THE IMPACT OF US-CHINA RELATIONS ON TAIWAN'S MILITARY SPENDING (1966-1992)

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Previous research has shown that Taiwan's military spending is affected either by China's military buildup or the US's military pipeline. This study investigates whether it is also true an ongoing US-China relationship has dynamic effects. Three major findings are obtained from the statistical analyses. First and foremost, the level of US-China conflict has a contemporaneous positive effect on Taiwan's military spending. Second, the analyses also indicate that the volatility of US-China relations has negative effects on Taiwan's military spending. This finding suggests that instability in US-China relations will prompt Taiwan to decrease its military spending due to a higher amount of perceived security on the one hand, and Taiwan wants to avoid further provoking China on the other. Third, analyses indicate that an error correction model fares better than a simple budgetary incremental model in explaining the re-equilibrating effects of GNP growth on Taiwan's military spending. Overall, the results demonstrate the interplay of domestic and international constraints and may help to predict what will be the expected military spending when Taiwan's economy changes. I suggest that Taiwan's military spending is likely to be influenced by US-China relations as well as by foreign investment and domestic economic constraints as long as the United States policy toward the Taiwan problem remains unchanged.

TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF ILLUSTRATIONS

Figure Page

CHAPTER 1

INTRODUCTION

1.1 Statement of the Problem

In the complex world of international relations, the Taiwan issue remains a principal difficulty in the relationship between the United States and China. Observers of US-China relations have always used the term "the Taiwan problem" to signify the difficulty in properly handling the Taiwan issue. Should the United States forge stronger and closer ties with Taiwan? Should the United States sell weapons to Taiwan? Should the United States establish cooperative or competitive relations with China? The answers to these questions, though seemingly straightforward, are not by any stretch of the imagination clear-cut. Finding appropriate answers to these questions has baffled policymakers in Washington, Beijing, and Taipei. Yet, one thing is clear. The so-called "Taiwan problem" implicitly means that Taiwan is a pawn in this game between two big powers.[1] That is, Taiwan's security is determined by actions of the United States and China.

Unlike most pawns in extended deterrence games, however, Taiwan holds some interesting bargaining chips. Taiwan is a vibrant emerging democracy with an equally vibrant economy. Today, Taiwan holds the world's third largest foreign exchange reserve, is among the world's top 15 trading nations, and supplies close to 60 percent of the world's information technology products.[2] Geographically, Taiwan is strategically situated in one of the world's most important sea-lanes. Militarily, with armed forces of about 370,000, it is one of the strongest armed forces in East and Southeast Asia.

That said, Taiwan's pariah status, due to lack of diplomatic relations with most countries in the world, makes actions by Taiwan's chief ally –the United States – and Taiwan's chief adversary – China – critical to Taiwan's military security. Foremost of these actions are the ebbs and flows in the relationship between the two powers. Since the founding of the People's Republic of China (PRC) in 1949 and the eventual de-recognition of the Republic of China (ROC) in 1979, levels of conflict and cooperation between the United States and China have affected Taiwan's perception of its own military security.

Some scholars have argued that a good US-China relationship is likely to benefit Taiwan and thereby enhances Taiwan's security (Huang, Kim and Wu 1992; Vogel 1997; Roth 1999; Lin 2000; Lasater 2000; Tan and Yu 2001). There are others such as Fisher (1998) and Wang (1998) who argue that an improved US-China relationship actually hurts Taiwan's interest and therefore compromises its security. However, other research contends that the United States strategic policy of maintaining the status quo makes US-China relations irrelevant to Taiwan's security (Chen 1999). These three contrasting scholarly views (which will be discussed in depth shortly) cannot possibly be supported by the same empirical reality. The question that this dissertation examines, therefore, is the following: What is the impact of the US-China relationship on Taiwan's military security? More specifically, does conflict or cooperation between the United States and China affect Taiwan's perception of its military security as operationalized by its military spending?

1.2 Historical Background

Understanding the historic background of the Taiwan problem will shed more light on the importance of an ongoing US-China relationship and its effects on Taiwan's military spending. There are at least four basic conclusions regarding the Taiwan problem that can be drawn by examining the historical record. First, among all the international actors, the United States plays the most important role in the relationship between China and Taiwan. Second, US-China relations must be taken into account in any discussion of Taiwan's security. Third, the US commitment to Taiwan's security contributes to peace between China and Taiwan and will likely grow increasingly vital. Fourth, volatility of the US-China relationship has significant effects on Taiwan's security, which are reflected in fluctuations in Taiwan's military spending.

Since 1949, Taiwan has been under the threat of invasion from the People's Republic of China. Nonetheless, with the United States acting as Taiwan's security guarantor from 1949 to the present, the PRC has been kept at an arm's length.

With rapprochement between the United States and China beginning with Richard Nixon's visit to Beijing in 1972 and the eventual de-recognition of ROC (Taiwan) by the Carter administration in 1979, the nature of Taiwan's security blanket was transformed dramatically. Instead of relative clarity in the protection of Taiwan's national security, the United States employs the so-called strategic ambiguity doctrine enacted in the Taiwan Relations Act (TRA). Taiwan believed that it was left to fend for itself because of the increasing security uncertainty flowing from the US-China normalization (Tan and Yu 2001).

Taiwan's huge and generally increasing defense spending each year reflects its

worries concerning the PRC threat. According to the US Arms Control and Disarmament Agency (ACDA), Taiwan's military spending consumed, on the average, 8.08% of its GNP during 1961-88. By comparison, the average figure for all countries covered by this agency was 5.4% (Ward, Davis, and Chan 1993).

To better understand the reasons why Taiwan's military spending is so high relative to that of most countries in the world, I argue that an ongoing US-China relationship is one of the key external factors that should be subjected to close scrutiny. Accordingly, this section reviews the historical evolution of US-China relations and its possible implications for Taiwan's military security. For the sake of convenience, I categorize the history of US-China relations into five distinct periods--hostility, rapprochement, normalization, retrenchment, and engagement.

1. Hostility (1949-1972)

During this period, the US-China relationship is basically hostile because of the occurrence of the Korean War (1950-53) and the Vietnam War (1964-75). In addition, various confrontations between the United States and the Soviet Union blocs during the Cold War era further hardened the relationship between China and the United States. During this period of time, the United States took actions to isolate China, for example the imposition of an embargo, which lasted 21 years until April 1971, on all US exports to China. The United States also imposed restrictions on travel and cultural exchanges by Americans with China; thus, the relationship between the two sides was very hostile (Chao and Myers 2000; Clough 1999; Cohen, Friedman, Hinton, and Whiting 1971; Gong 2000; Sheng 2001b; Tucker 2001).

On the other hand, Taiwan obtained the full support of the US military because of

its strategic and political importance. MacArthur once argued: "Under no circumstance must Taiwan fall under Communist control. Such an eventuality would at once threaten the freedom of the Philippines and the loss of Japan, and might well force out our frontier back to the coasts of California, Oregon, and Washington" (Cohen et al. 1971 pp. 41-42). In addition, the US-Taiwan Mutual Defense Treaty signed in 1954 put Taiwan under the direct protection of the US Seventh Fleet. This served Taiwan as an indispensable insurance security policy until the termination of the treaty at the end of 1978 (Chan 1988b, Huang 1997). In general, Taiwan's security was assured by the United States during this period of time.

2. Rapprochement (1972-1978)

In this period, the United States took the initiative to restore a friendly relationship with the PRC in order to constrain the military expansion of the Soviet Union. Richard Nixon visited Beijing in 1972 and signed the first Shanghai Joint Communiqué, in which Washington acknowledged a "one-China" policy. Later on, Washington further recognized the PRC as the "sole" legal government of China in the 1978 Normalization Communiqué (Harry 1992). Consequently, the United States terminated diplomatic ties with Taipei, abrogated the US-Taiwan Mutual Defense Treaty, and withdrew all its military personnel from the island. The rapprochement of the US-China relationship cast Taiwan into panic in terms of national security because the United States supported the Albanian resolution calling for seating the People's Republic of China in the United Nations (UN). Taiwan not only lost its representative membership in the United Nations but also many countries severed diplomatic ties. The role of the United States as a military protector became more tacit, indirect, and problematic (Chan 1988b). Taiwan

thus experienced considerable uncertainty about its security in this period.

3. Normalization (1979-1989)

With the alleviation of mutual hostilities after the 1979 normalization, the United States and China agreed to differ by shelving the Taiwan dispute. In 1979, in a rapprochement meeting with the Carter administration, the PRC insisted that the Taiwan issue is China's domestic affair, which was absolutely "non-negotiable" (Chang 1986). However, the United States did not yield to the PRC's pressure and enacted the Taiwan Relations Act (TRA) in 1979, which insists that the Taiwan problem be settled through only peaceful means. The TRA enjoins the United States to enable Taiwan to maintain a sufficient military capability to protect itself from possible PRC invasion. During this period, Washington adopted a policy of strategic ambiguity toward China and Taiwan in order to achieve a peaceful balance of power between both sides of the Taiwan Strait. Taiwan's security entered a relatively stable state in this period. In other words, a better US-China relationship was conducive to Taiwan's security. This may be because China is more confident that the United States will not support Taiwan's independence and thus feels less sensitive or hostile toward the Taiwan problem (Cohen et al. 1971 p.165). On the other hand, the TRA also may reinforce Taiwan's confidence that the United States will not abandon Taiwan after the normalization of the US-China relationship.

4. Retrenchment (1990-1994)

During this period, the US-China relationship reached its nadir since the 1979 normalization. The demise of the Soviet Union eroded the strategic importance of the PRC to counterbalance the Soviet Union in US strategic thinking. Meanwhile, the Tiananmen massacre in 1989 galvanized ideological differences and prompted

confrontations between the United States and China. In addition, proliferation of mass destructive weapons, human rights issues, trading frictions, and intellectual property rights issues led to further deterioration of the already tenuous US-China relationship.

However, the outbreak of the Gulf War in 1991 reduced hostility between the United States and China. Closer cooperation between the two countries occurred because the former desired the latter to join the international coalition to use force against Iraq. But such cooperation did not last long; the US-China relationship turned chilly again when the Bush administration approved the sale of 150 F-16 A and F-16 B warplanes to Taiwan in 1992. China lambasted the action as a clear violation of the 1982 communiqué, in which the United States agreed to gradually phase out arms sale to Taiwan. As one might gather from the above description, Taiwan's sense of its own security changed drastically in this period.

5. Engagement (1995-present)

During the period of Clinton's engagement policy with China, the US-China relationship has fluctuated. In 1995, former president Lee Teng-hui obtained a visa to visit his alma mater, Cornell University. China perceived this diplomatic breakthrough by Taiwan as a significant step toward Taiwanese independence and a sign of US support for such a move (Clough 1999, Gong 2000, Lasater and Yu 2000, Sheng 2001b). To protest Lee's visit to the United States, China called back Li Daoyu, PRC ambassador to the United States, carried out live artillery exercises, and launched three waves of missile tests to intimidate Taiwan, in 1995 and 1996.

To show US commitment to a peaceful resolution of the Taiwan problem, the Clinton administration sent two aircraft carrier battle groups into Taiwanese waters and in

doing so perhaps prevented a military conflict and tragedy from occurring.[3] During the 1996 Taiwan crisis, the US-China relationship reached the brink of war, which further demonstrated the dangerous possibility of the Taiwan problem. If not handled carefully, it could lead the United States and China to come into direct military confrontations (Clough 1999, Mann 2000, Sheng 2001b, Swaine and Mulvenon 2001).

In 1999, the US's bombardment of the Chinese embassy in Kosovo and, more recently, the 2001 confrontation over the EP3 reconnaissance plane, trapped the US-China relationship in a cycle of escalation and de-escalation. However, the Clinton administration never ceased its efforts to ameliorate the relationship. In 1997 and 1998, the Clinton administration announced construction of a strategic partnership with the PRC. A further shift in US foreign policy toward China became apparent in June 1998 when President Clinton visited Beijing, where he made a public declaration of the Three-No policy: no to support Taiwan independence, no to Taiwanese membership in international organizations, and no to any implicit diminution of the one-China policy (Gong 2000). In 1999, China and the United States reached an agreement to allow the former to join the World Trade Organization (WTO). Subsequently, approval by the US Congress of China's most-favored-nation (MFN) benefits on September 19, 2000, further demonstrated Clinton's pro-China stance through adopting a de-linkage policy of human rights and trade issues. The MFN status has been a US president's annual decision, required by the Jackson-Vanik Amendment to the 1974 Trade Act. This is a cudgel of the United States to exert its influence on China to exact better adherence to human rights standards (Clough 1999). However allured by the profitable nexus between China and the United States' two-side trades, Clinton administration gave up his "stick" without

even a fight. Taiwan's security was severely tested during this period, particularly in the 1996 Taiwan Strait crisis. However, due to limits imposed by data availability, this dissertation cannot conduct an empirical investigation of this most recent period.

