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Franck, Raymond; Melese, Francois

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A Game Theory View of Military Conflict in the Taiwan Strait

*Raymond E. Franck and Francois Melese**

US Naval Postgraduate School, 555 Dyer Road, Monterey, CA 93943-5103, USA

INTRODUCTION

Arguably the most significant risk of direct military confrontation between the US and the People's Republic of China (PRC) involves Taiwan. The objective of this paper is to apply simple game theory tools to examine the impact on the US of alternative scenarios governing the future of the two Chinas. While a strong case can be made for prospects of co-operative and friendly relations between the US and the PRC based on both parties seeking stable and mutually beneficial trade relations, there is also reason for caution.

For example, consider the pivotal relationship at the end of the nineteenth and early twentieth century between the British and German Empires. At that time there was reason to be optimistic due to strong trade relations and close kinship ties between the monarchies. However, in 1914 Britain entered into a long and bloody conflict with Germany. The precipitating cause was a relatively obscure British obligation to Belgium, characterized by the German government as “a scrap of paper”.¹ In short, Britain and Germany entered a protracted World War, shelving their mutual interests over a dispute involving a third party.

Such analogies should not be overdrawn. However, the potential for conflict between China and the US over the flashpoint of Taiwan warrants serious attention. Assessing the current risk of conflict in the Taiwan Strait requires careful thinking about contemporary political, economic, and military realities facing the two Chinas. This article contributes to that analysis, highlighting some implications for future US policy.

The objective of this paper is also to explore US capabilities that could affect the future of Chinese reunification: National Missile Defense (NMD); US forces' access to the Taiwan Strait region; and Taiwan's military capabilities. The next section briefly reviews economic tripwires that could eventually lead the PRC down the path of invading Taiwan. This discussion is followed by an assessment of the current political–military environment, and the development of a simple game theory model of potential conflict. The last section concludes with some policy implications of the model.

* This paper contains judgments and conclusions by the authors. It does not necessarily reflect any policy or position held by the US DoD.

We begin with a discussion of contemporary political forces driving the PRC's governing regime. Mao's original ideological basis for the regime has largely been discredited and disavowed. The regime's current claim to legitimacy is "pragmatism", or to paraphrase Deng Xiao Peng, being a cat that catches mice.² The concept of "catching mice" has been operationalized as: delivering economic growth and increased welfare, making China's territory secure from invasion, and recovering lost territories (appealing to wounded nationalism).

There have been major successes in all three areas. The rise of Chinese power and dissolution of the Soviet Union ended any serious threat of invasion. The regime successfully negotiated the return of Hong Kong and Macao. Moreover, the current period of economic growth and prosperity in China has been remarkable both for its magnitude and its longevity.³

Despite these achievements, the regime continues to face a chronic crisis of legitimacy. To pursue Deng's analogy, the key question is: what happens if the regime stops catching mice? If economic growth suddenly slows, with attendant worsening of social problems and failed expectations, the regime may feel compelled to find new mice to catch. Regimes such as Fidel Castro's in Cuba bolster their legitimacy by diverting public attention to inflated threats of invasion and subversion.⁴ Similarly, if China's economy begins to stumble, this might lead the regime to attempt to divert public attention by taking strong action in pursuit of lost territories – notably Taiwan.

We begin the next section by discussing the economic environment in which the PRC currently operates. We then consider the ongoing arms race in the Taiwan Straits. While the PRC has a clear advantage in force size, Taiwan has significant advantages in the quality of its forces in many key areas, as well as being afforded protection by special geographical features. In the near term, it is unlikely the PRC can successfully undertake an invasion of Taiwan.⁵ In the long run, the situation could be different. Taiwan cannot match the Mainland's military size and quantity advantages and is subject to ongoing pressure by the PRC on its potential arms suppliers that restrict its options in its ongoing military competition with the Mainland. Meanwhile, the PRC appears to be overcoming key gaps in its balance of forces with Taiwan.

The Taiwan Strait situation will be analyzed with the help of simple game theory tools. We develop a scenario that involves an attempted invasion by the PRC some years in the future. Presenting the extensive form (or tree structure) of the game, we assume Taiwan will repel the invasion to the best of its ability given its existing force structure. This allows us to focus on the PRC and the United States as the two key players in the game. The scenario itself involves matching Taiwan's force structure against that of the PRC, the possibility of US intervention, and the PRC's moves to deter that intervention through "access denial" and "access deterrence" activities.⁶

The objective of this particular game theory development of the Taiwan Strait issue is threefold: to shed light on the relative importance of the balance of forces between the PRC and Taiwan; to assess the PRC's access denial capabilities against US power projection; and to assess the PRC's access deterrence capabilities against US National Missile Defense (NMD). Several interesting policy insights derived from the model appear in the concluding section of the paper.

THE ECONOMIC ENVIRONMENT: PROMISE AND PROBLEMS

Both Beijing and Taipei have publicly stated they seek a peaceful resolution to the unification issue. Nevertheless, according to a recent Report by the US Secretary of Defense “[s]hould China use force, its primary goal likely would be to compel a negotiated solution on terms favorable to Beijing”.⁷ The question left unanswered is whether the PRC might achieve the same goal through its economic power instead of its military power?

Recognizing that Taiwan’s economy is sensitive to threats from Beijing, the PRC regime might be tempted to manipulate Taiwan’s stock exchange and investor confidence simply through its strategic use of credible threats. Alternatively, the regime could subtly hold hostage some of the increasing foreign direct investment from Taiwan that has entered the PRC since 2001 when both joined the World Trade Organization. However, any threat (or actual use of) force or economic blackmail could seriously backfire. Given China’s blistering pace of economic growth and ongoing market reforms – according to the World Bank its GDP is the sixth largest in the world, just after France, with 7–8 percent GDP growth rates over the last three years⁸ – Beijing likely recognizes that any conflict with Taiwan would threaten its economic growth, along with its access to foreign markets, new investment, and new technology. Concerns over minimizing disruptions in its own vital trade and shipping interests suggest that if Beijing did decide to engage militarily to force the reunification issue with Taiwan, China’s leaders would likely do so with sufficiently overwhelming military force to accomplish their objectives quickly before the US could intervene on Taiwan’s behalf. The challenge for the PRC would be to contain the conflict so as not to disrupt increasing trade and investment flows between itself and its other increasingly interdependent regional trading partners.

An important alternative scenario exists. Should economic growth stagnate and China enter a prolonged recession where protectionist pressures begin to reverse its openness to global markets, a military-led reunification effort might serve Beijing to deflect public criticism from its mismanagement of the economy. We next explore the very real possibility of a slowdown in China’s growth, and its possible implications.

Beijing’s longstanding multi-faceted approach to Taiwan has alternately emphasized economic, political, and military strategies. For example, following the March 2000 presidential election in Taiwan, Beijing pursued a low-key approach of expanding contacts in Taiwan with political and economic elites who favored reunification. It was an attempt clearly aimed at isolating President Chen Shui-bian’s Democratic Progressive Party.

