S.

D.   BRINKMANSHIP IN THE TAIWAN STRAIT CONFLICT

Brinkmanship is one strategy designed to achieve political objectives while risking, but not causing active hostilities. Now we will extend the previous discussion to examine the situation when the U.S. intervenes in the Taiwan Strait. In Figure 10, after the U.S. intervention, the PRC can either withdraw or confront the U.S. If the PRC prefers to withdraw, Taiwan can declare its independence or maintain the status quo. On the other hand, if the PRC chooses to confront the U.S., the U.S. could choose to withdraw or confront in response. If the U.S. chooses to withdraw, Taiwan

could be taken by force and the U.S. could lose its position in the Taiwan Strait. If there is a U.S.-PRC confrontation, there could be two possible results. The first is that war breaks out right away; the second is that both use brinkmanship strategies to persuade or threaten the other side to back down.

Figure 11 shows the most likely outcome in the Taiwan Strait issue after the U.S. intervention. Suppose there are four attitudes to the Taiwan Strait issue for the U.S. and the PRC: peaceful, patient, impatient, and aggressive.[42] That is, if the dovish sentiment is dominant, they will prefer the peaceful strategy, but if the hawks prevail, they will tend towards more aggressive strategies.

The numbers in the table reveal the most likely results for Figure 10. If at least one side chooses a peaceful strategy, the result would be peaceful because one party withdraws first. If both sides are patient, or one is patient but the other one is impatient, they may still have a chance at a peaceful result using brinkmanship strategy. However, if both sides are impatient, or one side is patient but the other side is aggressive, there could be a war as a result of the application of a brinkmanship strategy. At last, if both sides are aggressive, or one is impatient but the other one is aggressive, there could be a war without any possibility of negotiations.
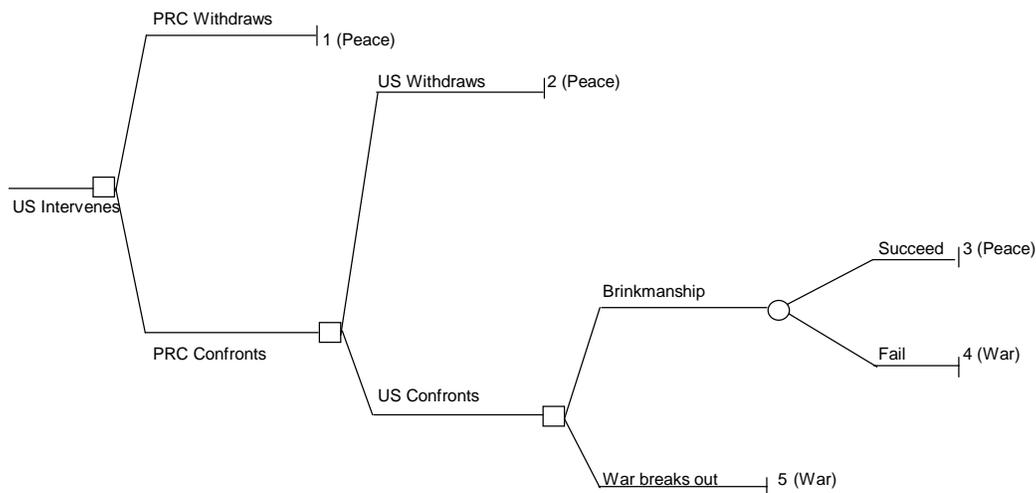

Figure 10.   Scenario in the Taiwan Strait in extensive form after the U.S. intervention

[42] Refer to the model in: Raymond E. Franck and Francois Melese, A Game Theory View of Military Conflict in the Taiwan Strait.

| | Dove | | Hawk | |
PRC\US	Peaceful	Patient	Impatient	Aggressive
Peaceful	1	1	1	1
Patient	2	3	3	4
Impatient	2	3	4	5
Aggressive	2	4	5	5

Dove ← Hawk (row axis)

Figure 11.   The most likely outcomes in the Taiwan Strait issue after the U.S. intervention (The numbers are related to those in Figure 9)