1.3 Significance of the Study

"The issue of Taiwan has all along been the most important issue at the heart of Sino-US relations" (China Agence France Presse, Sep. 2, 1999). Why is Taiwan's military spending an issue worthy of attention and study? The answer is intuitive because Taiwan is one of the world's most dangerous flashpoints--one that may lead China and the United States to a possible nuclear confrontation. In addition, a study of Taiwan's military spending has long-term implications for regional and international security. The peaceful resolution of the Taiwan problem is not only a grave concern of Beijing-Taiwan-Washington but also a geo-strategic issue of balance of power in the Asia Pacific region.

The error correction model (detailed in Chapter 4) of Taiwan's military spending specified by this dissertation has considerable theoretical and empirical plausibility. In all cases, the model is shown to be highly resilient and can explain approximately 90% of the variance in the evolution of Taiwan's military spending. Furthermore, this study clearly points out that there is a linkage between Taiwan's military spending and factors such as domestic economic growth, foreign investment, saving rate, and, consistent with my argument above, the volatility of the US-China relationship.

Both external and internal factors that affect Taiwan's military spending are summarized and shown to have significant effects in this study. In particular, the external

factor, an ongoing US-China relationship, determines the priority of Taiwan's national defense. On the other hand, the internal factors such as GNP, foreign investment, and saving rate fulfill the economic and financial feasibility of Taiwan's military spending.

Previous studies (Chan 1988a, 1988b; Huang, Kim, and Wu 1992; Huang 1997; Davis 2000; Gong 2000; Lasater and Yu 2000; Lasater 2001; Lijun 2001; Li, Hu and Zhong 1998) have considered the roles of China and the United States and their effects on Taiwan's military spending. However, little attention has been paid to the ongoing US-China relationship and its dynamic effects on Taiwan's military outlays. Measuring ongoing US-China relations allows this dissertation to capture directly the factors that have a bearing on the level of Taiwan's military spending.

Most arms race models are based on the action-reaction assumption that military outlays are related to a rival nation's military spending (Majeski 1985). This dissertation goes beyond this traditional view and points out that the uncertainty of US commitment indicated by the level of US-China hostility and volatility is a factor affecting Taiwan's military spending. The empirical evidence of this study infers that heightened tension between China and the United States may be harmful to Taiwan, as reflected by a drastic increase in its military spending, which is bad news for Taiwan's economic prosperity. On the other hand, a higher volatility in the US-China relationship at time t-1 is in Taiwan's favor as followed by a lower level in its next year's military budget share. That implies that Taiwan is cautious about any possible provocations to China and wants to avoid Chinese military adventurism to Taiwan.

The results of this study may be of interest to researchers in the area of US-China policy, East Asian security, alliances, and arms control who wish to have a better

understanding of the effects of US-China dyadic interactions and underlying motivations of Taiwan's military spending as these are important to the stability and security in Asia's Pacific region. The error correction model specified in this study is able to capture both short-run and long-run effects of GNP on military spending (detailed in Chapter 5) and may aid researchers to better predict Taiwan's military spending under varying conditions.

1.4 Organization of the Study

This dissertation consists of six chapters. Chapter One has presented the statement of the problem, the historical background of US-China-Taiwan relationships, and discusses the significance and organization of the study. The historical material provided by this chapter sheds light on the effects of US-China hostility on Taiwan's military security. The chapter also discusses the importance of the theoretical and methodological contributions of the dissertation for comprehending Taiwan's military spending, and, more specifically, for predicting short-run and long-run effects of GNP growth on military spending.

Chapter Two develops the research project and the major theses by reviewing existing literature about the arms race, external threat, military spending, and economic growth. This chapter provides an integrated set of hypotheses of external effects such as US-China hostility, volatility, and the PRC's military spending and internal effects such as economic growth, saving rate, and foreign investment, on Taiwan's military spending. This chapter discusses measuring the nature of the ongoing US-China relationship, which allows one to capture more directly the factors that affect fluctuations in Taiwan's

military spending.

Chapter Three establishes the theoretical framework of this dissertation. A diagram for the statistical outcomes of Taiwan's military spending will be illustrated and discussed. Taiwan's military spending is affected by the ongoing relationship between the United States and China. Taiwan is sensitive to any possible change of US commitment toward its security, and this will be reflected in its military spending on an annual basis. To Taiwan, a change of US commitment is equal to a threat to its security. Without the United States' military and political support, Taiwan will lose its qualitative advantages in facing its numerically advantaged adversary, China. In other words, security and threat are treated as two sides of the same coin. Specifically, a high degree of threat implies a low amount of security, which, in turn, leads to an increase in military spending. Subsequently, a greater amount of security will result in a lower level of military spending in response.

Chapter Four focuses on describing data and the operationalization and measurement of variables. A 28-point-scale taken from the WEIS data set is employed to measure the major independent variable, the index of US-China conflict or hostility. In addition, all variables are subject to diagnostic tests necessary prior to including them in the time series analyses to come. This chapter also provides a description of all the variables employed in the hypotheses and describes possible explanations for patterns observed in the data. The operationalization and measurement of the dependent variable and independent variables are discussed together with the method of data collection and method of analysis.

Chapter Five examines the problems encountered in this study and discusses the

appropriate methodology used to remedy them. A brief discussion related to methodological issues, such as stationarity, cointegration, autocorrelation, heteroskedasticity, normality, and non-linearity also are addressed. In this chapter, I further summarize the statistical findings, illustrate the substantive importance of coefficients, and discuss their prominence and policy relevance. I will report the results of the tests of each hypothesis and identify the relative influence of different factors in the Taiwan experience with respect to the external and internal effects on military spending. Some policy suggestions to Washington-Beijing-Taipei trilateral parties are discussed.

Finally, in Chapter Six, I will summarize the findings and discuss their implications on the future US-China relationship and its possible effects on Taiwan's security and military spending. Some directions and recommendations for future research also will be presented.

Endnotes

1. Chan, Clarke, and Davis (1996 p. 112) first point out that, in the early 1950s, Taiwan has appeared to many observers to be destined for the fate of a pawn in the intensifying superpower rivalry, and that of an economic and political basket case. With the defeat of the Kuomintang in the Chinese civil war and its withdrawal from the mainland, Taiwan had to bear the brunt of the ensuing population exodus and tremendous military burden in dealing with the constant military threat from the PRC. Facing the tottering economy and possible collapse from within, Taiwan's existence would have been problematic were it not for the timely and massive US aid and support. As far as Taiwan is concerned, it is usually the plight of being a pawn state. The incentives that induce the United States to be willing to come to Taiwan's aid are largely beyond Taiwan's ability to control or sustain. In other words, Taiwan cannot take for granted that the United States will come to its defense in the event of PRC invasion. What Taipei can do is to try its best to strengthen pragmatic ties with Washington to ensure the continuation of obtaining the weapon systems necessary for its military security.

2. "By 1998, Taiwan was the world's largest supplier of computer monitors, modems, motherboards, keyboards, power supplies, scanners, printing devices, and desktop and notebook computers. In 2000 Taiwan notebook computer suppliers occupied an approximately 60 percent share of the world markets" (Bolt 2001 p. 93).

3. The two battle groups include: "the nuclear attack submarines *Portsmouth, Columbus* and *Bremerton*; the aircraft carriers *Independence* and *Nimitz*; the destroyers *O'Brien* and *Hewitt*, the guided missile frigate *McClusky*, the oiler *Pecos*, and the guided missile crusiers *Bunker Hill* with the *Independence*; and the crusier *Port Royal*, the destroyers *Callaghan* and *Oldendorf*, the frigate *Ford*, and the replenishment ships *Willamette* and *Shasta* with the *Nimitz*" (Lasater and Yu 2000 p. 231).

CHAPTER 2

LITERATURE REVIEW

> "No relationship is more critical for international stability than that of China and the United States. No issue is more significant and potentially more explosive than Taiwan."
>
> ---Harold Brown, former US Secretary of Defense 2000

The enduring rivalry of the relationship between the United States and China not only threatens the security of Taiwan but also plants a destabilizing seed in East Asia. Joseph S. Nye, Jr. (1995) straightforwardly points out that instability across the Taiwan Strait greatly threatens the national security of the United States and endangers the stability of the Asian Pacific region. Therefore, Taiwan's military buildup is noteworthy and it behooves researchers of international relations to determine the most plausible explanations for the high level of military spending that has taken place in Taiwan.

Traditionally, two principal types of theories have been used to explain the causes and effects of military spending. The first type of theory focuses on influences exogenous to a country, and the second type of theory focuses primarily on internal considerations.

2.1 External Factors

Research on external threats and military spending abounds (Bennet 1996; Bolks 1999; Bolks and Stoll 2000; Cusack 1985; Cusack and Ward 198; Fearon 1994; Gastillo et al. 2001; Lebovic and Ishaq 1987; Nincic 1983; Oren 1996; Reiter 1996; Singer 1958;

Saris and Middendorp 1980; Ward 1984; Ward and Mahajan 1984;). Most researchers in the first tradition rely on the pioneering work of Lewis Richardson (1960). Richardson presented the first theory of dynamic effects of the arms race, and argued that the driving force behind fluctuations in military spending was the action-reaction between two rival nations. That is, arms race is a process in which changes in a nation's military spending are driven by its opponent's defense expenditures (Richardson 1960; Li, Hu and Zhong 1998 p. 169). There is vast literature on this topic, ranging across the disciplines of political science, economics, sociology, and psychology. Recent empirical work includes Anderton (1989), Bolks and Stoll (2000), Chan (1990), Cusack and Ward (1981), Dasai and Blake (1981), Intriligator and Brito (1993), Kydd (2000), Majeski (1985), Majeski and Jones (1981), Marra (1986), McGinnis (1991), Moll and Luebbert (1980), Ninic (1982), Ostrom and Oren (1996), Smith (1977), Squires (1982), Ward and Mahajan (1984), and Wsard (1984).

Although conceptually quite compelling, Richardson's model has met with at best mixed empirical success particularly when applied to the case of Taiwan. Steve Chan (1988a, 1988b) indicates that the Richardson model of reciprocal armament escalation can at best only partially explain Taiwan's military spending, because the PRC's defense behavior is far more likely to be influenced by its traditional and potential adversaries such as India, Japan, Russia or the United States than from Taiwan (see also Bolks and Stoll 2000; Kynge and Fidler 1999; Li, Hu and Zhong 1998).[1] Chan's empirical finding bolsters his argument that China's military outlays at time t-1 have a negative and statistically insignificant effect on Taiwan's military spending.

Richardson (1960 p. 62) offered two possible explanations for such a negative

relationship. First, an inverse relationship is consistent with the adoption of the virtuous precept to return good for evil. The second reason, submissiveness, refers to the special condition in which a weak nation is dwarfed by the strength of its adversary and would submit rather than engage in a hopeless arms competition (see also Oren 1996). These two explanations are not applicable to the case of Taiwan.

Wohlstetter (1974b p. 80) further points out: "The trouble with most arms race theories has been that they start by assuming an accelerating competition and then look about for some mechanism that might conceivably explain it." As far as Taiwan is concerned, I argue that the ongoing US-China relationship is the underlying motivation rather than the PRC's military expenditures *per se* that affects variations of Taiwan's military spending. This argument will be specified in greater detail as the analysis progresses.

After recognizing the limitations in applying a Richardson model to the case of Taiwan, this dissertation investigates how the ongoing US-China relationship affects Taiwan's military spending. In "Taiwan's Calculation on Military Spending," Chan (1988b p. 913) puts it briefly but clearly:

> "The effectiveness of the US's coat-tailing (providing a security umbrella) Taiwan in part depends paradoxically on Washington's leverage in Peking, which in turn reflects and perhaps even presumes to some extent an ongoing Sino-American relationship."