While current dynamic economic conditions tend to support such low-level engagements, economic clouds loom over Mainland China that could soon change this peaceful climate. Although drawing more Foreign Direct Investment (FDI) than the United States in 2002,⁹ lost in the hype and excitement about China’s economic boom is its fragile financial system. It could well be that this high level of FDI actually reflects weaknesses in China’s financial system, notably its inability to make efficient use of its own high level of domestic savings. In fact, the *International Herald Tribune* recently

asked the troubling question: "Is Beijing brewing its own Asia-crisis-like meltdown?"¹⁰

Whereas China's markets for labor, goods, and services are as liberal as those in most market economies, its capital markets have only undergone cosmetic changes since the days of central planning. In effect, most financial capital in China is still allocated by the government. The most disturbing reflection of this legacy of Communist control is that fully 50 percent of all loans made by Chinese banks are unlikely to be repaid in full. The size of total bank credit outstanding was reported to be over 100 percent of GDP (111 percent in 2000).¹¹ The *Economist* magazine recently reported estimates by Goldman Sachs that China's bad debt problem may require \$500–\$600 billion to clean up, or between 44 and 68 percent of its annual GDP.¹²

Originally, the state banks were no more than conduits through which ministries disbursed money to state-owned enterprises (SOEs). Historically, China's Central Bank guided commercial banks to achieve target loan growth directed toward government-preferred industries. This so-called "window guidance" is largely modeled on the Bank of Japan's credit allocation system, a legacy of its World War II wartime economy, but a system that survived into the early 1990s. As a consequence, the relevant comparison for the potential of a Chinese economic meltdown may not be so much with East Asia's financial crisis as it is with Japan's.

Much like Japan, China has been squandering its capital for years subsidizing SOEs. However, while in the mid-1950s China's economy was twice as big as Japan's, due largely to China's devastating Cultural Revolution and Japan's export-driven growth, by 1994, Japan's economy was nearly nine times the size of China's (with only a tenth of the population). Although China is beginning to close that gap, investors may soon become concerned about the quality of China's economic growth as well as its fragile financial system.

Today China's economic growth is largely powered by public spending. Industrial overcapacity, unproductive investments, and questionable corporate governance along with creative accounting could lead to a collapse in economic growth similar to that recently experienced in Japan. Whereas Japan is a wealthy country that can afford to stagnate, China is a poor country vulnerable to unrest.

Because the rural population was allowed more freedom to experiment than were city dwellers whose capitalist experiments it was thought might pose a threat to China's SOEs, much of China's modern capitalist class consists of former peasants. In order to sustain the many SOEs on life support, the credit growth quota system contributed to structural problems that by 1988 brought urban inflation up to 21 percent. High inflation cut the population's real income. Combined with subsequent credit tightening by the government, this led to a severe recession that nearly precipitated a revolution – the incident at Tiananmen Square.¹³

Despite the general perception that China is transforming itself from a socialist economy to a market economy, central planning has actually increased when it comes to fiscal and monetary policy. For instance the ratio of government expenditures to GDP grew from 12 percent in 1997 to over 18 percent in 2000. Moreover, in 1998, the performance of SOEs fell to its worst level in years. In an attempt to clean up their loan portfolios, in 1999 and 2000 the four major Chinese banks transferred non-performing loans to SOEs (largely made under political pressure prior to 1995) equal to 1.3 trillion

yuan to asset management companies set up by the government. But even after that transfer, their non-performing loan (NPL) ratio to total loans is estimated at 35 to 40 percent. The bottom line is that China's high growth rates have been based on a delicate balance that might be difficult to sustain.¹⁴

Since SOEs employ roughly half of all urban workers, urgently needed structural adjustments to resolve the NPL problem, together with necessary reforms (privatization?) to the SOEs, will likely cut short-term growth rates, and undermine social stability. The question remains whether China is capable of smoothly modernizing its monetary policy framework and resolving its NPL problems without major social upheaval. The last major recession led to violent repression of free expression at Tiananmen Square.¹⁵ Could the next lead to forced reunification?

MILITARY COMPETITION IN THE TAIWAN STRAIT REGION

There is fairly broad consensus regarding the military balance in the Taiwan Strait.¹⁶ The static counts for PRC and Taiwanese forces are presented in Table 1. The PRC is substantially larger than Taiwan with all attendant consequences: a larger GDP, military force structure, and defense budget. The post-Maoist economic reforms launched a sustained period of rapid economic growth that allowed the People's Liberation Army (PLA) to increase its capabilities and shift its missions from strictly territorial defense towards power projection.

Meanwhile, there is evidence the PLA is reducing its size, but transforming itself into a more professional, better trained and better equipped force.¹⁷ This suggests the Mainland is indeed orienting itself less toward territorial defense and more toward power projection. According to a Defense Department report:

... Beijing's military modernization program . . . is designed to prepare the PLA to conduct regional active defensive warfare in support of Chinese economic interests and sovereignty claims – a doctrinal shift away from a focus on the large-scale, land-based guerrilla warfare of Mao's classic 'People's War'. Rather than technological breakthroughs, Beijing's military modernization effort could more accurately be described as a focus on asymmetric engagement capabilities.¹⁸

Further evidence of the PLA's transition is provided by the increased mobility of ground forces through reorganization into Group Armies, elite rapid reaction forces and smaller reserve components. For instance, paramilitary and security functions have been largely relegated to the People's Police. In contrast, the armed forces in Taiwan have, for some time, been structured and equipped to repel an invasion from the Mainland.¹⁹

The PRC's recent military investments have a strong flavor of power projection, especially toward the "near abroad". The build-up of relatively short-range ballistic missiles (SRBM) continues, with most of those forces deployed against Taiwan. "Within the next several years, the size of China's SRBM force is expected to grow substantially."²⁰ China's naval forces are also being modernized, with newer models of surface combatants and submarines clearly designed to increase its capabilities to

Table 1
Mainland-Taiwan military balance in static terms

<i>Category</i>	<i>PRC</i>	<i>Taiwan</i>
National (2001)		
Population	1293 M	22 M
GDP	\$1200B	\$290B
Defense budget	\$47B	\$11B
Armed forces personnel		
Active	370K	227K
Reserves	1700K	500–600K ^a
Land forces		
Available forces	48 Divisions ^b	21 Divisions ^c
Naval forces		
Large surface combatants	63	32
Small surface combatants	109 ^d	59
Submarines	67	4
Mine warfare	39 ^e	12
Amphibious	56	18
Fleet replenishment and support	66	15
Air forces (Air Force and Navy)		
Bombers	245	0
Fighters	2122	414
Transports ^f	513	53
Tankers	10	0
Recce/EW/AEW	290	15
Theater missiles		
IRBM	130–150	0
SRBM	335	0

Source: IISS, *The Military Balance, 2002-2003*, London: Oxford University Press, 2002.

Notes

- Plus a large number of paramilitary forces (1.5 million).
- Forty-four divisions in the Group Armies plus three airborne (Air Force) and three marine brigades.
- Includes five divisions on Quemoy and Matsu, two Marine and seven reserve divisions.
- Excludes coastal patrol craft.
- Includes one minelayer.
- Mostly light and medium transports, potentially usable in a Taiwan Straits conflict. Mainland forces include 35 heavy transports of Soviet or Russian origin.

control nearby ocean areas (such as the Strait) or to impose a blockade against Taiwan shipping. Imports of Russian fighter aircraft and air-air munitions have improved the PLA's air superiority capabilities. The addition of larger transport aircraft has enhanced its ability to establish an air bridge across the Straits. Larger numbers of air-to-surface and surface-to-surface missiles have also improved the PLA's ability to take control of the Straits, and to discourage third-party intervention (access denial), for instance, from the US Seventh Fleet.²¹

Meanwhile, the armed forces on Taiwan have settled into a long-term military competition with the Mainland. Taiwan defense planning is largely focused on defeating an invasion or blockade. While Taiwan has shown significant willingness to import new military equipment and incorporate new technology into its armed forces, recent defense reforms have included reducing personnel strength – albeit by a smaller percentage than has the PLA. However, these smaller forces tend to be better trained and equipped than their Mainland counterparts.²² The Taiwan Air Force, for example, has significantly fewer aircraft but a substantial advantage in modern (fourth-generation) fighters. Its Navy is reasonably well equipped, well run and well maintained. Land forces are well structured for counter-landing operations, with significant air defense capabilities.