The successful key to brinkmanship is that both sides are patient. Through constant persuasion and threat, both sides can find a way to negotiate a peaceful end. That is, although keeping an intense confrontation is important when using brinkmanship, it is more important for both sides to have the patience to negotiate. Even though while one side is more impatient, the other side may still likely attempt to persuade it from a destructive conflict by taking the patient attitude. However, if both sides are impatient to use brinkmanship, it could fail and result in a nuclear war. A worse case is if one side is patient but the other side is aggressive, the aggressive side might start a nuclear attack out of miscalculation. Therefore, although outcomes "4" and "5" both lead to war, outcome "4" would be more dangerous than "5." Outcome "5" would likely result in a conventional war right away due to the aggressive attitudes of both sides. However, outcome "4" could bring about a nuclear war after failed brinkmanship. Therefore, brinkmanship should be applied based on the attitude of the other side. When the U.S. confronts Chinese brinkmanship in the Taiwan Strait conflict, it can not show a weak attitude. Especially when China is very aggressive and the U.S. cannot raise the tension, there could be reason for China believing threats based on the assumption that nuclear forces can resolve everything.

Like the former Soviet Union leaders before the Cuban Missile Crisis, China today apparently thinks the U.S. people want comfort and peace and will never use nuclear weapons. At one time, Chinese was backward in nuclear technology.

Therefore, China has consistently proclaimed a "no first use" nuclear doctrine.[43] However, in recent years with the development of ballistic missiles and nuclear technology, the PRC's nuclear policy has changed. Some Chinese generals threaten the U.S. with nuclear forces publicly, especially over the Taiwan Strait issue. For example, People's Liberation Army General Zhu Chenghu once said: "We will prepare ourselves for the destruction of all the cities east of the Xian. Of course, the Americans will have to be prepared that hundreds of cities will be destroyed by the Chinese."[44] In other words, they think they can achieve strategic objectives through nuclear forces and do not take the risk seriously.

There are some reasons for China to use nuclear threats because their nuclear forces have developed very quickly. However, the U.S. nuclear threat to China has not changed in response. By experience in the Cuban Missile Crisis, we know verbal threats are not completely useful. In the Cuban Missile Crisis, language had been very serious, but the former Soviet Union did not believe it until the U.S. started the generation sequences of nuclear forces. Therefore, only by pushing the situation to a dangerous brink, would the U.S. make China really understand it will not shrink back because of the possibility of nuclear war. Only when China believes this, can the U.S. establish a mutual nuclear threat relationship with China with both sides striving to avoid using their nuclear forces. The Cuban Missile Crisis established the mutual nuclear threat foundation between the U.S. and the former Soviet Union.[45] This crisis confirmed the principle that they could not use nuclear forces in their future conflicts. The security the U.S. enjoys now is not only based on nuclear technology, but also by demonstrating that determination to resolve the crisis. The greatest danger at present is that the U.S. and China have not yet confirmed the principle that nuclear forces cannot be used in solving their conflicts, including the Taiwan Strait issue. At present, some Chinese generals are addicted to the prospect of using nuclear forces to resolve

43 Annual Report to Congress--Military Power of the People's Republic of China 2006, available at: http://www.ndu.edu/inss/symposia/pacific2006/Gunnesspaper.pdf (last accessed May 2007).

44 Financial Times, Top Chinese general warns US over attack, July 14, 2005, available at: http://www.ft.com/cms/s/28cfe55a-f4a7-11d9-9dd1-00000e2511c8.html (last accessed May 2007).

45 The Cuban Missile Crisis Briefing Room, Conclusion, available at: http://library.thinkquest.org/11046/briefing/index.html#Conclusion (last accessed May 2007).

the Taiwan Strait issue and some other issues with the U.S. Therefore, the solution is not the U.S. nuclear technology or the National Missile Defense (NMD) program, but on showing willingness to use the nuclear forces if necessary.

E.   STAG HUNT GAME IN THE TAIWAN STRAIT

The relationship of Taiwan and China today is captured well in the stag hunt game. Taiwan wants to be an independent country some day, but China hopes to reunify with Taiwan. These interests are like two parallel lines with no convergence. The assumed payoff matrix for the stag hunt game between Taiwan and China is pictured in Figure 12. The first number in each block is the payoff of Taiwan and the second one is the payoff of China. If both sides pursue peace (e.g., maintaining the status quo or reaching a peaceful agreement), they will both get the maximum payoffs. However, if one of them defects the opposite side (e.g., Taiwan announces independence or China attacks), the peaceful side will get the minimum payoff. This model is not totally the same as Figure 3 in Chapter III because when both sides decide to give up their peaceful strategies, they will not get a payoff as good as when the other decides to continue a peaceful strategy. However, both they may take action to raise their payoffs. For example, if China attacks, Taiwan could be forced to decide independence to seek the international sympathy and support. However, as hunters (metaphorically) in this situation, cooperation will result in a win-win situation, but defection will result in worse outcomes for both.