Following Chan's suggestion, this dissertation investigates the impact of US-China relations on Taiwan's military spending. In his article, Chan simply tested the impact of the PRC threat (measured by PRC military outlays) and the US pipeline (measured by US military outlays) respectively. This dissertation goes further by assessing the dynamic

effects of US-China relations on Taiwan's military spending.

Until now, three kinds of arguments have been made concerning the nature of the relationship between the United States and China and its impact on Taiwan's military spending.[2] Ezra F. Vogel (1997) suggests that the key to managing the Taiwan problem is for the United States to have a better relationship with China. Enjoying a better political and economic relationship with the United States, Beijing might feel confident that it eventually could achieve a peaceful integration of Taiwan and thus would show less hostility toward Taiwan. Lin Cheng-yi (2000, p. 6) argues: " An improved and stable US-PRC relationship could contribute to the security of Taiwan." The reason is that improved relations between China and the United States help maintain peace in Taiwan Straits. Beijing would be more likely to accommodate Washington on the Taiwan issue (see also Lee 1995), because it feels more confident that the United States will be less likely to support the independence of Taiwan and will be more compromised to its position in dealing with the Taiwan problem.

In addition, American policymakers expect that improved US-China relations, achieved by approving China's permanent trade benefits and helping China enter the WTO, may drastically change China's cost calculation in resolving conflicts by use of force. In other words, US policy thinking is based on the premise that the better the US-China relations, the less likely the PRC is to invade Taiwan (Tan and Yu 2001).

Concurrently, Lasater (2001) suggests that the worse the Sino-American relationship becomes, the more sensitive the Taiwan problem will be, therefore the more likely the military confrontation will grow. Stanley O. Roth (1999, p. 178) points out that the improvement in US-PRC relations not only did not harm Taiwan, but also

significantly contributed to Taiwan's extraordinary economic and political development. Huang, Kim and Wu (1992 p. 56) in their empirical investigation found that the better the US-PRC relationship, the less likely that the PRC would come into conflict with Taiwan. But this finding is opposite to their expectation that an improvement in the US-China relationship will increase the likelihood of China's initiating a conflict against Taiwan.

Conversely, Richard Fisher (1998) of the Heritage Foundation warns that closer US ties with the PRC at the expense of Taiwan could jeopardize the latter's military security. The United States would be more likely to yield to the PRC's pressure to reduce its arms sales to Taiwan. Without US weapons, Taiwan will eventually lose its qualitative advantage in terms of military capabilities, which, in turn, will greatly impair Taiwan's military security. Besides, Taiwan's leadership treats US arms sales to Taiwan as a very important indicator of US political support, which is crucial to Taiwan's survival.[3] Stephen J. Yates (2001) states that US arms sales to Taiwan are crucial because Taiwan's military strength will promote peace through deterrence, while its weakness will only invite aggression and invasion. If arms sales are more apt to occur when US-China relations are poor, then it follows that poor US-China relations are good for Taiwan.

According to this view, Taipei cannot afford to lose Washington's military and political support. Besides, improved US-China relations may lead the PRC to adopt a more adventuresome military strategy toward the Taiwan dispute, by leading it to anticipate that the United States will compromise its defense commitment. Wang (1998) and Lin (2000) argue that the occurrence of the 1996 Taiwan Strait Crisis partially resulted from the compromising attitude of the Clinton administration towards the PRC.

In contrast, Chen Chien-ming (1999) suggests that US-China relations do not have a

prominent effect on Taiwan's military security. He further argues that only if a balance-of-power exists among Washington-Beijing-Taipei trilateral relations, can the military security of Taiwan be ensured. If the United States only attempts to play a balancing role between China and Taiwan, it will not anticipate any specific resolution of the Taiwan issue and will let the problem be solved by both sides of the Taiwan Strait on their own. In other words, the United States will not tilt against either side. If this is the case, the US-China relationship in actuality is irrelevant to Taiwan's military spending or security because neither China nor Taiwan can affect the US policy of status quo. This is a typical example following the classical rule of international relations, that the strong do as they please and the weak do as they must.

It is with these inconsistencies in mind that this dissertation aims to examine the relationship between US-China relations with Taiwan's military spending. More specifically, this study addresses the questions: Is the US-China relationship critical in determining Taiwan's military spending? Do changes in the level of hostility in US-China relations affect Taiwan's military spending? In answering these questions, I attempt to connect the study of US-China relations to the broader and more fundamental issue of the perception of external threat and its consequent impact on military spending.

The nature of the relationship between Taiwan's security, external threat, and military spending is still controversial; however, I argue that security and threat are two sides of the same coin and are reflected on the fluctuations of military spending on an annual basis. In other words, a higher level of external threat means less security and will be associated with a higher level of military spending. Similarly, a lower level of threat means more security and will be responded to by a lower level of military spending

(Ward and Mahajan 1984). Following this logic between security and spending, I argue that a worse US-China relationship is beneficial to Taiwan's security, and will prompt a lower level of military spending. The reason may be because the United States will be less likely to forsake Taiwan when the US-China relationship is poor, which means a higher sense of security to Taiwan. This might partially explain Chan's finding of a negative relationship between PRC military spending and that of Taiwan.

In contrast, it also could be the case that a less hostile US-China relationship is conducive to Taiwan's security. If this is true, then we can conjecture that improved US-China relations can spill over to relax tensions across the Taiwan Straits. Therefore, Taiwan will perceive itself as more secure and will be more likely to decrease its military spending. By the same token, the escalation of conflict between the United States and China may lead to higher tensions between China and Taiwan that, in turn, may make the latter feel insecure. As a result, Taiwan will immediately boost its military expenditure to alleviate the perceived threat.

If Taiwan perceives the United States to be a balancer, one would not expect any effects of US-China relations on the level of Taiwan's military spending. If this case obtains then internal factors would be the major determinants of Taiwan's military spending as will be discussed in the next section.

2.2 Internal Factors

The second line of thought that will be pursued in this dissertation focuses on internal considerations rather than external ones in explaining variations in military spending. Among these internal factors are the nature of the budgetary process and the

political economy of military spending.

1. The Budgetary Process

Harris (1986 p. 14) examined the importance of endogenous economic factors on military spending levels in five ASEAN countries--Indonesia, Malaysia, Philippines, Singapore, and Thailand. He concluded that:

> "…economic conditions, especially government current revenue, appear to exert at least a moderate influence on annual changes in defense expenditure in ASEAN…A nation's GNP sets a broad limit on its domestically-financed defense expenditure, and that defense expenditure in the previous year is a good indicator of its level in the next year."

This argument is congruent with the theory of the budgetary process, which maintains that the dynamics of military spending are based primarily on organizational inertia within the state. The main proposition underlying the theory is that decision-makers employ standard operating procedures (SOPs) for implementing the rules of bureaucracies. It further can be inferred that the best indicators of new increments to military spending are simply those which obtained in the immediate past (Chan 1988a, 1988b; Chung 1996; Harris 1986; Li, Hu and Zhong 1998; Solomon 1998).

According to the incremental budgetary model, increases in military spending are determined by a simple series of decisions ordered in time (Castillo et al. 2001; Choucri and North 1975; Chung 1996; Harris 1986; Kamelt and Mowery 1987; Moll and Luebbert 1980; Ostrom 1977, 1978; Ward 1984; Ostrom and Mara 1986; Wildavski 1964; Russet 1970). In other words, one can predict the current military spending budget based on the immediately preceding, time t-1 budget. This perspective implies that the base year's spending suggests what is plausible and what is needed for determining the

next year's spending level (Castillo et al. 2001). Rattinger (1975) found that past expenditures are the best single indicator in explaining military spending for all members of European NATO and the Warsaw Treaty Organizations. So one potential explanation of the determinant of military spending is the bureaucratic politics of the budgeting process represented by incrementalism (Solomon 1998).[4]

2. Guns and Butter

The theory of political economy of military spending focuses on the relationship between military spending and economic growth. Three main views of the defense-growth relationship are incorporated in the theory of political economy and military spending. Those are the military Keynesian view, the Marxist view, and the "Rich nation, strong army" view (Chung 1996, Looney 1989, Mosley 1985, Threddenick 1985). The military Keynesian and Marxist theoretical formulations contend that the direction of the defense-growth relationship runs from military spending to economic growth, not vice versa. But "Rich nation, strong army" theorists propose the direction of the relationship runs from economic growth to military spending. They argue that increased state activity and the corresponding increases in military spending are an inevitable accompaniment of economic growth (Chung 1996). Richer countries are likely to devote a larger proportion of their budgets to defense (Cusack and Ward 1981; Chung 1996 p. 304; Looney 1989 p. 38; Thorn 1967). This dissertation focuses mainly on the "Rich country, strong army" assumption in the case of Taiwan because it is congruent with the theoretical formulation posited by this dissertation.

The direction of causality seems to be fairly consistent with the common belief,

'Rich country; strong army' (*Fuquo-Chyangpin*), that is, when a society is getting richer, people are more likely to encourage the state authority to provide more and better goods and services. Joerding (1986 p. 38) first conducts a Granger Causality test on economic growth and defense spending. He finds that it is economic growth that Granger causes military spending, not the other way around. Based on empirical research on data gathered from 1965 to 1987, Looney (1994) points out that economic growth has a significant positive impact on military spending. Smith (1977) also found that defense spending is a positive function of economic growth as well as security variables based on threat evaluation and military alliances. Chowdhury (1991) and Kusi (1994) suggest that the higher the economic growth, the greater the military expenditures. Gastillo et al. (2001 p. 36) further point out two plausible reasons about why economic growth will lead to increases in military expenditures. The first is because as nations become wealthier they believe they have more to protect. Second, greater wealth allows nations to pursue aggressive foreign policy objectives considered unobtainable before. Given these findings, one can plausibly assume that countries with rapid economic growth are more able to indulge themselves in the luxury of defense programs, just as rich families are usually more able to purchase security insurance than poor families (Chung 1996, Clough 1999, Gastillo et al. 2001, Gong 2000). Chung (1996) further points out that rapidly rising incomes might produce an even more rapidly rising level of tax revenues of which the powerful defense lobby might be expected to secure a proportional share. In contrast to the arms race literature, Harris (1986), Hewitt (1992), Looney (1987, 1989a, 1989b), Looney and Frederiksen (1986, 1988, 1990), and Maizels and Nissanke (1986) all indicate that economic variables show great promise in providing a more accurate picture

as to underlying causes of military spending levels.

Threddenick (1985) tested the impact of economic variables on the pattern of Canadian military spending. He concluded that "recent large increases in Canadian defense expenditures have been influenced more by economic growth than by security considerations" (p. 78). Solomon (1998 p. 64) in research on the case of South Korea also argues:

> "As its economy grows, a nation has more resources with which to provide security. In a broad sense, the production possibility curve of a country moves as the GNP grows, enabling the society to enjoy more military security as well as civilian output. Therefore, military expenditures and GNP are hypothesized to be positively related so that defense is a normal good whose demand rises with income."

In the context of Taiwan, the relationship between economic growth and military spending has been of considerable interest to political scientists. According to Steve Chan (1988a, 1988b), what makes the case of Taiwan theoretically challenging is that it is often identified as an outlier case, an "enigma" to unravel (Clark 1989). Chan (1988a p. 913) states:

> "Taiwan has achieved one of the highest rates in gross national product and most sustained growth rates in gross national product (GNP) at an average annual rate of 8.8% during 1952-85 and in exports at an average annual rate of 24% during 1953-85 in the world. Its saving rates, its inflation rate, and its unemployment rate again rank it among the top performers globally. "

The "enigma" of the coexistence of rapid economic growth and high military expenditure in Taiwan seems to indicate that its economic growth is conducive to its military spending. Following this line of thinking, I hypothesize that economic growth has significant impact on Taiwan's military spending. However, no theoretical consensus

or empirical tests of hypotheses concerning the Taiwan enigma have been achieved so far. Steve Chan (1988b p. 27) calls for more research to be undertaken to unravel the puzzles posed by the Taiwanese experience.