However, Taiwan continues to face some significant challenges. Especially worrisome are the buildup of SRBMs on the Mainland for which they have no effective defense, and the imbalance in submarine forces coupled with a weak Taiwanese Anti-Submarine Warfare (ASW) capability. While neither military has yet achieved contemporary standards of joint operations, battlefield awareness, or command control and precision strike, both are taking steps to improve their performance in these areas.²³

TAIWAN STRAIT SCENARIOS

There is fairly widespread agreement on the most likely forms of military conflict that could take place in the Taiwan Straits.²⁴ The range of possibilities can be captured reasonably well in four scenarios:

1. *Low-level harassment.* The ballistic missile tests of 1996 are one good example. Less flashy but likely more worrisome would be a concerted program of maritime harassment, featuring seizures of Taiwanese merchant and fishing vessels on various pretexts.
2. *Blockade.* The PRC could decree that all air and sea shipments into Taiwan must first be screened at a Mainland facility – with dire consequences for those not complying. A successful economic blockade would likely force a negotiated reunification.
3. *Limited air and missile strikes.* Completed against Taiwanese military installations – especially airfields and command control facilities – the objective of the strikes would be more psychological than military to demonstrate the island's vulnerability to the PLA's military power.
4. *Full-scale invasion.* The objective would be forced reunification through a military takeover of the island.

A recent RAND study²⁵ of the confrontation in the Taiwan Strait selected the invasion scenario for its analysis. The authors argued that the relative attractiveness of the other choices is ultimately governed by the expected outcome of a full-scale invasion. An invasion offers the most decisive and complete answer to the question of reunification. We believe similar considerations have made invasion the central planning scenario in military exercises for both the PLA and Taiwan Ministry of Defense.

For the purposes of this paper, we focus on the invasion scenario. However, the framework developed below acknowledges the possibility that the PRC might shift its strategy after an unsuccessful or only partly successful invasion, and instead engage in hostilities against Taiwan through low-level harassment or a blockade to achieve its goal of compelling a negotiated reunification on terms favorable to Beijing.

PRELIMINARY NET ASSESSMENT: PRC vs TAIWAN

As noted, the principal advantage the PRC has today is quantitative. If its numerically superior forces could be transported to Taiwan and supported in sufficiently large numbers, then an invasion would soon overwhelm the defenders. However, whereas Taiwan has a numerical disadvantage, it enjoys a generally superior quality of troops and equipment. Another factor favoring Taiwan is its defensive orientation. While reserves on the Mainland are of little, if any, direct use in an assault on Taiwan, reserve forces in Taiwan would be fighting on their home territory and would therefore likely be more effective in defense of their homeland. In the event of an invasion, the mainland must rely on its core of active units that are expensive to equip and sustain. Conversely, Taiwan can rely on augmenting its active forces by mobilizing its relatively less expensive and highly motivated reserves.

A third, and related, set of advantages for Taiwan follows from its geography. The invasion of Taiwan would involve passage across the Taiwan Straits, requiring simultaneous establishment of air, land, and sea superiority. At present, there is neither reason to believe the PLA is capable of establishing sufficient control of the Straits to support an invasion, nor of transporting the necessary invasion force to defeat the local defenses.²⁶

Besides the obvious water barrier, the Taiwan Straits are a very difficult arena in which to conduct anti-submarine warfare (ASW) – a notable PLA weakness.²⁷ Consequently, even a few strategically located submarines could seriously threaten a large amphibious landing group. Moreover, the west coast of Taiwan has only a limited number of areas conducive to amphibious landings, muddy beaches being much more common than sandy.²⁸ Airborne and helicopter borne insertions are possible. However, sustaining high-intensity conflict against a well-equipped and motivated resistance is likely impossible without substantial sea-borne landings to bring in the necessary quantities of materiel.

The basic backdrop to the balance of forces in the Taiwan Straits is fairly straightforward. In the near future, a cross-Strait invasion of Taiwan would be a military adventure with high risks for all concerned, but especially for the PLA. The PLA has immense advantages associated with quantity, as one would expect. However, the armed forces

of Taiwan have a significant qualitative advantage in several key areas, notably in their modern fighter aircraft and in their aircrews.²⁹ Furthermore, the PLA lacks power projection capability over water. It cannot be confident of its ability to exert air and sea control in the Taiwan Straits against determined defenses in conditions of modern, high-tech warfare. Just as importantly, the PLA is not yet in a position to transport sufficient combat power to Taiwan to sustain a successful invasion against land forces on the island.³⁰

The long-term military perspective of the Taiwan Strait situation, however, is more ominous. The PLA can, and likely will, take steps to solve its quality problems. While the PRC is improving the quality of its forces and is increasingly structuring them for power projection, Taiwan cannot ever hope to overcome its numerical disadvantage. Moreover, whereas the PLA has extensive access to equipment and technology from abroad, pressure exerted by the PRC against potential arms suppliers to Taiwan severely restricts their options, increasingly shifting the military balance in favor of the PRC over time.³¹

In short, the PRC is steadily enhancing its ability to invade and conquer Taiwan, even against determined resistance. It has the ability, and demonstrated willingness, to use its increasing national power to limit Taiwan's options to counter this threat. While this obviously poses significant problems for Taiwan, it is also a matter of some concern to the United States – Taiwan's main strategic ally.

Under the Taiwan Relations Act outlined below, the US is committed to ensure that any reunification is achieved through peaceful means. At present, the possibility of US intervention against an invasion is a major factor in the balance of power in the Taiwan Strait. It is likely that the credibility of US intervention will become more important as time goes on. Thus US policy-makers will increasingly be challenged to weigh the benefits of alternative options to prevent forced reunification against the costs of intervention. The game structure developed in the next few sections offers a disciplined approach to review and address these challenges.

Preliminary Net Assessment: PRC vs. US Intervention

The relevant underpinnings of US involvement and possible intervention in the Taiwan Strait are found in the Taiwan Relations Act of 1979.³² Section 3 of the Act (the current "scrap of paper") contains three provisions. First, the US will make available to Taiwan sufficient military goods and services for a "self-defense capability". Second, the assessment of necessary capabilities is to be made through consultations between the executive and legislative branches. Finally, the US will take "appropriate action" in response to threats to Taiwan's security.

As a consequence of this Act, the US government finds itself in the role of an arms supplier to Taiwan, and could find it necessary to intervene should the PRC engage in military hostilities against Taiwan. For purposes of this discussion, we assume that timely US intervention can prevent a successful invasion of Taiwan. China's activities to deny or deter US intervention would likely begin in anticipation of (and might actually signal) a planned invasion.

Access Denial

The possibility of access denial activities by the PRC to counter US force projection is embedded in US military planning. “Access denial posits military actions designed to disrupt and delay the deployment of US and allied forces.”³³ A key aspect of the Taiwan Straits confrontation is the possibility of outside intervention from the United States and its coalition partners. A determined PRC can be expected to take measures to either deny intervening powers access to the Taiwan Strait, or at least to delay effective intervention.