<div align="center">

China

	Peace	Attack
Peace	4, 4	0, 3
Independence Announcement	3, 0	2, 2

Taiwan

</div>

Figure 12.   Assumed Payoff Matrix for the Stag Hunt Game between Taiwan and China

For avoiding the condition where both sides of the Taiwan Strait end in common ruin because no one wants to get the less payoff, a binding agreement would be an efficient solution. Therefore, Taiwan and China would do better to cooperate or conclude agreements to solve cross-Strait differences. For instance, they can acquire trust from the other side via the establishment of military confidence-building measures, the economic integration of bilateral trade relations, cultivating non-governmental communication, etc. Only through effective communication and cooperation can China and Taiwan both succeed in escaping their current predicament in the Taiwan Strait conflict.

F.   FUTURE OF THE TAIWAN STRAIT ISSUE

1.   Taiwan Presidential Election in 2008

The election for the 12th Taiwanese President and vice-President will be held in March 2008. In Taiwan there are two main political parties: the KMT (Kuomintang) and the DPP (Democratic Progressive Party). Each party will nominate candidates for both offices. Basically, the KMT supports dialogue with the Communist Party of China under the "1992 Consensus," which states that both China and Taiwan belong to one China with both sides having different interpretations of that term.[46] The DPP, on the contrary, opposes recognizing "One China" and leans towards independence.[47] Therefore, the KMT is considered moderate, while the DPP is deemed radical regarding Taiwan's relationship with China. The DPP had won the 2000 and 2004 Taiwanese Presidential elections. However, according to a survey by the Taiwan United News in January 2007, the likely KMT candidate, Ma Ying-jeou, will defeat the likely DPP candidates, Frank Hsieh.[48] The outcome of this election will have considerable effect upon cross-Strait relations. The first impact may be on the U.S. 10 billion dollar arms sale. The DPP agrees with the arms sale while the KMT opposed it. The second impact involves whether the "three links" strategy will be executed or not. ("Three links" means direct postal, direct transportation, and

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[46] 1992 consensus, Wikipedia, available at: http://en.wikipedia.org/wiki/1992_Consensus (last accessed June 2007).

[47] Republic of China presidential election, 2008, Wikipedia, available at: http://en.wikipedia.org/wiki/ROC_presidential_election,_2008 (last accessed June 2007).

[48] Taiwan United News, January 26, 2007, available at: http://www.e-stock.com.tw/asp/board/v_subject.asp?ID=3236314 (last accessed June 2007).

direct trade links between mainland China and Taiwan.) The KMT supports immediately opening up these links with China, while the DPP opposes direct links.[49] The other important impact of the election will be on the defensive referendum. Some DPP supporters take it as a strategy of brinkmanship in response to the PRC's "Anti-Separation Law" and more than 700 ballistic missiles aimed at Taiwan. However, some KMT supporters think this referendum is a provocation and oppose it.[50]

2. Democratization in China

After the major economic reforms that have taken place in China, there are two U.S. opinions on China's rise to become a global power. The first one is that it will have a great impact on U.S. economic interests in Asia. This opinion is based on the zero-sum game theory. The second is that China's peaceful rise is not a zero-sum game but creates a lot of commercial opportunities for global companies, including those in the U.S.[51] However the gap between economic development and the autocratic political system is still significant.[52] Based on the relationship between the U.S. and the former Soviet Union, we know that democratization in an autocratic country tends to decrease hostility with democratic states. One of the most noted examples is the Intermediate-Range Nuclear Forces (INF) Treaty, which was signed in1987, the year the USSR started its economic reforms.[53] It was an agreement between the U.S. and the former Soviet Union to eliminate nuclear and conventional

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[49] Three Links, Wikipedia, available at: http://en.wikipedia.org/wiki/Three_links (last accessed June 2007).