2.3 The Integrated Model

In addition to action-reaction theory, Richardson also takes into account the hostility and the economic burden of producing and maintaining arms when modeling an arms race (Intriligator and Brito 1990; Li, Hu and Zhong 1998). Bolks and Stoll (2000) argue that most of the arms race literature ignores hostility in the international environment that can have an impact on armaments decisions. They observe that failure to include a measure of environmental hostility will underspecify significantly the external factors that drive decisions about the level of military spending. Nincic (1983) indicates that domestic economic factors were more influential than external threats as determinants of annual fluctuations in Soviet military spending. However, Bolks and Stoll (2000), Gastillo, Lowell, Tellis, Munoz, and Zycher (2001), Looney (1989), and Ostrom (1978) argue that both the internal and external environments affect a country's defense spending. To unravel the Taiwan enigma, I suggest that the external threat, real or perceived, be taken into account along with the domestic economic constraints.

Taiwan's military spending is directly connected to its demand for security because it has been faced with a lopsided numerically advantaged enemy, the PRC. Within a stark and brutal self-help international system, Taiwan not only has to reinforce its own military buildup independently but simultaneously must seek external alliances in order to alleviate the threat posed by its archenemy, China. To a great extent, US support is

critical in providing the wherewithal for Taiwan to maintain a qualitative edge, in order to compensate for its quantitative inferiority (Chan 1988b). In addition, Taiwan's economic growth also plays a very important role in supporting its heavy defense burden and ensuring its security. To achieve this goal, Taiwan has to retain a balanced relationship between China and the United States to survive. A close relationship with the United States allows Taiwan to equip itself with arms and alliances to deter China's invasion while a good relationship with China provides Taiwan access to China's markets, which is essential to Taiwan's economic livelihood. I therefore argue that US-China relations and economic conditions are the two most important factors that should be taken into account in any attempt to explain the dynamics of Taiwan's military spending.

In this dissertation, I will employ an integrated model that incorporates the conflictual levels of competing nations to investigate their effects (operationalized as US-China hostility) on Taiwan's military spending. This study focuses on the causal relationship between external threat (US-China conflictual interactions) and economic growth, and military spending. The scope of this dissertation is confined to Taiwan (ROC), China (PRC), and the United States. I contend that the dyadic relationship between the United States and China is one of the most important causal variables, which, taken along with domestic factors such as economic growth, saving rate, and foreign investment, drive Taiwan's military spending (Lipow and Antinori 1995, Heo and Ro 1998, Sun and Yu 1999).

As far as Taiwan's experience is concerned, external threat as well as economic growth seems to boost military spending. Benoit (1978 p. 271) points out that "countries

with a heavy defense burden generally had the most rapid rate of growth, and those with the lowest defense burdens tended to show the lowest growth rates." His study finds that 14 countries out of 44 Less Developed Countries with the highest defense burdens and economic growth in the sample have all been engaged in wars or seriously threatened by them, or been in peculiarly exposed strategic positions (Lipow and Antinori 1995). Benoit (1973, 1978) further suggests that there is a possible psychological linkage between defense spending and economic growth. An external crisis will facilitate closer cooperation and a stronger motivation to work together among people. The result will be to boost economic growth, which permits increased military spending. Israel, Taiwan, Singapore, and South Korea are the exemplary cases of these relationships. With these considerations in mind, I employ an integrated model specified to investigate the dynamic impact of external threats (i.e., the level of conflicts between the United States and China) and economic growth on Taiwan's military spending.

In sum, as is evident from the preceding discussions three main theoretical perspectives each seems to contribute to an explanation of Taiwan's military spending. Both external and internal factors must be considered in explaining Taiwan's military spending. Following this line of thinking, I propose a set of hypotheses based on an integrated theoretical formulation in the next chapter.

Endnotes

1. According to Sun and Yu (1999), since the Korean War, the United States was viewed as China's number one enemy until the early 1970s. Even after 1979, when a formal diplomatic relationship was established between the two countries, the United States was still perceived by China as a major threat. On the other hand, the Sino-Soviet relationship deteriorated dramatically in the 1960s, which led to several serious border clashes in 1969 along the Ussuri and Amur rivers. Subsequently, the Soviet Union became China's number one archenemy until the mid-1980s. India had several border military confrontations and wars with China from 1959 to 1962. Since then it was treated as one of China's military threats until 1979. Japan has been treated as a rival of China, partly because of the bitter memory associated with its invasion of China in the 1930s, and partly because Japan is a close ally of the United States. Taiwan also is regarded as a long-time military rival of China, but because of its relatively small size and military strength it brings no major threat to China.

2. To ensure its military security, Taiwan has adopted the strategy of building an "independent defense system" and "replacing quantity with higher quality" (Lee 1995 p. 361). To achieve this goal, Taipei has substantially increased its military expenditure over time. Taiwan's military budget reached $11 billion in 1993, a prominent increase from the $2.784 billion in 1979 (FBIS-China September 23, 1993). Taipei has enforced its military security with weapons purchased from the United States and France (Lee 1995). In addition, Former Premier Hao Pei-tsun also argues that Taiwan cannot reduce its defense budget because the PRC's threat to Taiwan has increased in light of the PRC's increasing military budget and build-up since the collapse of the Soviet Union (FBIS-China March 30, 1992). From the above evidence, we can further infer that Taiwan's military spending is closely tied to its perception of its own military security.

3. "Lee Tung-hui views weaponry more as a symbol of reassurance and resolve than as a key component of a larger force structure designed to attain genuine warfighting objectives, because he values US-supplied weapons systems as a critical indicator of greater US support (military as well as political) for Taiwan" (Rand p. 16).

4. According to Ward and Hanajan (1984), incrementalism is perceived to be especially important in the budgetary decision-making process because it implies that historical base. That is, what was spent or allocated last year, is a given from which to proceed in making calculations about what is needed and/or plausible in the subsequent or current period. Combined with assumptions about normal organizational behavior, this incremental aspect suggests that military expenditures tend to increase themselves over time: Next year's budget will be based on this year's, plus a little more.

CHAPTER 3

THEORETICAL FORMULATION AND HYPOTHESIS TESTING

> "The ROC (Taiwan) in addition to cementing its links with the United States has also sought to develop mutually beneficial interaction with the PRC, as a means of strengthening the security of Taiwan"
>
> ---Ralph N. Clough (1999 p. 24)

Security commitment, threat perception, and military expenditures in arms race processes have long been important research foci in international relations. For arms race's action-reaction theory, the Taiwanese case shows how a client state's military spending is not only a direct function of external threat but also threats as reflected through perceptions of its patron's commitment (Cha 2000). In this dissertation, I argue that the level of commitment signaled by the United States to Taiwan is refracted through its bilateral interactions with China, and conditions Taiwan's military spending and perceptions of external threat. That is, Taiwan's leadership tends to believe that a more reliable US commitment when the US-China relationship turns sour can increase Taiwan's security by balancing against military threats posed by powerful China. Whereby, Taiwan's perception of a greater external security or lesser external threat will result in a lower level of Taiwan's military spending in response.

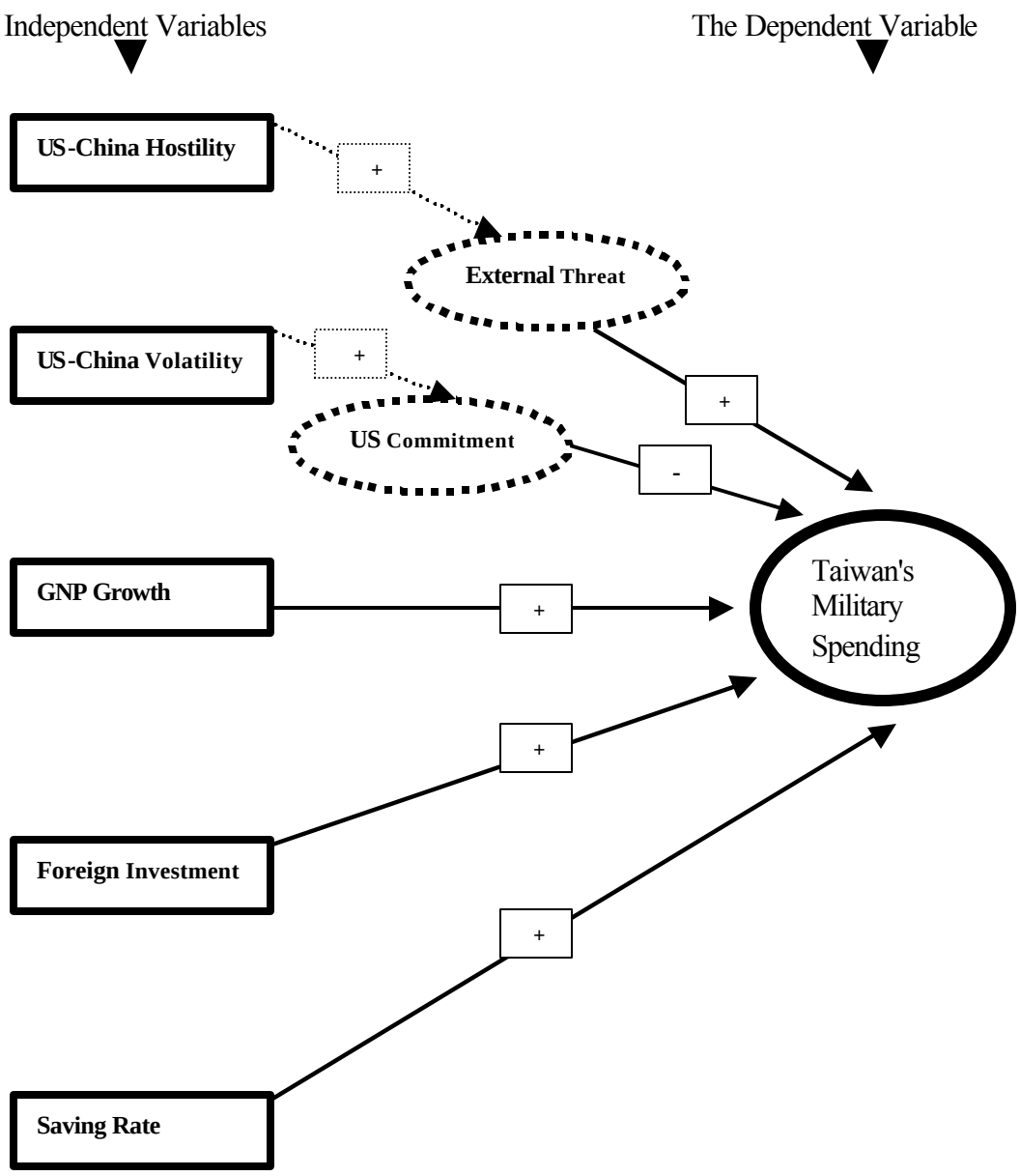
An alliance with the United States (external balancing) can provide Taiwan with additional strength and a more deterrent posture toward China. Therefore, as far as Taiwan is concerned, a stronger perceived US commitment is equal to more security or less external threat. Consequently, this will lead to a decrease in Taiwan's military spending. In addition, if Taipei perceives a weaker US commitment due to an improved

US-China relationship or a higher external threat due to a heightened US-China hostility, it will boost its military buildup to avoid the risks of abandonment or entrapment. Abandonment is the fear that the United States may fail to come to Taiwan's aid in the event of war (Snyder 1984). Entrapment is the fear that the entanglement in a dispute between the United States and China will turn detrimental to Taiwan's security (Snyder 1984). Sorokin (1994, p. 425) further argues that "if a state chooses to rely on an asymmetric alliance for security, it is more concerned about the risk of abandonment than the risk of entrapment." It is noteworthy that states need economic support to undertake their military buildup (internal balancing). That is, a higher economic growth will provide Taiwan the resources to carry out its military buildup or the strategy of internal balancing.

Thinking of potential costs of relying on US commitment as refracted through the fluctuations of US-China relations puts security, external threat and military spending into a meaningful context. That is, "threat" and "security" are seen to be two sides of the same coin. In other words, a high degree of threat implies a low level of security while a lower threat is equivalent to a higher level of security. Thus, a greater amount of security should, *ceteris paribus*, be associated with no, or only a small increase of military spending and a greater amount of threat should be accompanied with a greater increase in military outlays (Ward and Mahajan 1984, Gates and Terasawa 1992, Sorokin 1994, Cha 2000, Danilovic 2001).