Access denial capabilities impart at least two major advantages to the PRC. First, the chance of a successful invasion is directly related to delaying the arrival of US forces. Second, even if an invasion were unsuccessful due to US intervention, the PLA could still employ access denial strategies in conjunction with a shift to blockade. In the event that access denial is successful in preserving an effective blockade against Taiwan, the PRC would eventually expect the US and Taiwan to negotiate reunification rather than endure the continued economic costs of a blockade.³⁴

Access Deterrence

The possibility exists that US intervention against a PRC invasion of Taiwan *might* be deterred through threats of strikes against the US homeland using Weapons of Mass Destruction (WMD), and that US National Missile Defense (NMD) programs are a logical counter.³⁵ The authors have called this access deterrence, “An interesting variant of [access denial] is to deter (or preclude) deployment using (asymmetric) threats of attack . . .”³⁶ Simon discusses a similar problem, explaining that the US “would be more likely to intervene in a conflict [between countries A and B where the US has a friendship with country B] if A is conventionally-armed than if it is nuclear-armed. This is simply because the US would be more directly threatened by a nuclear-armed opponent than by a conventional-armed opponent.”³⁷

An aim of this paper is to explore the operational usefulness of a US National Missile Defense (NMD) or Ballistic Missile Defense (BMD) shield in this context.³⁸

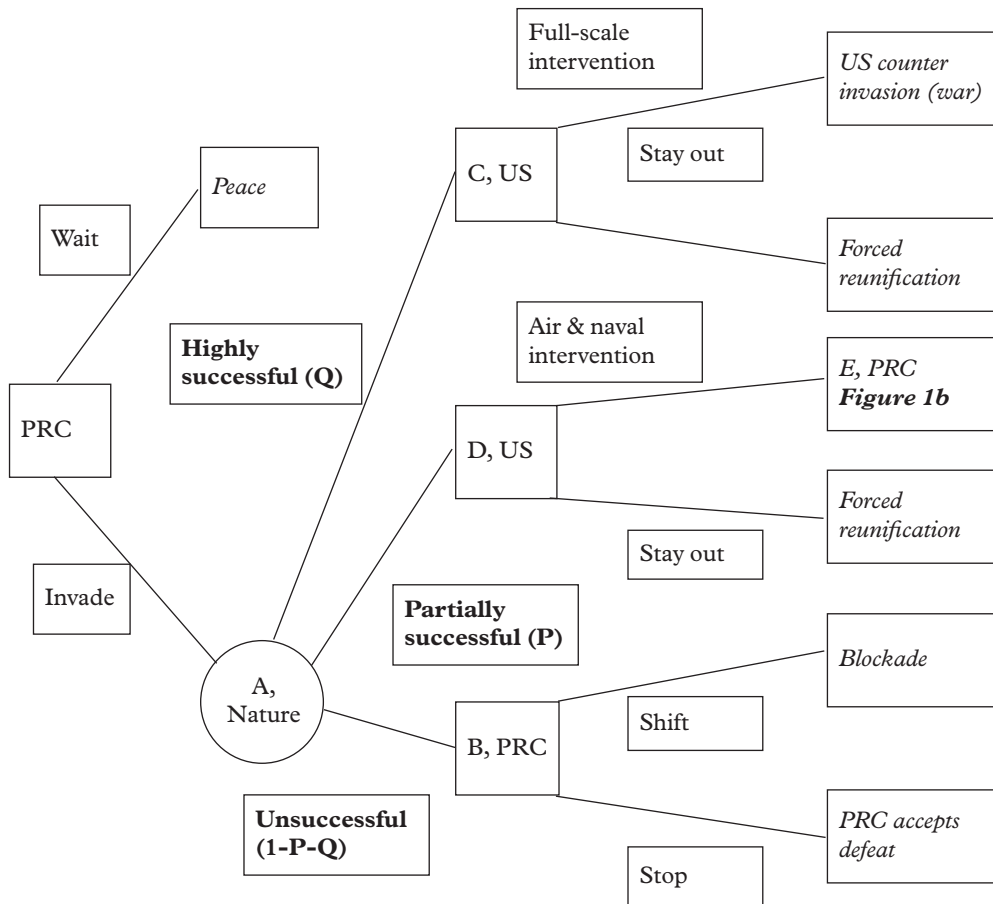
Any serious threat of a future nuclear strike by the PRC against the US homeland (say circa 2015) would likely involve more than 100 warheads, enough to overwhelm a small-scale NMD, but probably not enough to overwhelm a large-scale NMD. We will differentiate between possible future US “types”, according to whether the country has a small- or large-scale NMD capability at that time.³⁹

THE GAME SCENARIO⁴⁰

Applying the logic of game theory, we look forward and reason back. The extensive form of the game (or game tree) illustrated in Figures 1a and 1b reveals a sequential series of possible moves and counter-moves from our two players: the PRC and the US. The invasion scenario begins from the perspective of the first player – the PRC. In looking forward, the starting point of the game involves two decisions that face the PRC: to “Wait”, in which case there is continued Peace; or to “Invade”, in which case the PRC launches a full-scale invasion of Taiwan.

The “nature” of the military balance between the PRC and Taiwan at the time of the attack determines the success or failure of the PRC’s decision to invade. Three possibilities are modeled: a “Highly Successful” invasion (with probability Q), “Partially Successful” (with probability P), or “Unsuccessful” (with probability $1-P-Q$). These three states of nature emanate from Node A in Figure 1a labeled as “Nature”, and reflect the military balance that exists between Taiwan and the PRC at the time of the decision to invade.

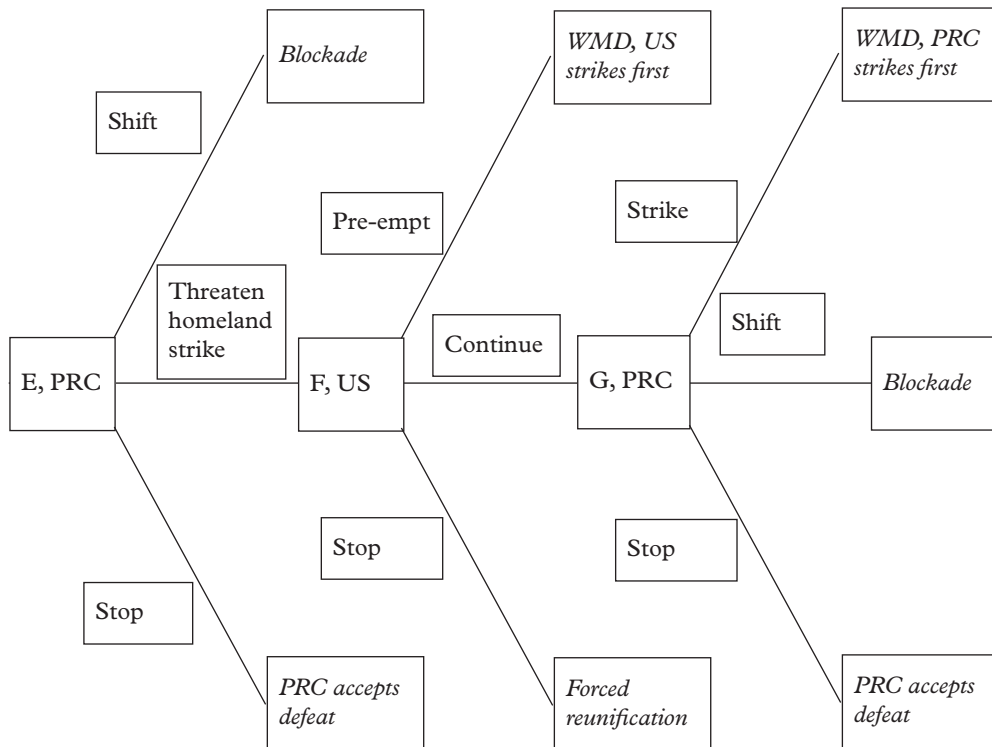
Figure 1a
Game scenario in extensive form



The result of the PRC invasion is termed “Unsuccessful” if the Taiwanese defenders can repel the invasion without any US intervention. In that case, the PRC has two options (Node B). It can “Shift” to low-level harassment and a blockade against Taiwan (and simultaneously engage in access denial activities against any US attempts to thwart the blockade). Alternatively, it can “Stop” all military operations and accept the defeat of its attempted forced reunification.