[50] Taiwan Libertytimes News, available at: http://www.libertytimes.com.tw/2004/new/feb/9/today-o4.htm (last accessed June 2007).

[51] Interview: China's rise no zero-sum game, Forbes, available at: http://english.peopledaily.com.cn/200509/01/print20050901_205848.html (last accessed June 2007).

[52] Richard N. Haass, China and the Future of U.S.-China Relations, December 5, 2002, available at: http://www.nti.org/db/china/engdocs/haassrh_1202.htm (last accessed June 2007).

[53] Perestroika, Wikipedia, available at: http://en.wikipedia.org/wiki/Perestroika (last accessed June 2007).

ground-launched ballistic and cruise missiles with ranges of 500 to 5,500 kilometers.[54] Therefore, if China is willing to give up the Communist Party autocracy and start to democratize, we can expect the relationship among China, Taiwan, and the U.S. will greatly improve.

3. The U.S. Presidential Election in 2008

The U.S. will hold its 55th consecutive quadrennial election for President and vice President of the U.S. in November 2008.[55] Although there are many potential candidates, the delegates from either Democratic Party or Republican Party will still win this election ultimately. No matter which party wins this election, the outcome will significantly affect the relationship among China, Taiwan, and the U.S.. Ronald Reagan was believed the most supportive U.S. President to Taiwan.[56] In 1982, Reagan signed the "August 17 Joint Communiqué" with China to reduce arms sales to Taiwan. However, he also issued "Six Assurances" to Taiwan, including that the U.S. would not agree to set a date for ending arms sales to Taiwan nor to consult with China on arms sales to Taiwan. It also included the assurance that the U.S. would not revise the Taiwan Relations Act.[57] Moreover, the current U.S. President, George Walker Bush, approved a 10 billion dollar arms sale to Taiwan, although it is still vetoed by the Taiwanese opposition party today. However, the former U.S. President Bill Clinton issued the "Three No's" principles on Taiwan. In 1998, Clinton said: "I had a chance to reiterate our Taiwan policy which is that we don't support independence for Taiwan, or 'two Chinas,' or 'one Taiwan, one China,' and we don't believe that Taiwan should be a member in any organization for which statehood is a

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54 Intermediate-Range Nuclear Forces Treaty, Wikipedia, available at: http://en.wikipedia.org/wiki/Intermediate-Range_Nuclear_Forces_Treaty (last accessed June 2007).

55 United States presidential election, 2008, Wikipedia, available at: http://en.wikipedia.org/wiki/United_States_presidential_election%2C_2008 (last accessed June 2007).

56 Taiwan Libertytimes News, available at: http://www.libertytimes.com.tw/2004/new/jun/7/today-file3.htm (last accessed June 2007).

57 Shirley A. Kan, Taiwan: Major U.S. Arms Sales Since 1990, CRS Report for Congress, November 9, 2006, available at: http://www.fas.org/sgp/crs/weapons/RL30957.pdf (last accessed June 2007).

requirement."[58] From these policies the Republican Party seems friendlier to Taiwan. However, U.S. strategies are mainly driven by U.S. interests, so it is hard to judge the effect on China and Taiwan policies by which party wins the 2008 election.

G.   BRINKMANSHIP OR STAG HUNT IN THE FUTURE

Because the Communist Party still controls economy and politics in China, there is no indication that they would move to democratization in the near future.[59] On the other hand, the U.S. strategy on the Taiwan Strait is not decided merely by which party wins the Presidential election in 2008. Therefore, we consider primarily the effect of the 2008 Taiwan Presidential election on the Taiwan Strait issue here.

Basically, the "three links" is taken as a policy of symbolic cooperation for both the PRC and Taiwan. Therefore, this policy could lead the cross-Strait relations from confrontation to cooperation (like the stag hunt game). On the other hand, the 10 billion dollar arms sale and the defensive referendum are deemed strategies for raising tension. They might lead to brinkmanship strategies in cross-Strait relations. Figure 13 examines the Taiwan Strait issue in extensive form based on different strategies of Taiwan. If Taiwan prefers cooperation to hostility; that is, Taiwan opens up "three links" but declines arms sales from the U.S., the probability of Chinese invasion could be less than that of using a confronting strategy. However, "three links" could bring some national security problems, and an arms sales veto could cause the U.S. to have no desire to defend Taiwan.[60] Therefore, if China decides to attack Taiwan, the probability of the PRC's success for the war when Taiwan adopts a confronting strategy would be less.