Summing up the theoretical expectations of Taiwan's military spending discussed above, it can be diagrammed as shown in Figure 3-1:

Figure 3-1: The Theoretical Framework of Taiwan's Military Spending



As shown above, variables on the right-hand side are the independent variables, which, I hypothesize, should have effects on the evolution of Taiwan's military spending.

The first two variables, US-China hostility and volatility, are the two major external factors to be investigated in this study. The rest of the three variables, GNP growth, foreign investment, and saving rate, are control variables as suggested by the previous studies and should be incorporated in any attempts to investigate the dynamics of Taiwan's military spending (Chan 1988a, 1988b, 1990; Chan and Clarke 1992a, 1992b; Huang 1989, 1997). The anticipated correlations in the diagram will be specified in greater detail as the theoretical formulation progresses.

In this dissertation, I attempt to integrate external threats and internal economic constraints into one model, in which both US-China relations (reflecting the level of US commitment or external threat perception) and economic growth are the decisive factors affecting the dynamics of Taiwan's military spending. Hence, I hypothesize that Taiwan's military expenditures increase because of an increase in either economic strengths or threat perceptions flowing from the bilateral interactions between the United States and China.

3.1 Theoretical Formulation

Being a "pawn" caught between China and the United States, Taiwan fears getting too close either with China or the United States will abridge its independence and identity. On the one hand, cooperation with the United States leads to a loss of some degree of Taiwan's independence by becoming the US's client state. This will lead Taiwan to worry about the risks of abandonment or entrapment (Rothstein 1968), and I argue that such worry will be reflected in the level of Taiwan's military spending over time. On the other hand, reunification with China leads to loss of Taiwan's sovereignty.

This will increase the dangerous possibility of eventual war between both sides of the Taiwan Strait. Choosing the lesser evil, Taiwan is struggling to equip itself with arms and alliances with the United States as the means to deter China. Most and Siverson (1987) indicate that arms and alliances are substitutes for one another: either of them can be adopted to achieve the same goal, security (see also Sorokin 1994 p. 422). That is, if Taiwan's leadership perceives US commitment as reliable, then it is assured to reduce its military spending. Otherwise, Taiwan will be forced to spend more funds on military buildup to avoid the risk of abandonment in the event of war.

As far as Taiwan's security is concerned, the fluctuating US commitment has been both a blessing and a curse. The United States often shuns a direct military association with Taiwan for fear of provoking China and overextending its commitments and resources. Such a wobbly attitude makes Taiwan worry about the reliability of US pledges of future assistance, and its possible backsliding in wartime. As argued above, the greater worry will be responded to by a higher level in Taiwan's military spending because of a perceived weaker US commitment leading to a higher risk of abandonment. In the history of Taiwan's security, only when China became a clear and present danger to Taiwan, would the United States then provide political, economic, and military support to prevent Taiwan from being merged by China. For example, when China shelled the offshore islands of Taiwan in 1954, the Eisenhower administration was willing to sign the Mutual Defense Treaty (MDT) with Taiwan, and declared that US defense of the offshore islands would probably lead to the use of atomic weapons (Chiu 1979, Harding 1992, Tucker 2001, Tow 1991).

In August 1958, in the second Taiwan Strait crisis, China shelled the offshore

islands of Taiwan to test the Soviet Union's willingness to confront American military power. The United States sent six aircraft carriers laden with nuclear-capable aircraft to Taiwan. Nuclear cannons were installed at Taiwan's offshore islands, and Matador nuclear-tipped missiles also were deployed in the key positions around the island (Tow 1991). However, for fear of the occurrence of a direct nuclear confrontation, these nuclear weapons were immediately withdrawn when China successfully developed its own atomic weapons in 1964.

In 1996, in the third Taiwan Strait crisis, China launched a series of military maneuvers in the waters near Taiwan. The People Liberation Army's Second Artillery fired a total of six M-9 ballistic missiles pinpointed to blockade the two major harbors of Taiwan, Keelung and Kaohsiung. The Clinton administration responded by dispatching two carrier battle groups to the vicinity of Taiwan and deterred China's further military provocations. "But without the forceful bipartisan pressure applied by Representatives Christopher Cox and Nancy Pelosi, and their colleagues, the carriers likely would not have been sent" (Timperlake and Triplett 1999 p. 158).

US commitment to Taiwan has not always been consistent, and at key junctures in history such as Nixon's visit to Beijing in 1972, Carter's rapprochement with China and abrogation of Mutual Defense Treaty with Taiwan in 1979, Reagan's second Shanghai Communiqué, and Clinton's Three-No policy in 1998, Taiwan has witnessed dramatic reversals of the US's China policy. As a result of these perceived "betrayals," Taiwan is understandably paranoid about even the slightest change in US attitudes toward the island (Swaine and Mulvenon 2001).

Therefore, Taiwan's military spending is tied to the fears about the US commitment

as perceived through the level of volatility in the US-China relationship and about the external threat emanating from the level of hostility in the US-China dyadic interactions over time. That is, a more hostile US-China relationship implies a greater external threat to Taiwan because of a higher risk of entrapment. On the other hand, a higher volatile US-China relationship implies a greater US commitment because of lesser risk of abandonment. Therefore, I argue that a high degree of US commitment or lesser degree of external threat would be associated with a lower level of Taiwan's military spending due to a more perceived level of security. From the first Formosa Resolution Act to defend Taiwan and its offshore islands to the Shanghai Communiqué and subsequent de-recognition of Taiwan, US policy toward Taiwan has been anything but consistent. Truman's "hand offs policy," which announced that no forces would be used to defend Taiwan, wanted to let Taiwan go to the communists (1948-1952) (Tucker 2001). Eisenhower's fear of the Soviet Union's intervention and possible confrontation with China resulted in his waffling on defending Taiwan's offshore islands (1953-1960) (Tow 1992). Nixon's visit to Beijing tried to trade off Taiwan with Vietnam (1969-1974) (Lasater 2000). Carter's sudden recognition of Beijing and abrogation of the Taiwan-US Mutual Defense Treaty was a betrayal of a loyal friend (1977-1980) (Sheng 2001b). Reagan's visit to China in 1984 taught Taiwan a lesson not to cling to the past (1981-1988) (Mann 2000). Bush's pro-China attitude did not deny US arms-sale of 150 F-16 warplanes to Taiwan (1989-1992). Clinton's critiques of Bush's coddling dictatorships from Baghdad to Beijing did not affect his engagement policy toward China (1993-2000).

The lack of consistency in US policy toward the Taiwan issue is vividly described by Drury (2001 p. 88) who states that "the US policy toward the Strait is more like the

proverbial duck paddling in the water: serene on the surface but chaotic beneath." He further adds, "US policy toward China and Taiwan has taken a path more like a rabbit escaping a predator--a series of quick shifts, sharp turns, and backtracking" (p. 97).

Such flip-flops in US policy toward China and Taiwan raise the question of whether there is any guarantee that the United States will come to Taiwan's aid in the event of war. As far as Taiwan's security is concerned, ironically the arguable reliability of the US's commitment to defend Taiwan has thus become a more critical concern than the PRC's intention and capability to invade Taiwan. Taiwan's leadership knows that with American military, economic, and political support, Taiwan will be able to deter attacks from China in the foreseeable future. However, Taiwan can never focus too much on the fealty of the US's commitment to assist Taiwan in the event of future military confrontations with China. This fear prompts Taipei to spend an inordinate amount of time trying to assess the state of US-China relations, probe the relative strength of Washington's commitment to Taiwan, and manipulate congressional support to ensure continued political support and arms sales to Taiwan (Swaine and Mulvenon 2001).

Unlike the realist (Morgenthau 1948) point of view, Taiwan's military spending is not driven by the lust for power, but instead is motivated by the fears of abandonment or entrapment from the United States. Taiwan's military spending, in this sense, is a function of its insecurity predicted by the ongoing US-China relationship. Therefore, I suggest that a greater level of threat to Taiwan's security or, more specifically, a weaker US commitment or higher external threat, will result in a higher level of Taiwan's military spending.

As stated above, recognition of Taiwan's constant worrying about the PRC's

military threat and the fluctuating US commitment have constituted the underlying motivation and theoretical foundation of this dissertation. In fact, international relations long have focused on the concept and impact of threat. Very simply, Wolfer (1962 p. 13) claims that states react in fear to threats to national survival, national independence, and territorial integrity.

In most countries, security issues are viewed primarily from the perspective of potential external threats, and the role of the armed forces is to defend against such threats (Ball 1988, Bolks 1999). "Protection against external aggression provides the raison d'être for all armed forces, and external security considerations are most often used to justify increases in military spending" (Kim 1995, p.1).

I contend that the external threat to Taiwan is not based solely on the total amount of China's military spending, but also on China's bilateral relationship with the United States. That is, being a pawn in the superpower game, Taiwan is a client state, controlled and constrained by the ongoing US-China relationship (Chao and Myers 2000, Clough 1999, Sheng 2001b).

According to Cusack and Ward (1981), threat is an important component of the relationship between rival nations. They further indicate that "it is important to include dynamic elements of the perceived threat system in the formulation; typically, empirical work has ignored the dynamic aspect of the threat system" (Cusack p. 433). Threat is a strong driving force boosting military spending, and it is also an underlying logic of the arms race literature in general. Threat does not remain at a constant level, and the reaction of Taiwan to external threat does not remain static. In this regard, the US-China relationship is too important to be ignored in evaluating a potential external threat, and

should be included in any attempt to understand the dynamics of Taiwan's military spending. By focusing solely on the PRC's military spending, it is possible to overlook factors that have a direct bearing on the level of Taiwan's military spending.

In this dissertation, I argue that the US-China relationship is one important dimension of the external threat to Taiwan because it provides a dynamic reflection of an important element in the military budgeting environment. In addition, Taiwan has good reasons to be paranoid about even the slightest change of US attitude toward Taiwan's security. Following this logic, it may be hypothesized that the level of Taiwan's military spending will vary through time due to the ups and downs of US-China relations or, in specific, the risks of abandonment or entrapment.

This dissertation concentrates on military spending as an indicator of military security because military budget is observable and can cover the whole spectrum of military activities, including elements such as research and development. In addition, money is the most general of all metrics providing considerable flexibility in assessing how specific security requirements are met through reallocation of military resources (Becker 1977; see also Chung 1996).

In contrast, it is extremely difficult to determine a nation's comparative military capability because the training, preparedness, and motivation, and quantity and quality of weapons vary by country (Lebovic and Ishaq 1987). Furthermore, seemingly offensive weapons can be used for defensive purposes and qualitative and quantitative military advantages are mainly contingent upon the conditions under which weapons and troops are used (Levy 1984). For instance, eight diesel-powered submarines recently approved for sale by the United States to Taiwan are treated as offensive weapons and strongly

opposed by the PRC, regardless of the fact that the United States and Taiwan have repeatedly explained they will merely be used on the defensive purposes. This arms sale package is in accordance with the Taiwan Relations Act, which stipulates that the United States will provide Taiwan with defensive weapons necessary for it to maintain a sufficient self-defense capability (Mann 2000 p. 95).

3.2 Hypotheses Testing

1. US-China Hostility and Military Spending

Following the above discussion, three relationships (positive, negative, and nonexistent) between the levels of US-China hostilities and the levels of Taiwan's military spending are hypothesized as follows:

Hypothesis 1: The greater the level of conflict between the United States and China, the higher Taiwan's military spending will be.

This hypothesis states that a higher level of conflictual US-China relationship will lead to a higher level of Taiwan's military spending because of the higher perceived risk of entrapment. In other words, a peaceful US-China relationship will lead to a lower level of Taiwan's military spending because of the lower perceived risk of entrapment. Thus, a better US-China relationship is not only advantageous to both China and the United States but also beneficial to Taiwan by leading it to decrease military spending. For example, when the United States shifted its diplomatic recognition from Taipei to Beijing in 1979, China made a number of conciliatory moves toward Taiwan. They not

only halted bombardment of the offshore islands with propaganda shells and appealed to end the military confrontations but also proposed the establishment of direct communication, travel, and shipping services across the strait (Clough 1999 p. 33). Such offers might lead Taiwan to feel more secure, leading it to commit less funds to its military as shown in the years 1979 and 1980.