The probability (Q) of a highly successful invasion depends on the military balance at the time of the invasion, the position of US air and naval forces, and the PLA’s access

Figure 1b
Subgame from Node E



denial activities – its efforts to contest US force projection into the theater of operations. If the PRC invasion turns out to be “Highly Successful”, this leads to only two possible responses from the other active player in the game – the US. The US options (Node C) are: to implement a “Full-Scale Intervention” to reverse the invasion; or to “Stay Out” and accept forced reunification. The outcome of a US decision to intervene (“US Counter Invasion” or War) is likely to be costly in terms of both lives and resources.

Finally, if the invasion is only “Partly Successful”, then US intervention is necessary (and assumed sufficient) to prevent forced reunification. That is, the US (at Node D) can choose “Air and Naval Intervention”, or to “Stay Out” and accept forced reunification. If the US chooses to intervene, the PRC (at Node E, Figure 1b) has three options: to “Stop” and accept defeat; to “Shift” its engagement to a blockade against Taiwan; or to engage in access deterrence – to “Threaten Homeland Strike” (WMD strikes against the US homeland).

The US response to the threat of a homeland strike (Node F) is either to: “Stop” and withdraw, in which case there is forced reunification; to “Pre-empt” in which case the outcome is a WMD attack where the US strikes first; or to “Continue” its deployment (“Air and Naval Intervention”). In the event the US continues its deployment the PRC has a final decision (Node G): to “Strike” or carry out its threat of a WMD attack on the US; to “Shift” its strategy to a blockade, or to “Stop” and accept the defeat of its forced reunification.

Possible Outcomes

There are 12 ending nodes, with seven separate “outcomes”. The outcomes themselves are best viewed as truncations of a more complicated game tree (or as supporting scenarios). The outcomes themselves are briefly described below.

Peace: No military hostilities.

Forced reunification: The invasion is successful, or will be, and the US decides not to intervene.

US Counter Invasion: The US attempts to reverse a PRC invasion of Taiwan. This is likely to be costly in terms of both lives and resources.

Blockade: The PRC declares an air and naval blockade of Taiwan. A blockade is likely to last a considerable length of time, is costly for all parties involved, and could eventually lead to reunification on terms favorable to Beijing.

PRC Accepts Defeat: The invasion is unsuccessful. The PRC accepts the defeat of its forced reunification attempt – possibly awaiting better opportunities in the future.

WMD, US Strikes First: The US chooses to pre-empt against the possibility of a Chinese WMD attack against the US mainland. The attack itself is likely to feature weapons of selective destruction, with nuclear forces and command control networks as the primary targets.

WMD, PRC Strikes First: The PRC carries out its WMD threat. We postulate at most a few hundred warheads against US area targets.

Player Types

We consider four US player types and four PRC player types. The US types vary according to two dimensions: the size of US National Missile Defense (NMD – or US ability to overcome access deterrence); and the effectiveness with which US forces can access the Taiwan Strait in the event of conflict – US ability to overcome access denial. The four US player types include: small NMD & Assured Access, US(S, A); large NMD & Assured Access, US(L, A); small NMD & Contested Access, US(S, A’); large NMD & Contested Access, US(L, A’).

The four PRC player types are referred to as “confident”, “patient”, “impatient” and “desperate”. A *confident* China is highly secure, enjoying economic prosperity, stability and reform. This player is confident enough in eventual reunification and is willing to wait for peaceful reunification with Taiwan through economic integration. A *patient* Chinese regime is under some pressure at home due to issues concerning the economy or the legitimacy of the regime that reduce the prospects for peaceful reunification with Taiwan. Pressure is building for forced reunification. An *impatient* China is under considerable pressure to produce results on Taiwan, and to do so fairly quickly. Finally, a *desperate* Chinese regime is in danger of losing control of the Mainland and sees forced reunification with Taiwan as its best means of reclaiming legitimacy.

Preference Orderings

The players' preference orderings over the seven possible outcomes are reported in Table 2 for the four US player types, and Table 3 for the four PRC player types. An ordinal ranking of the seven possible outcomes of the US confrontation with the PRC (with 1 most preferred and 7 least preferred) appears for each player type.

For example, take the first player listed in Table 2, US player 1, or US(S,A) with a Small NMD and Assured Access to the Taiwan Strait. Regardless of the US player type, the assumption is that the Peace outcome is always preferred to a PRC Defeat. US player 1 favors peace (rank 1) followed by a PRC Defeat (rank 2), a blockade (rank 3), and favors Forced Reunification (rank 4) over a War to recover Taiwan or US counter invasion (rank 5). However, Player 1 favors a War to retake Taiwan over a WMD US first strike on China (rank 6), and considers a WMD PRC first strike on the US the worst possible outcome (rank 7).

In contrast, US player types 2 and 4, US(L,A) and US(L,A'), in Table 2 are assumed to possess sufficiently large NMD capabilities to prefer risking a WMD PRC first strike on the US rather than launch a WMD first strike on China.⁴¹ It is also assumed that players facing contested access (US player types 3 and 4) would rather face forced Reunification than deal with the costly consequences of a persistent Blockade.

Table 2
US player rankings

<i>US player types</i>	1	2	3	4
Outcomes	US (S, A)	US (L, A)	US (S, A')	US (L, A')
Peace	1	1	1	1
PRC defeat	2	2	2	2
Blockade	3	3	4	4
Force reunification	4	4	3	3
War	5	5	5	7
WMD, US First	6	7	6	6
WMD, PRC First	7	6	7	5

Notes

For the US player,

(S, A) = small NMD with assured access to the Taiwan Strait region;

(L, A) = large NMD with assured access;

(S, A') = small NMD with contested and uncertain access;

(L, A') = large NMD with contested access.

In Table 3, a "Confident" China (PRC player 1) prefers Peace (rank 1) to forced reunification (rank 2), and prefers Defeat (rank 3) to WMD warfare involving the US and Chinese homelands. A "Patient" China (PRC player 2) prefers forced reunification (rank 1) to peace (rank 2), but would rather accept defeat (rank 3) than conduct a costly blockade (rank 4). An "Impatient" China (PRC player 3) would accept a war involving the US counter-invasion of an occupied Taiwan (rank 3) over the prospect of the defeat

Table 3
PRC player rankings

<i>PRC player types</i>	1	2	3	4
Outcomes	Confident	Patient	Impatient	Desperate
Peace	1	2	2	4
PRC defeat	3	3	5	7
Blockade	4	4	4	3
Force reunification	2	1	1	1
War	5	5	3	2
WMD, US First	7	7	7	6
WMD, PRC First	6	6	6	5

of its attempted forced reunification (rank 5). A “Desperate” China, in danger of losing political control, most prefers forced reunification, but would rather fight a counter-invasion war by the US than conduct a (prolonged) blockade. Moreover it is ready to risk WMD attacks (US first strike or PRC first strike) rather than accept defeat.