In Figure 13, if the KMT wins the 2008 Presidential election, and the Taiwanese select the "three links" strategy, the probability of PRC attack is P, and the probability that the PRC wins this war is R. On the other hand, when the DPP wins

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58 Embassy of the People's Republic of China in the United States of America, available at: http://www.china-embassy.org/eng/zmgx/zysj/kldfh/t36241.htm (last accessed June 2007).

59 June 4th and Democratization in Mainland China, Taiwan National Policy foundation, available at: http://www.npf.org.tw/PUBLICATION/CL/092-CL-C-092-109.htm (last accessed June 2007).

60 The Journalist, Taiwan, December 28, 2006, available at: http://tw.bbs.yahoo.com/cgi-bin/ListFrame.cgi?board=weapon&query=%5B%B7s%BBD%5D%A4%A3%ADx%C1%CA%B4N%B5%A5%A6%BA+Buy+or+Die%3F&rf=search&exact=1 (last accessed June 2007).

the 2008 Presidential election, that is, Taiwan chooses a more aggressive strategy, the probability of a PRC attack is Q, and the probability that the PRC wins is S. Therefore, the probability of forced reunification when Taiwan takes the more moderate "three links" strategy is $(P \times R)$; the probability of forced reunification when Taiwan takes the more radical "arms sale" strategy is $(Q \times S)$. As shown above, $1>Q>P>0$ and $1>R>S>0$, so we are unsure which value is bigger between $(P \times R)$ and $(Q \times S)$. This explains why these topics are always major political issues in Taiwan.

There are two ways to decrease the probability of forced reunification: decreasing $(P \times R)$ or $(Q \times S)$. For the KMT, if they place more emphasis on Taiwanese national defense, P is maybe increased a little while R will likely decrease a lot. Similarly for the DDP, if they communicate more friendly intentions to China, S is maybe increased a little while Q would likely decrease a lot. That is, if the KMT and DDP can lean toward the strategies of the other party a bit, they can reach an identical objective. Therefore, it should be feasible to complete the three links and arms sales at the same time. However, due to the seriously different opinions between the KMT and DDP now, it is hard to see this result being attainable in the short term.
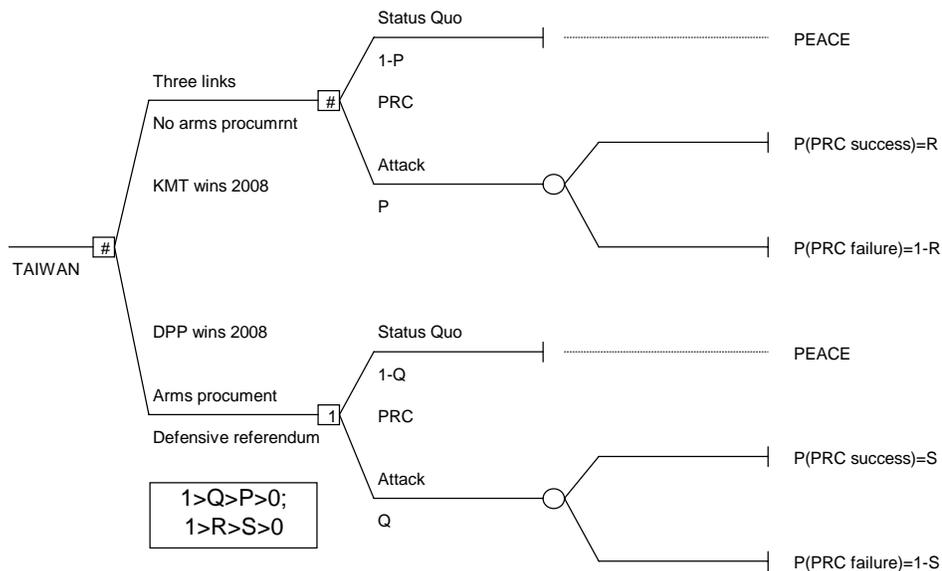