An improved US-China relationship also might be beneficial for Taiwan's security because of the perceived lesser risk of entrapment from the United States. On the other hand, China might be more willing to put aside the Taiwan dispute when its relationship with the United States is steady and good (Khalilzad 1999). This argument is advanced by many American China experts, politicians, and scholars such as Madeleine Albright, William Cohen, Lawrence Eagleburger, Charles Freeman, Alexander Haig, Henry Kissinger, Anthony Lake, Kenneth Lieberthal, Winston Lord, Brent Scowcroft, David Shambaugh, Susan Shirk, Michael Swaine, and Michael Oksenberg (Gertz 2000).

A better US-China relationship also is endorsed by Beijing. For example, Chinese Premier Zhu Rongji, in a speech at the Massachusetts Institute of Technology, said that a better US-China relationship is the key to the solution of problems. China is not a potential rival, nor an enemy, but a trustworthy friend of the United States. From his statement, an improved US-China relationship might relegate the Taiwan dispute to the back burner in US-China relations. This would provide Taiwan some breathing space in terms of its security, and lead it to decrease military spending in response.

However, other China experts, politicians, and scholars such as Kurt Campbell, Christopher Cox, Bob Dole, Richard Fisher, Bill Gertz, Bates Gill, Newt Gingrich, Barry Goldwater, Jesse Helms, Michael O'Hanlon, Nancy Pelosi, Edward Timberlake, William

Triplettagree and Stephan Yates, argue that the higher the level of US-China hostility will lead to a lower level of Taiwan's military spending. In other words, as claimed in *The China Threat* (Gertz 2000), a conflictual US-China relationship is conducive to Taiwan's security because the United States would be more likely to beef up Taiwan's defense capabilities. In addition, a strong US posture toward China is beneficial to Taiwan's security as demonstrated in the 1949, 1954, 1958, and 1996 Taiwan Strait crises. Campbell points out that "the common sense of helping Taiwan's defense is an easy way of preventing a war in the Taiwan Strait that could involve the United States" (Gertz 2000 p. 51). Moreover, a wobbly US commitment would lead China to misinterpret that the United States would be willing to reach an accommodation with them over the Taiwan issue and would not stomach a military defense of Taiwan if the island were attacked (Lasater and Yu 2000 p. 234). Following this logic, a conflictual US-China relationship is presumably conducive to Taiwan because of the less need to establish its own arms. From this we can derive a negative correlation hypothesis, i.e.,

Hypothesis 2: The greater the level of conflict between the United States and China, the lower the level Taiwan's military spending will be.

This hypothesis to a great extent justifies that "Taiwan's policy toward the United States is aimed to prevent Washington from improving relations with China or otherwise striking a deal with Beijing that might compromise Taiwan's interests" (Swaine and Mulvenon 2001 p. 10).

Finally, if the United States is, as proclaimed, simply to play a neutral or balancing

role between China and Taiwan, one would expect that there will be no significant impact of US-China relations on Taiwan's military spending because the United States, a hegemon, will not tilt against either side of the Taiwan Strait. A nonexistent relationship can therefore be hypothesized as follows:

Hypothesis 3: Hostilities between the United States and China have no significant effects on Taiwan's military spending.

Ted Galen Carpenter (1998, 2000), a foreign policy analyst at CATO Institute proposes that the United States should not meddle in the Taiwan dispute. He further advocates that Taiwan is of no vital interest to the United States and that American officials need to make it clear to both Beijing and Taipei that under no circumstances will the United States intervene in a PRC-Taiwanese war (see also Cohen et al. 1971, Hickey 1999 p. 23, Lasater 2000, Sheng 2001b, Tucker 2001). This argument makes sense if Taiwan is trivial to the national interest of the United States; the latter certainly will not take the risk of offending China for the sake of Taiwan, which may lead to a possible nuclear confrontation between two superpowers.

2. US-China Volatility and Military Spending

This dissertation also investigates the extent to which historical volatility in the US-China relationship affects Taiwan's military spending. I hypothesize that a volatile or unstable US-China relationship is conducive to Taiwan's security because of a perceived higher US commitment or lower risk of abandonment. Taiwan's leadership will be more

likely to perceive that the United States will be less likely to trade Taiwan to China when the US-China relationship is unstable and turns sour. Such a perception of heightened security will lead to a lower level of military spending. In order to test this theoretical argument, I operationalize the volatility of US-China relations and measure its impact on Taiwan's military spending. Ideally, this relationship should be observed with a lag as described as follows:

Hypothesis 4: The higher the volatility of US-China relations, the lower Taiwan's military spending will be.

This hypothesis makes sense because the volatile relationship between the United States and China will open windows of opportunity for Taiwan to obtain greater political, economic, and military support from the United States. In other words, the unstable US-China relationship will motivate American willingness to develop a closer relationship between Taipei and Washington than would be achieved otherwise. This would also explain in part why China would want to avoid hostile relations with the United States, because Taiwan might capitalize such opportunities to cement closer ties with the United States at the expense of China. For example, the bellicose threat by Beijing's leaders in the 1996 Taiwan Strait crisis stimulated the US Congress to vote for a new bill strengthening the Taiwan Relations Act and even to consider committing the United States to defend Taiwan (Chao and Myers 2000 p. 46). Closer relations between Taipei and Washington will result in a lower level military spending by Taiwan because of a perceived increase in security resulting from a stronger US commitment to Taiwan's

security.

However, Taiwan is very cautious not to offend China while forging closer ties with the United States, and will be more likely to avoid increasing military spending in the wake of some "triumphs" over China on the diplomatic battlefield. There are two reasons. Militarily, China could retaliate by flexing its military muscle and launch a disastrous assault against Taiwan. Economically, China could sanction Taiwan by closing its enormous markets on which Taiwan depends for its economic livelihood (Boultin 1997).

China's renewed efforts to improve relations with the United States after the 1996 Taiwan Strait crisis, the bombardment of the Chinese embassy, and the EP3 accident increased Taiwan's anxieties that China and the United States might try to pressure Taiwan to enter into cross-Strait talks (Swaine and Mulvenon 2001). In other words, an improving and stable US-China relationship will increase Taiwan's fear of abandonment from the United States and result in a higher level of military spending to alleviate its fear due to a lower amount of security emanating from a perceived weaker US commitment to protect Taiwan.

For example, the enactment of the Taiwan Relations Act (TRA) by the US Congress in 1979 enhanced US-Taiwan relations since it redefined possible US reactions toward Taiwan's security crisis. The TRA aimed to provide some semblance of the American security commitment to the island as enshrined in the now defunct Mutual Defense Treaty (Swaine and Mulvenon 2001). To a great extent, this explains why after the US-China rapprochement in 1979, Taiwan did not rapidly expand its military spending in the following year, i.e., it wanted to avoid further provoking China.

When Ronald Reagan visited Beijing in 1984 he reconfirmed that his Six Assurances toward Taiwan remained unchanged. The Six Assurances clearly indicated that the United States had not agreed to set a date to end arms sales to Taiwan; had not agreed to consult the PRC government before selling weapons to the ROC; had not agreed to revise the TRA; would not mediate between China and Taiwan; would not alter its position regarding sovereignty over Taiwan, and would not force Taipei to negotiate with Beijing (Clough 1999, Gong 2000, Harding 1992 p.116, Mann 1999). Reagan's assurance of Taiwan's security explains in part why Taiwan's military spending did not increase after his amelioration of the US-China relationship but, on the contrary, Taiwan reduced its military outlays substantially in 1985.

3. Economic Growth and Military Spending

After testing the effects of US-China relations on Taiwan's military spending as stated above, I next test economic effects. Specifically, I hypothesize:

Hypothesis 5: The higher Taiwan's GNP growth, the greater its military spending will be.

This hypothesis is congruent with "Rich country, strong army" that the causal arrow goes from economic growth to military spending--wealthier countries simply have more resources available to apportion (Thorn 1967, Looney 1989, Chung 1996). Here the aim is to test whether the "Wealthy country, strong army" proposition is applicable to the Taiwanese case. That is, I maintain that continuing material prosperity and economic

growth are essential to the growth of Taiwan's military spending, particularly given the severe external threat emanating from an evolving US-China relationship. Economic growth is treated as an important factor to ensure Taiwan's national security in terms of financial support for military expenditures.[1]

Taiwan must contend with a range of economic and political threats, which largely originate from China. Politically, the PRC is recognized as the sole legitimate government of China by most states, including every major power (Boutin 1997). Beijing considers Taiwan to be a part of China and does not renounce the use of force to take Taiwan back into its fold. In economic terms, cross-Strait trade officially began in 1987 when Taiwan lifted the ban on indirect economic interaction with China. Since then, Taiwan has become increasingly dependent on Chinese markets to a degree that perhaps affects the survival of Taiwan's critical economic sectors (Swaine and Mulvenon 2001). By 1996 Taiwan's combined exports to Hong Kong and Mainland China had surpassed its exports to the United States. Taiwan's government expressed worries that China is exerting a greater and greater influence on Taiwan's economy (Clough 1999, Gong 2000). This might explain why Taiwan has to avoid offending China while cementing the relationship with the United States. This might also explain why Taiwan will spend more on the military to alleviate a higher perceived threat or insecurity emanating from China.

For Taiwan, it is important to recognize that economic development is a requirement for its survival. Particularly, Taiwan needs economic growth to support its tremendous military outlays. Taiwan must take all measures to maintain a close economic relationship with Mainland China for its economic growth and prosperity on

the one hand, and to equip itself with arms from and alliances with the United States for its national security on the other. That is, a stronger US commitment to Taiwan's security allows Taiwan more confidently to engage with China politically, economically and even militarily.

4. Budgetary Incrementalism and Military Spending

Finally, according to the theory of budgetary incrementalism (Wildavski 1964; Russet 1970; Ostrom 1977, 1978; Moll and Luebbert 1980; Ward 1984; Kamelt and Mowery 1987; Harris 1988), one is able to predict that Taiwan's military spending at time t is a function of its immediately preceding spending at time t-1. This might help the researcher to decide what will be the expected military spending in the absence of external shocks.

Hypothesis 6: The higher Taiwan's military spending at time t-1, the greater its spending will be at time t.

3.3 Model Specification

These hypotheses presented above will be incorporated into a model as follows:

Model 1:

$$\Delta\text{Taiwan Military Spending}_t = c + d_1\, D\text{Military Spending}_{t-1} + d_2\, \text{US-China Hostility}_t$$

$$+d_3\ \mathrm{DGNP}_{t-1} + d_4\ \mathrm{Saving}_t + d_5\ \mathrm{Foreign\ Investment\ Rate}_t + d_6$$

$$\mathrm{DChina's\ Military\ Spending}_{t-1} + d_7\ \mathrm{US\text{-}China\ Volatility}_{t-1} + e_t$$

The dependent variable on the left-hand side of the equation is the change in Taiwan military spending from year t-1 to year t. The independent variables are displayed on the right-hand side. They include: change in Taiwan's military spending at lag time t-1, the degree of US-China hostilities in year t, Taiwan's gross national product (GNP) at time t-1, saving rates at time t, foreign investment as a percentage of gross domestic capital formation (GDCF) at time t, China's military spending at time t-1, and the volatility of US-China relations at time t-1 (the last four are control variables and will be discussed in detail in the next chapter). The e_t is a stochastic error term assumed to be normally distributed. In the model, several variables are differenced. This is a remedy to make a series mean stationary and hence avoid the threat of spurious relationships (Granger and Newbold 1974, Hendry 1980).[2]

Stationarity is a very important characteristic for all variables in a time series analysis.[3] If violated, it then will more likely lead to a spurious relationship, which would be characterized by high t and F values and R^2 values but not with an appropriate Durbin-Watson test statistic (Engle and Granger 1987). The inflated t-statistics will result in rejecting the true null hypothesis or committing a Type I error.