Game Results By Player Type

The extensive form of the game (or game tree) for any two PRC and US players was presented in Figure 1 above. Applying the logic of game theory and the aid of an Excel spreadsheet (available upon request) we solved the 16 games that involve all possible combinations of player types. The results were derived as the authors have explained elsewhere, for example, by “looking forward and reasoning back”.

The key decision facing the PRC is to “WAIT” and maintain the *status quo*, in which case the outcome is continued “Peace”, or to “INVADE”. If the PRC chooses to invade, then from Figure 1 it must consider three possibilities: first, that the invasion is “Highly Successful” with probability Q ; second, that it is only “Partly Successful” with probability P ; and finally, that it is a “Failure” with probability $(1-P-Q)$. The question remains how to analyze the games with these probabilities.

Since the player’s preferences over the outcomes are expressed as ordinal rankings we cannot calculate expected values. In any case expected values are more appropriate for a repeated game, whereas the decision by the PRC to Wait or to Invade might better be modeled as a “one shot” game. Regardless, a useful way to solve this set of games is through “maximum likelihood”. Maximum likelihood in this case reveals which is the most likely event given an invasion attempt: Success, Part Success, or Failure.

The maximum likelihood expression is simply $\text{Max}[P, Q, 1-P-Q]$. For example, if we believe the PRC thinks the highest probability (or maximum likelihood) is $\text{Max}[P, Q, 1-P-Q] = P$, then it will consider its attempted invasion is most likely to be Partly Successful. This narrows the problem down to simply comparing Peace (from waiting) with the payoff for the PRC at node D in Figure 1a (continued in Figure 1b). Tables 4, 5 and 6 report the outcome of the PRC’s decision to wait or to invade for different possible pairs of players, when invasion is most likely to be: Partly Successful (Table 4),

Highly Successful (Table 5), or a Failure (Table 6). Note that the “Peace” outcome in the Tables always corresponds to a PRC decision to wait, while any other reported outcome reflects the (likely) result of an attempted invasion of Taiwan.

Table 4 reports the outcome of the PRC’s decision to wait or to invade when an attempted invasion of Taiwan is most likely to be only partly successful. In this case, regardless of which US player they face, both a “confident” and “patient” China (PRC players 1 and 2) will always wait, with the outcome continued Peace. An “impatient” China (PRC player 3) facing a US player for whom access to the Taiwan Strait is assured (US players 1 and 2) will also choose to wait. However if the same China faces a US player (US players 3 and 4) for whom access to the Taiwan Strait is contested for any reason – from internal political pressure in the US to stay out, to access denial activities by the PRC to keep the US out – then the PRC will choose to invade and the most likely outcome is forced Reunification. Finally, in the case of a “desperate” China (PRC player 4) the choice will always be to invade. If this desperate China faces a US player for whom access is assured (US players 1 and 2) then an invasion will most likely result in a blockade. However, if access is contested, then invasion will most likely lead to forced reunification. Interestingly, a small or large US NMD appears to matter less than whether or not access is denied.

Table 4
Results for player combinations when invasion is likely partially successful:
PRC decision table for Node D vs Wait

		<i>PRC</i>			
		<i>Node D</i>	1	2	3
US	1 (S, A)	Peace	Peace	Peace	Blockade
	2 (L, A)	Peace	Peace	Peace	Blockade
	3 (S, A')	Peace	Peace	Forced reunification	Forced reunification
	4 (L, A')	Peace	Peace	Forced reunification	Forced reunification

Table 5 reports the outcome of the PRC’s decision to wait or to invade when an attempted invasion of Taiwan is most likely to be highly successful. In this case, regardless of which US player they face, a “patient”, “impatient”, and “desperate” China (PRC players 2, 3 and 4) will always choose to invade, with the most likely outcome forced reunification. However, a “confident” China (player 1) will always choose to wait, regardless of which US player it faces.

Table 6 reports the outcome of the PRC’s decision to wait or to invade when an attempted invasion of Taiwan is most likely to end in Failure. In this case, regardless of which US player they face, a “confident”, “patient”, and “impatient” China (PRC players 1, 2, and 3) will always choose to wait. However, a “desperate” China (PRC player 4) will choose to invade, with the most likely outcome being a blockade, regardless of which US player it faces.

Table 5
Results for player combinations when invasion is likely highly successful:
PRC decision table for Node C vs Wait

<i>Success vs Wait</i> Node C		PRC			
		1	2	3	4
US	1	Peace	Forced reunification	Forced reunification	Forced reunification
	2	Peace	Forced reunification	Forced reunification	Forced reunification
	3	Peace	Forced reunification	Forced reunification	Forced reunification
	4	Peace	Forced reunification	Forced reunification	Forced reunification

Table 6
Results for player combinations when invasion is likely to fail:
PRC decision table for Node B

<i>Failure vs Wait</i> Node B		PRC			
		1	2	3	4
US	1	Peace	Peace	Peace	Blockade
	2	Peace	Peace	Peace	Blockade
	3	Peace	Peace	Peace	Blockade
	4	Peace	Peace	Peace	Blockade

CONCLUSIONS

A “Confident” China is unambiguously peaceful. A China that is “Patient” or “Impatient” tends to be belligerent, but can be deterred through investments that assure US access to the Taiwan Strait (overcoming access denial activities) and robust defenses on Taiwan. As one might expect, it is more difficult to deter an Impatient than a Patient China. In this game theoretic framework, a Patient China can be deterred unless an invasion is likely to be highly successful. However, an Impatient China would launch an invasion even if it is likely to be only partially successful. An Impatient China with significant access denial capabilities is especially difficult to deter. A “Desperate” PRC is very warlike and otherwise unpleasant to live with. The most likely result is invasion followed by forced reunification, unless Taiwan is able to repel the invasion without outside intervention. (This is our worst case scenario.)

For the US, the PRC’s Access Denial capabilities (raising the cost of engaging in the Taiwan Strait area) matters more than the PRC’s Access Deterrence threats to the US homeland. There is no difference in results for large US NMD vs. small NMD. Among other things, this suggests the possibility that resources committed to Confidence Building Measures (CBM) that lead to a Confident China might substitute for National Missile Defense (NMD) investments. In contrast, capabilities for contesting US access on a sustained basis make the Blockade result more costly for the US. If, as we have assumed,

strongly contested access makes “Forced Reunification” better than “Blockade” in US preferences, results of any confrontation can change significantly.⁴²

A number of interesting insights emerge from the analysis presented here. China’s policy regarding unification with Taiwan appears less as a cycle of compromise and tough talk and more as a response to conditions on the Mainland itself. We think the cyclical view is valid but incomplete. Military action against Taiwan by a secure (“confident”) PRC regime, for example, is highly unlikely. While the Taiwan Relations Act does indeed introduce ambiguity into the Taiwan Straits situation, it is also true that US intervention becomes more or less likely based on a number of considerations, some of which have been explored here.

With regard to the PRC, there are two useful observations. First, a “confident”, secure China is in the best interests of the US. More accurately, the political and economic conditions that lead to a secure, confident China are in US interests. Improved economic and political relations combined with confidence-building measures can help create those conditions. Second, the effectiveness of US policies is sensitive to the future state of the PRC. For example, our analysis indicates that a “confident” China is unambiguously peaceful, a revisionist China (“patient” or “impatient”) is belligerent but can be deterred, and a “desperate” China is unambiguously hostile.