Figure 13.   Scenario in the Taiwan Strait issue in extensive when Taiwan takes different strategies

V.   CONCLUSIONS AND RECOMMENDATIONS

We live in a globalized and interdependent world; what happens in any given region can significantly impact the whole world. The Taiwan Strait issue is one of the most important issues in the world today. If China engages in an unprovoked attack of Taiwan, the probability of U.S. intervention is relatively high. Since the U.S. and China are both nuclear powers, this could threaten nuclear war. The U.S. had successfully stopped the Cuban Missile Crisis by threatening to use its nuclear arms in a brinkmanship strategy in 1962. This success also inspired many countries, including China, to develop nuclear arms. Since the first atomic bomb was dropped on Hiroshima over 60 years ago, humans have avoided nuclear war. The Taiwan Strait issue offers another test of our resolve to avoid nuclear confrontation.

In the Taiwan Strait, the most likely excuse for China to attempt a military conquest is for Taiwan to unilaterally declare its independence. However, independence has become a tool for Taiwanese politicians' to manipulate public opinion. But in manipulating the Taiwanese sentiments they also risk the security of the region and the world. The U.S. and its allies are unlikely to dispatch troops to defend Taiwan unless China attacks Taiwan without provocation. If the U.S. and its allies intervene in this conflict, they could soon withdraw if China raises a nuclear threat. However, such a confrontation could make China a more aggressive power in the region. For this reason, the U.S. might apply a brinkmanship strategy to cope with the Chinese nuclear threat much as it did in the Cuban Missile Crisis. If the U.S. succeeds, China will likely back down or withdraw; but this would also risk a destructive nuclear war.

The lesson of this study is that it is critical for both the leaders of the U.S. and China to deal with this potential crisis. Hopefully, brinkmanship is a last resort in the game among the U.S., China and Taiwan, and nuclear power will not be used in resolving the Taiwan Strait issue. Accordingly, all three parties would do well to commit to patiently maintaining the status quo. Even better, all three parties could sign an agreement that commits all parties to maintain the status quo for an extended period. The recommendations from this study are as follows: First, that it would be risky for Taiwan to declare its independence or take actions that threaten the status

quo, like holding an independence referendum. Second, if Taiwan promises not to declare its independence, China should withdraw or at least reduce the missiles which target Taiwan, and renounce the use of military force to achieve reunification. Third, the U.S. should make clear that it will not support Taiwanese independence and will only intervene if China attacks Taiwan without any provocation. That is, the U.S. would do better to practice "strategic transparency," not "strategic ambiguity."

To avoid Chinese leaders starting a war, Taiwan and the U.S. should do the following. First, Taiwan should develop and intensify its national defense, at least to have its own capability for resisting a Chinese attack before the arrival of the U.S. assistance. Second, the U.S. could signal its willingness to risk nuclear weapons use to cope with an unprovoked attack from China. Although brinkmanship is a last resort in the Taiwan Strait issue, under certain dire circumstances it may be the only way to avoid a highly destructive war. Third, Taiwan and the U.S. should help foster democratization in China. Finally, Taiwan should pursue improved relations with China through initiatives such as "three links," the economic integration of bilateral trade relations, cultivating non-governmental communication, etc.

Ideally, instead of confrontation, the two sides of the Taiwan Strait should cooperate. It is likely that the Taiwanese would want to reunify or form a confederation someday if the advantages of reunification are greater than the disadvantages. China should keep developing its economy and preparing for democratization to improve relations with Taiwan. Moreover, Taiwan should adopt more open approaches to China. For example, open more Taiwanese commerce to China and encourage more Chinese tourism in Taiwan. This could promote communication between both peoples and encourage the mainland Chinese to gradually pursue more liberal policies in the region.

In conclusion, the challenge is to turn the Taiwan Strait issue from a zero-sum or negative-sum game to a positive sum, win-win situation for the U.S., China, and Taiwan. The hope is that the Taiwan Strait issue can be resolved peacefully over time. As commercial relations expand and the military threat to Taiwan retreats, China could enjoy the advantages of gradual democratization. In that case the Taiwanese

people would no longer live under the threat of war, natural reunification would occur as a result of common interests, and the U.S. would gain a valuable friend in the region.

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