Employing an error correction mechanism, one can solve this problem. In the error correction model (ECM), Taiwan's military spending in both level and difference are used, thus one is able to capture the relationship between differenced and level values of Taiwan's military spending and economic growth without any inference problems in

either the theoretical or methodological sense.[4] In addition, using the ECM model is useful relative to the budgetary incremental model, which explains the dependent variable, based on its own history providing a little explanatory or theoretical contribution to the extant literature. Thus an ECM model is tested as an alternative to the budgetary incremental model:

Model 2:

$$\Delta\textbf{Taiwan Military Spending}_t = c + d_1\,\textbf{ECM}_{t-1} + d_2\,\textbf{US-China Hostility}_t + d_3\,\textbf{DGNP}_{t-1} + d_4\,\textbf{Saving}_t + d_5\,\textbf{Foreign Investment Rate}_t + d_6\,\textbf{DChina's Military Spending}_{t-1} + d_7\,\textbf{US-China Volatility}_{t-1} + e_t$$

The concept of an ECM is basically applicable to a situation where external shocks perturb an equilibrium state between two cointegrating series (Beck 1993, DeBoef and Granato 1995).

In order to know which model has a stronger explanatory power, whether the lagged endogenous model or the ECM model is preferable, I will estimate both models, compare their goodness-of-fit, and perform various diagnostic tests. In the next chapter, I discuss several variables that are included in the models.

Endnotes

1. Mark Herander (1991) provides some considerations of the impact of economics in terms of the effects of economic growth and prosperity on national security. He points out that any event that interferes with the flow of trade and so reduces a trading nation's economic welfare constitutes a threat to its national security.

2. Spurious Relationship: when we have two separate series in a time series model with independent processes that are both non-stationary, yet appear to be statistically significant when they actually are not. This leads the researcher to commit a Type I error. Granger and Newbold suggest that if you compare the regression results against the Durbin-Watson d statistics and the adjusted R^2 is greater than d then the estimated regression probably suffers from spurious regression. Traditionally this problem can be remedied by differencing the data of the two series. However, differencing only takes care of short-term spuriousness, but it will eliminate the long-term relationship (Granger and Newbold 1986).

3. Stationarity: A data series is stationary if there is no systematic change in the mean (e.g., no trend), no systematic stochastic variation, and if strict periodic variations (seasonal) are stable. Time plays no role in the sample moments (Charemza and Deadman 1997).

4. To compare both short- and long-term relationship, we need to use the error correction mechanism or ECM approach as explained in the following equation:
   $\Delta Y_t = B_0 + B_1\Delta X_t - \alpha(Y - C_1X)_{t-1} + E_t$
   1) ΔY_t and ΔX_t after first differencing are contemporaneously stationary.
   2) $\alpha(Y - C_1X)_{t-1}$ is the error correction mechanism, which is a linear combination of x and y. The ECM captures the long-run relationship while the differenced x and differenced y capture the short-term one.
   3)α represents the speed of adjustment toward equilibrium and its range lies between negative 1 and 0 (Clarke, Norpoth, and Whiteley 1998).

CHAPTER 4

DATA ANALYSES

4.1 Data Description

The empirical analysis focuses on the period 1966-1992. Later years are excluded because of the lack of any data on US-China interactions in Charles McClelland's (1971) World Events Interaction Survey (WEIS) data set. Multiple sources of data are employed. Taiwan's Military Expenditure (T_MILEXP), and Taiwan's Gross National Product figures (T_GNP) are collected from the U.S. Arms Control and Disarmament Agency (ACDA) and Taiwan's Council for Economic Planning and Development (CEPD *Taiwan Statistical Data Book 1997*), respectively.

ACDA's estimates are selected over other estimates because they provide military expenditure figures in US dollar values with reference to GNP. Alternative sources, such as the Stockholm International Peace Research Institute (*SIPRI*), do not provide GNP estimates (Sun and Yu 1999). Other independent variables such as saving rate (T_SAVING), foreign investment as percentage of gross domestic capital formation (T_FORINV), and China's military expenditures (C_MILEXP) are collected from *Taiwan Statistical Data Book 1997* and the ACDA data set. External threat (dyadic interactions) variables are taken from the extended WEIS data set, updated by Rodney Tomlinson at the US Naval Academy, which contains 1750 events for the China-US and China-Taiwan dyads during the period studied.

The WEIS data set is a collection of international events based on the *New York*

Times Indexes, in which data like the country(ies) triggering the event, target countries, date, nature of event (conflictual or cooperative) are recorded.

The interaction variable, US-China dyadic interactions (UC_HOSTILITY), is operationalized as the summation of "conflictual" scores, with intensity accounted for, manifested by interactive events involving the United States and China in a given year. The initial dyadic interaction variable is composed of 62 levels, representing events of different degrees of cooperation or confrontation. They are Yield, Comment, Consult, Approve, Promise, Grant, Reward, Agree, Request, Propose, Reject, Accuse, Protest, Deny, Demand, Warn, Threaten, Demonstrate, Reduce Relations, Expel, Seize, and Use of Force (see Appendix I for details of 62 levels and Appendix II for recoding syntax). The variable UC_HOSTILITY is aggregated to provide annual data to match with ACDA's variables (more explanations will be provided later).

Other conceivable measures of external threat include Lipow and Antinori (1995), who used average defense spending in the case of 75 nations. Sezgin (1998) used defense spending of a rival country in his analysis of Turkey. Karl (2000) used occurrence of war in his Israel study. Oren (1995) used military capability and levels of hostility from the COW project to study the US-Russian case. Kollias (1996) used a security dummy in the Greek-Turkish case. Sun and Yu (1999) used a war dummy in China's case.

These empirical studies on external threats and military spending have reported conflicting findings, attributed to the use of cross-sectional analysis, sample variations, differences in specification selected, time period examined, and databases used. Nicholas (1999 p. 501) suggests that "these considerations point to the justification for case-

specific studies using time series data for individual countries." Huang (1997) also agrees that dynamic case studies can add more precision to our understanding and, more important, the cumulative knowledge derived from studying individual countries also can shed light on the underlying reasons of cross-national diversity. Gastillo et al. (2001) further suggest using a combination of case studies and statistical methods because the former is good at testing a causal mechanism while the latter is best at testing the background conditions of a hypothesis and determining the effects of its individual variables.

After comparing different situations for different countries, I decided to follow Oren's (1995), and Huang, Kim and Wu's (1992) measurement of external threat by taking the levels of environmental hostility into account, because it allows one to take into account dynamic effects in the dyadic interactions, which are ignored by previous studies oftentimes. In this dissertation, I use the levels of US-China hostility ranging from 1 to 28 as indicators to measure the degrees of external threat to Taiwan. As argued before, the level of US-China hostility is the appropriate variable to capture dynamic exogenous effects on Taiwan's military spending.

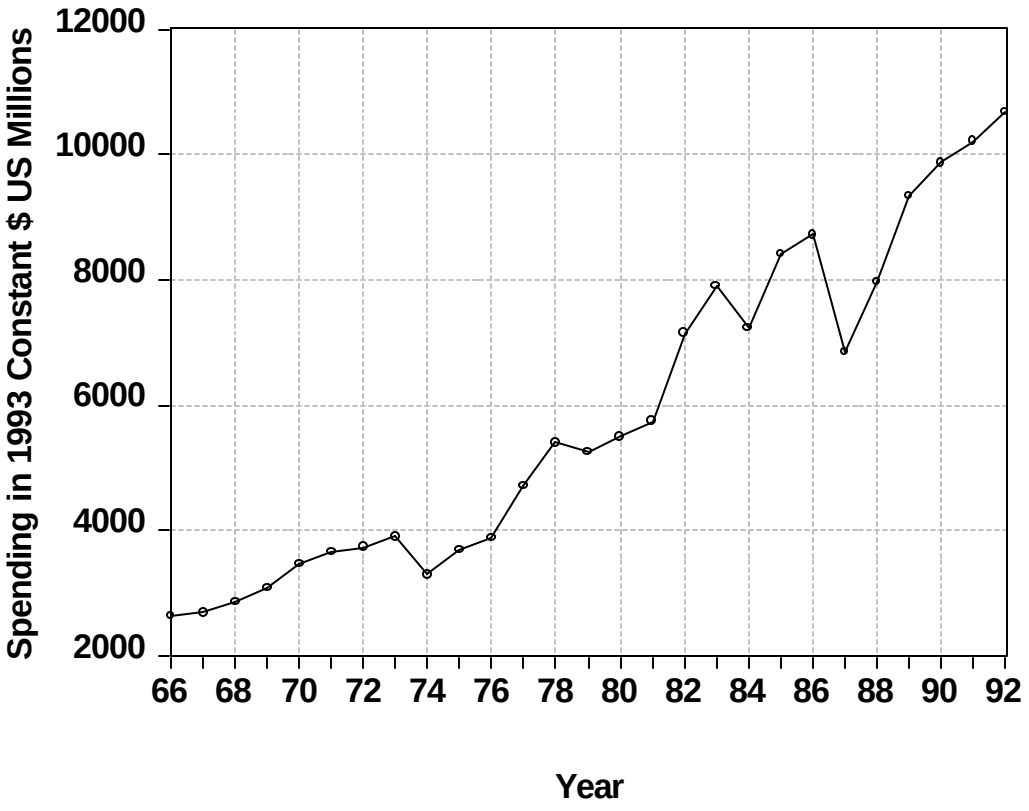
1.2 Operationalization and Measurement

Before discussing testing procedures, measurement and dynamics, several key variables will be discussed as follows:

4.2-1 The Dependent Variable—(Taiwan's Annual Military Spending, 1966-1992)

According to the ACDA (1974), military spending is defined as current and capital expenditures to meet the needs of the armed forces. However, in most of the arms race literature, military spending has been operationalized as a single-dimensional indicator as military spending (Mosley 1985). This dissertation follows this operationalization because the military expenditure decision processes oftentimes vary across countries, making it difficult to compare them. But total military expenditures in the form of money outlays can easily be compared and collected from the ACDA data set (Chung 1996).

Figure 4-1 Taiwan's Annual Military Spending, 1966-1992



Taiwan's annual military spending collected from the ACDA was measured in millions of constant US 1993 dollars (see Figure 4-1 above). From 1966 to 1992, Taiwan's annual military spending increased upwardly from about US $ 2.637 billion to US $ 10.6

billion. The first trough in Taiwan's military spending happened in 1974 followed by a drastic upward trend in 1977 until the second trough appeared in 1984. This is illustrated in Figure 4-1. The third trough occurred in 1987 followed by an upward surge again in 1989. Another upward trend began in 1991.

Possible explanations: Mao Tse Tung died in 1976. This alarmed Taiwan, which worried about a possible diversionary attack from China. It also suggested a possible opportunity for Taiwan to recover the mainland if power struggles occurred after Mao's death. On the other hand, Taiwan's first political uprising, the Chungli Incident, occurred in 1977, and triggered a violent protest. Angry demonstrators set fire to a police station and police patrol cars. This resulted in military repression by the Kuomintang government; thousands of people were involved and many were injured in this political turmoil. Taiwan's leadership worried that such domestic instability might prompt a surprise attack from China. Therefore, Taiwan needed a military buildup to control domestic reactions and to deter invasions from China.

In October 1984, Chiang Nan, a writer with US citizenship, was murdered. Taiwan's Military Intelligence Bureau was allegedly involved. After this incident, Ronald Reagan, a pro-Taiwan president, applied pressure through the 1986-1987 Foreign Affairs Authorization Act on Taiwan's Kuomintang (KMT) regime to put democratization into practice. This resulted in permitting the establishment of an opposition party, the Democratic Progressive Party (the current ruling party of Taiwan) in September 1986, and lifting of martial law in July 1987.[1] In 1991, the Democratic Progressive Party won its first major victory and gained a number of seats in the legislative Yuan, where Taiwan's annual military budgets are approved. These political

domestic events may have affected Taiwan's military spending as reflected in the troughs and peaks in Figure 4-1.

In terms of the US-China relationship, Washington announced normalization of relations with the PRC in 1978 and cut off diplomatic ties with Taiwan in 1979. Taiwan recognized this diplomatic setback, especially the termination of the US-Taiwan Mutual Defense Treaty, as a serious threat to its security. Therefore, it expanded its military expenditures. Interestingly, however, Taiwan's military spending increased only slightly after the 1979 normalization. Perhaps this was due to the enactment of the TRA by the US Congress in the same year to ensure Taiwan's security. Arguably also important were the relatively peaceful interactions between the United States and China at that time.