For the United States, the Taiwan Strait question is difficult now, will become more difficult in the future, and could involve an international crisis of a severity not experienced in the past four decades. Given those considerations, muddling through is not a promising approach.⁴³ However, neither of the post-Soviet US Administrations seems to have found good alternatives. To further that aim, we suggest military analyses at the strategic level (attempted here) and policy analyses at the national level intended to anticipate and perhaps avoid the worst consequences. We think military analyses at the operational level have entered diminishing returns with respect to their ability to inform national policy – basically because that level of analysis seems to have been done well already.

Besides the current ambiguous policy of muddling through to avoid potential military conflict, there are two clear choices for US policy-makers: disengage or engage.⁴⁴ The US can disengage from Taiwan by progressively weakening its military commitment, while encouraging and helping Taiwan get the best possible terms of reunification with the Mainland. Alternatively, the US can engage by strengthening its position against forced reunification to one of limited self determination for Taiwan. (Such a policy would likely imply the possibility of *de facto* but not *de jure* independence.) While both approaches are difficult, costly, and risky to execute, they may be more promising than muddling through.

Disengagement would be a controversial choice at home and carry risks abroad. There is strong pro-Taiwan element in the American body politic. Moreover, disengaging could greatly increase the incentives for Taiwan to acquire weapons of mass destruction. The second choice also carries risks. A PRC that perceives a hardening commitment to Taiwan is unlikely to behave in ways that support long term US interests.

Should the US choose some variation of the engagement option, we think our

analysis provides some insights for framing future policy questions.⁴⁵ Our analysis suggests some clear priorities in protecting Taiwan's self-determination should the US choose to do so: first, improve Taiwan's ability to defend itself, and second, preserve capabilities for timely US intervention.

Finally, the game model in this paper suggests a much lower priority for constructing a relatively large NMD that can defeat a Chinese WMD attack; it does not provide much leverage in a confrontation with a PRC determined to achieve reunification with Taiwan through invasion. While a large NMD might serve other purposes (even with respect to the PRC), our analysis indicates it does not provide much return on investment in a Taiwan Strait contingency.⁴⁶

NOTES

1. The document in question was an 1839 treaty, whose provisions included Prussian and British guarantees of Belgian neutrality in the event of a general European war. The "scrap of paper" characterization was attributed to the German Chancellor (Bethman-Hollweg) after a conversation with the British Ambassador. "4 August 1914, Origin of the Term 'A Scrap of Paper'", *The World War I Document Archive*, www.hcu.ox.ac.uk/mirrors/www.lib.byu.edu:80/, 15 April 1996, accessed 13 June 2003. Remak, J., *The Origins of World War I: 1871-1914*, Hinsdale, IL: Dryden, 1967. LaFore, L., *The Long Fuse: An Interpretation of the Origins of World War I*, Philadelphia: Lippincott, 1965. Massie, R., *Dreadnought: Britain, Germany and the Coming of the Great War*, New York: Random House, 1991.
2. This is a statement widely attributed to Deng. One translation is "It doesn't matter the color of the cat as long as it catches mice." www.paulhrabal.com/quotes.htm, accessed 15 May 2003. The statement has also been noted as a Chinese proverb.
3. World Bank, *China at a Glance*, 14 September 2002.
4. Two recent articles by D. Gonzales discuss the Cuban regime's crackdown on dissidents, and its relation to stated fears of subversion and aggression. "Cuban Dissidents Get Prison Terms as Long as 27 Years," *New York Times*, 8 April 2003, A9. "Dissident Accuses Cuba of Manipulating Fear of US Invasion," *New York Times*, 20 May 2003, A5.
5. A. Cordesman, *China and the US: National Missile Defenses and Chinese Nuclear Modernization*, Washington, DC: Center for Strategic and International Studies (CSIS), 2001.
6. Franck and Melese (2002) also discuss Access Denial and Access Deterrence as separate matters. We consider Access Denial as operations intended to preclude or delay the deployment of US forces into any given region. We define Access Deterrence as an attempt to preclude US intervention through threats of strikes with Weapons of Mass Destruction (WMD) against the US homeland. Franck, R. and Melese, F., "The Access Deterrence Scenario: a New Approach to Assessing National Missile Defenses", *Defense & Security Analysis*, 18(3), 2002, pp. 227-238.
7. US Secretary of Defense, *Report to Congress Pursuant to the FY2000 National Defense Authorization Act*, p. 46.
8. Country Profile Table from www.devdata.worldbank.org, accessed 11 March 2003.
9. World Bank, *China at a Glance*, 14 September 2002.
10. Pesek, W., "China's fragile economic foundation," www.iht.com, accessed 10 March 2003.
11. Ikeya, M., *Rating & Investment Information Inc.*, 22 January 2002, p. 2.
12. "Banking on Growth", *The Economist*, 18 January 2003, p. 67.
13. Gong, G., "Tiananmen: Causes & Consequences", *Washington Quarterly*, Winter, 1990.
14. Ikeya, M., "China - Unique Strengths and Weaknesses of Monetary Policy", *Rating & Investment Information Inc.*, 22 January 2002.
15. Gong, G., *op. cit.*
16. Examples are Bitzinger, Whitehurst, Shlapak and Cordesman. Bitzinger, R. and Gill, B.,

- Gearing Up For High-Tech Warfare? Chinese and Taiwanese Modernization and Implications for Military Confrontation Across the Taiwan Strait, 1995–2005*, Washington, DC: Center for Strategic and Budgetary Assessments, 1996. Whitehurst Jr., C., *American Military Options in a Taiwan Strait Conflict*, Clemson, SC: Strom Thurmond Institute, 1999. Shlapak, D., *et. al*, *Dire Strait? Military Aspects of the China-Taiwan Confrontation and Options for US Policy*, Santa Monica, CA: RAND, 2000. Cordesman, A., 2001.
17. Bitzinger, R., *ibid.*, Shlapak, D., *ibid.*, and Cordesman, A., *ibid.*
 18. US DOD, “The Security Situation in the Taiwan Straits”, *Report to Congress Pursuant to the FY1999 Appropriations Bill*, February 1999.
 19. Ministry of National Defense, Republic of China, *2000 National Defense Report*, Military History & Translation Bureau (trans.), Taipei: Ministry of National Defense, August 2000. See especially Chapter 3.
 20. US DOD, *op. cit.*
 21. Shlapak, D., *op. cit.*, Cordesman, A., *op. cit.*
 22. Shlapak, D., *op. cit.* www.emerald designs.com/matchup, 2002, accessed 2 May 2003.
 23. Bitzinger, R., *op. cit.*, Shlapak, D., *op. cit.*
 24. Bitzinger, R., *op. cit.*, Whitehurst, C., *op. cit.*, Shlapak, D., *op. cit.*. However, the Federation of American Scientists website features a longer list, www.fas.org/man/dod-101/ops/taiwan-background.htm, accessed 1 May 2003.
 25. Shlapak, D., *op. cit.*
 26. Shlapak, D., *op. cit.* In addition, Taiwan is densely populated, with a number of large cities – which means labor-intensive urban combat, assuming the defenders are motivated. “Taiwan Geography”, www.fas.org/man/dod-101/ops/taiwan-geo.htm, accessed 1 May 2003.
 27. Bitzinger, R., 1996.
 28. “Taiwan Geography”, www.fas.org/man/dod-101/ops/taiwan-geo.htm, accessed 1 May 2003.
 29. Shlapak, D., *op. cit.*
 30. For example, the Federation of American Scientists website features an interesting discussion of the tasks and correlation of forces regarding the Normandy landings of 1944 compared with a hypothetical PRC invasion of Taiwan in the near future. Overall, the picture is not favorable for a near-term crossing of the Taiwan Strait, www.fas.org/man/dod-101/ops/taiwan-d-day.htm, accessed 1 May 2003.
 31. Press reports provide persuasive evidence that the PRC can affect both Taiwan’s arms acquisition opportunities and US arms sales decisions. In 2001, a US DOD study identified a number of needed items for Taiwan, which included diesel submarines and the AEGIS radar (which can track a large number of incoming ballistic missiles). That Taiwan eventually turned to the US for diesel submarines is interesting, since the US Navy has not ordered a non-nuclear submarine in decades and countries like Germany would be more logical choices. In the case of submarines, it appears the US was the arms supplier of last resort. The PRC objected to a proposed list of “advanced weapons” sales, which included surface combatants equipped with the AEGIS radar, antisubmarine warfare planes and diesel submarines. In the end, the US decided to sell submarines and other weapons, but not the radars – which the PRC was “most upset about” – despite identification as a Taiwan defense need. Gordon, M., “Secret Study Concludes Taiwan Needs New Arms”, *New York Times*, 1 April 2001, Section 1, p. 1. Eckholm, E., “China Expresses Concern Over Arms Sale to Taiwan”, *New York Times*, 25 April 2001, A8. Sanger, D., “Taiwan to Get Some Arms from US, but Not the Best”, *New York Times*, 29 April 2001, Section 4, p. 2.
 32. Text of the Act is available at <http://usinfo.state.gov/regional/ea/uschina/taiwact.htm>; accessed 26 May 2003.
 33. Franck, R. and Melese, F., *op. cit.*
 34. Components of an access denial plan could include items from a list including the following:
 - massed missile attacks, ballistic and cruise, against US Carrier Battle Groups;
 - political and diplomatic pressure to limit basing access, especially in Japan, Korea and the Philippines;

- open-ocean submarine operations against US CVBGs;
- special forces operations against US installations;
- information warfare, to include lethal measures against command centers and satellites; and
- nonlethal – weapons with wide-area effects (such as EMP pulse).

In the late 1990s, there were serious studies and assessments of potential access denial capabilities against deploying US forces conducted at the Naval Postgraduate School. As one would expect, these placed strong emphasis on counters to deploying Carrier Battle Groups. Harney's manuscript is one product of this effort. Harney, R., *The Enemy's Access Denial System*, unpublished manuscript, Monterey, CA: Naval Postgraduate School, December 2000.

35. Cordesman *op. cit.*, Nathan, J. and Tien, C., "The 'China Threat', National Missile Defense and American Public Opinion", *Defense & Security Analysis*, 19(1), 2003, pp. 35–54.
36. Franck, R. and Melese, F., *op. cit.*
37. Simon, M., "Rogue State Response to BMD: the Regional Context," *Defense and Security Analysis*, 18(3), 2002, pp. 271–292.
38. Any NMD candidate would have to pass technical feasibility and operational effectiveness tests, as well as demonstrate clear contributions to national security.
39. We assume a small-scale US NMD circa 2015 would provide highly effective protection against a strike involving a few dozen warheads, and that a larger-scale NMD would provide highly effective protection against a strike involving a few hundred warheads with countermeasures. We also assume the capabilities of the US NMD system are common knowledge. There are, of course, a number of interesting and highly relevant questions involving the technical feasibility of NMD and its effectiveness against an attack with countermeasures. These issues have been addressed elsewhere and are beyond the scope of this analysis.
40. The military balance between the PRC and Taiwan, plus US intervention forces, informs a PRC theory of victory. The success of the full-scale invasion scenario for the PRC depends on achieving all four of the following objectives: air superiority over the Straits; sea control of invasion routes across the Straits; air and missile strikes to prepare the battlefield on Taiwan; and landing a force of sufficient size to overcome local defenses. We add to this that the success of a campaign of forced reunification depends largely on "surprise", "disruption" and "persistence". Strategic "surprise" increases the chances that US forces are not well positioned to intervene, and would take longer to do so. The element of surprise also means major operations would be under way before Taiwan's sizeable reserve forces could be mobilized to protect key assets such as airfields, aircraft, naval combatants and command centers. Operational "disruption" exploits the opportunities that surprise presents. Large-scale air and missile attacks could destroy assets Taiwan requires to contest air and sea control in the Straits. Disruption of Taiwan's military command and control would reduce the capabilities of surviving forces and disrupt the mobilization of its reserves. Successful disruption activities would lay the groundwork for the PRC's invasion forces to defeat any remaining resistance. Finally, strategic "persistence" would see the PRC shifting to an air and sea blockade of Taiwan in the event of a failed invasion. Persistence in substituting a blockade for an unsuccessful invasion could eventually be rewarded in a negotiated reunification on terms favorable to Beijing.
41. A methodological note. Some would assert that the US always prefers to strike should homeland warfare with WMD come to pass. This is a reasonable view, with which we have no quarrel. However, none of the game results are affected by reversing this preference ordering. Moreover, our ordering might be viewed as something of a stretch to see if large-scale US NMD can make a difference. Therefore, our preference ordering imparts an *a fortiori* flavor to our results concerning the relative unimportance of large-scale NMD.
42. However, a US that has already engaged in combat operations for Taiwan might be more willing to stick with a counter-blockade campaign. This is also a matter outside the scope of this particular model.

43. The current US policy seems to have a strong “muddling through” component. This caused some embarrassment in US policy-making circles during the 1996 missile exercise crisis. President Clinton is reported to have said at the time: “I hate our China policy. I wish I was running against our China policy”, Gellman, B., *Washington Post*, 21 June 1998, A1. More recently, President George W. Bush has made statements affirming US commitment to defense of Taiwan. However, a US decision not to sell advanced radars (*Aegis* types is likely to have blurred the message). Sanger, D., “US Would Defend Taiwan, Bush Says”, *New York Times*, 26 April 2001, A1. Sanger, D., “Taiwan to Get Some Arms from US, but Not the Best”, *New York Times*, 29 April 2001, Section 4, p. 2.
44. Reasonable people can certainly find fault with our list of alternatives, which we do not believe is necessarily exhaustive. O’Hanlon, for example, finds considerable virtue in continued strategic ambiguity. O’Hanlon, M., “A Need for Ambiguity”, *New York Times*, 27 April 2001, Section A, p. 25.
45. Should the US choose to disengage, our analysis has much less to offer.
46. As noted, we find little advantage for large-scale US NMD in a Taiwan Strait confrontation. Interestingly, Franck and Melese reach a much different conclusion. In that case, the US faced a regional power with few prospects of success in a regional war conducted without WMD. In this particular case, the PRC always has the option of blockade. This provides real prospects of victory against a Taiwan highly dependent upon international trade and a United States that does not have vital interests at stake. Given a relatively attractive alternative, the PRC is unlikely to threaten WMD strikes, and therefore NMD does not make much difference. An effective, large-scale NMD of the US might have real returns, perhaps against China in other contexts. But this analysis indicates that such NMD doesn’t have much significance in a military confrontation over Taiwan.