In 1984, Ronald Reagan was reelected president, and his strong anti-communism stance assured Taiwan's security. This led to a reduction in Taiwan's military expenditures (see Figure 4-1). In addition, Beijing started its economic reforms orchestrated by Deng Xiaoping's leadership in 1987, and thereby indicated it had no intention to engage in military expansion. Meanwhile, Lee Teng-hui was inaugurated as president of Taiwan in 1988 and he signaled that his top priority was to improve economic ties with China. Taiwan's investment in China increased when Taiwan and China began to soften their hostilities toward each other in 1987. In the same year, Taiwan not only nullified martial law but also granted permission for Taiwan citizens to visit relatives in China. In 1991, Lee announced that Taiwan's government would renounce the use of military force for the pursuit of national unification. Both sides of the Taiwan Strait further established semi-official organizations authorized to negotiate with each other to resolve problems arising in people-to-people relations across the strait.

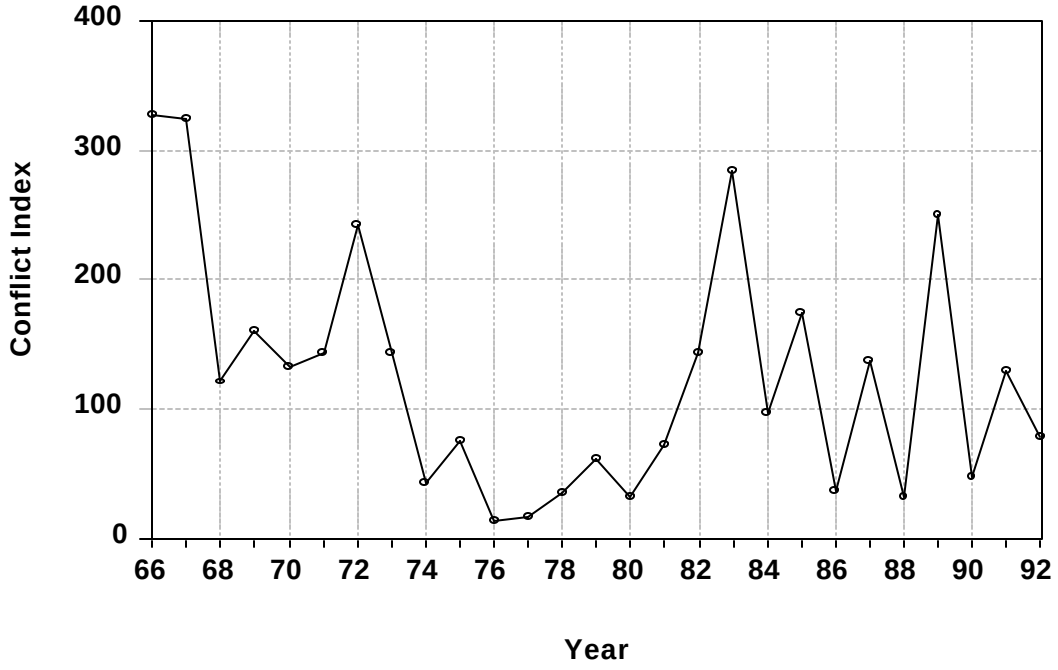
These were the Strait Exchange Foundation on the Taiwan side and the Association for Relations Across the Taiwan Strait in China (Clough 1999, Chao and Myers 2000, Harding 1992, Sheng 2001, Tucker 2001). To account for these several political events, dummy variables for the years 1977, 1984, 1987 and 1991 are included as controls in the models of Taiwan's military spending.

4.2-2 Other Independent Variables

1. Index of US-China Conflict

The first continuous independent variable, the index of US-China conflict, is operationalized as the sum of the conflictual scores from Reject (11) to Force (22) events manifested by the dyadic interactions between China and the United States from 1966 to 1992. The interaction data are available in the extended WEIS data set (see Appendix II).

Figure 4-2 Index of US-China Conflict, 1966-1992



According to Goldstein (1992), McClelland's WEIS data set should not aggregate all events into a single conflict-cooperation time series. He further points out that WEIS is constructed within a conceptual framework that explicitly denies the possibility of reducing data to one dimension of the conflict-cooperation spectrum. Huang, Kim and Wu (1992 p. 50) measured the frequency of conflicts between China and the United States by reling on Edward Azar's Conflict and Peace Data Bank (COPDAB) from 1948 to 1978. The COPDAB data set contains a variable (called the conflict scale category) which records each event according to the degree of conflict or cooperation involved on a 15-point ordinal scale--the lower the score, the higher the degree of cooperation and vice versa, a score of 8 representing a neutral act. However in the final statistical analysis, they only counted those conflicts in categories 11 (hostile diplomatic-economic actions) to 15 (full-scale air, naval, or land battles).

When I converted WEIS data into a conflict-cooperation continuum, I found that the relatively rare frequencies of conflictual events were obliterated by most of the cooperative events, thus no significant variations could possibly be captured. Therefore, I explored the possibility of re-coding the scales by simply counting the number of conflictual events started from Reject (11), which is the eleventh category in the WEIS data set (see Appendix I), and its two subcategories 111 and 112 are coded as value 1 and 2 separately. Following throughout this procedure, I coded the last category Force (22) and its three subcategories 221, 222, and 223 as values 26, 27 and 28 (see Appendix II). After these data transformations, US-China hostility becomes an ordinal variable, which ranges from 1, the least conflictual score, to 28, the most conflictual score. Larger values represent higher levels of conflict or hostility between China and the United States. The

lowest raw score of hostility, 1, reflects the occurrence of actions such as turn down proposal; reject protest, demand, or threat between the United States and China (detailed in appendix I), and the highest raw score of hostility, 28, reflects military engagement as at the subcategory 223 (see appendix I). The hostility scores are aggregated by each year as shown in Figure 4-2. Taking the total accumulated scores for each year allows one to detect the impact of accumulated intensity of US-China hostility on Taiwan's military spending on an annual basis.

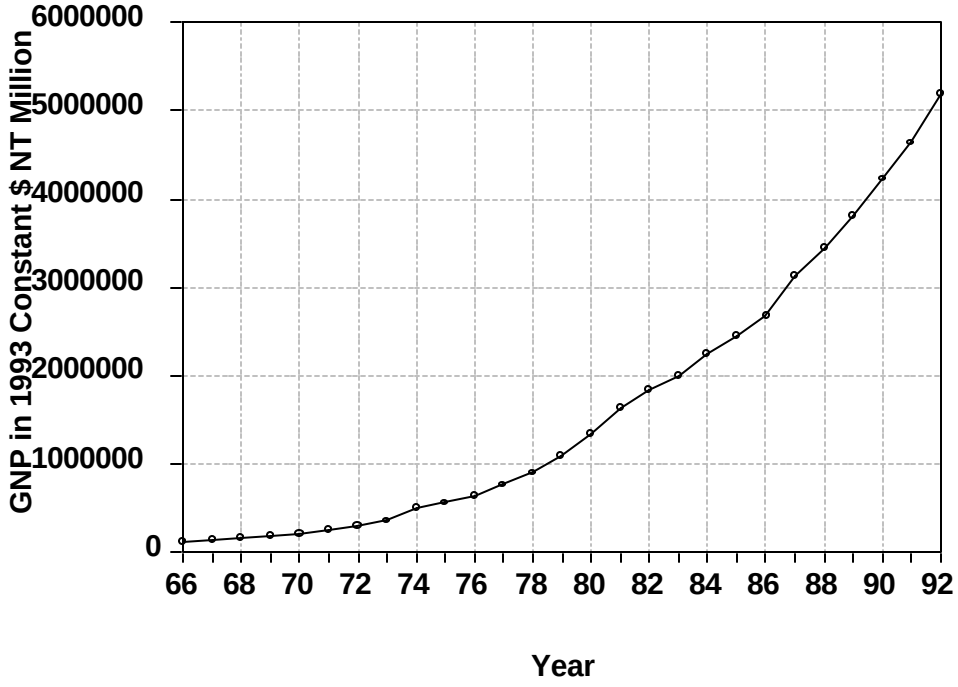
As shown in Figure 4-2, after Nixon's visit to China in 1972, US-China relations improved rapidly until the inauguration of Ronald Reagan in 1980. The strong anti-Communist characteristics of the Reagan administration increased tension between the two countries, and levels of hostility increased rapidly in the three years from 1981 to 1983. However, in Reagan's second term his administration seemed to moderate its hostile attitude toward China. The amelioration of US-China relations continued until the occurrence of the Tiananmen massacre in 1989 (see Figure 4-2).

2.Taiwan's Annual Economic Gross National Product

Gross National Product (GNP) is an economic measure much like Gross Domestic Product (GDP). GNP is the total market value of all final goods and services produced annually by citizens of a country (Arnold 1998). Unlike GDP, GNP measures the production of goods and services by the citizens of a country, no matter where in the world they reside (Arnold 1998). It is widely used as the basic measure of the performance of the economy in producing goods and services. As noted above, GNP is a relevant factor because it is related to national income, which delineates the overall

ability of a country to maintain a particular volume of military expenditure (O'Leary and Coplin 1975).

Figure 4-3 Taiwan's Annual Gross National Product, 1966-1992



The data on Taiwan GNP in 1993 constant New Taiwan (NT) dollars, per million units (see Figure 4-3), are taken from the *1997 Taiwan Statistical Data Book*. In the 1960s, Taiwan made a transition from import-substituting industrialization (ISI) to export-oriented industrialization (EOI), whereupon a high degree of economic growth was achieved over time as shown by the upward trend in Figure 4-3 (Copper 1999, Ferdinand 1996, Fields 1995). Keeping pace with economic growth, the exchange rate of the New Taiwan dollar to the US dollar also rose. Taiwan's foreign currency reserve increased rapidly in the last half of the 1980s, reaching around 80 billion US dollars in 1987, and became the third largest in the world, following Japan and Germany. Taiwan

was recognized as a "nation of wealth." Afterwards, GNP kept increasing, and Taiwan has achieved a position as the highest foreign reserve country in the world after July 1992 (Chan and Clarke 1992, Copper 1999, Ferdinand 1996, Fields 1995, see also *Taiwan's 400 Year History*).

Chan and Clarke (1992) summarize the factors leading to Taiwan's economic growth. These include the legacy of Japanese colonialism, the Cold War ideology of the United States, and the global economic cycle at the time of its initial export drive. However, consciousness of the PRC threat and its effects should not be overlooked (Chan 1990). As stated above, Taiwan's economic growth and industrialization should enhance its military power, with the aim of increasing national strength to promote security and peace.

3. Error Correction Mechanism

The ECM, a linear combination of Taiwan's military spending and Gross National Product, is a stationary variable, which is measured as the residuals of the cointegrating regression of T_MILEXP and T_GNP. In the statistical model, the ECM operates with a lag of 1 period, and it captures the long-term relationship between T_MILEXP and T_GNP (see Figure 4-4 in the back).

In keeping with the idea that T_MILEXP and T_GNP are in dynamic equilibrium (i.e., they move together in the long-run), it is expected that ECM's coefficient, β_1, will carry a negative sign, and be greater than 0 and less than 1 in magnitude. The relationship is shown in the following equation: Δ (T_MILEXP) = $\beta_0 + \beta_1$ $ECM_{t-1} + u_t$. where Δ = difference operator (i.e. T_GNP_t - T_GNP_{t-1})

β_0 = constant

β_1 = regression coefficient

ECM = error correction mechanism, $T\_MILEXP_t - C_0 - C_1 T\_GNP_t$, where C_0 and C_1 are estimated by the cointegrating regression in $T\_MILEXP_t = C_0 + C_1 T\_GNP_t$.

ε_t = error term

The negative sign of β_1 implies that shocks to T_MILEXP at time t will be adjusted or "re-equilibrated" in subsequent periods by the cointegrating relationship between Taiwan's military spending and GNP. The adjustment rate is determined by the magnitude of β_1. For example, if β_1 = -.5, this means that 50% of a shock (from whatever source) to T_MILEXP at time t will be eroded at time t+1. In other words, fifty percent of what remains of the shock at t+1 will be eroded at t+2 and so on into the future. For example, if the total shock at time t is .8 then it will erode 50 % of .8 at time t+1, that is .4. Following through the procedure, it will become .2 at time t+2 and .1 at time t+3 and so on until it re-equilibrates to the original level. If the error process, ε_t, meets standard (Gauss-Markov) assumptions, the parameters in the above equation may be estimated using OLS regression (Clarke, Norpoth, and Whiteley 1998).

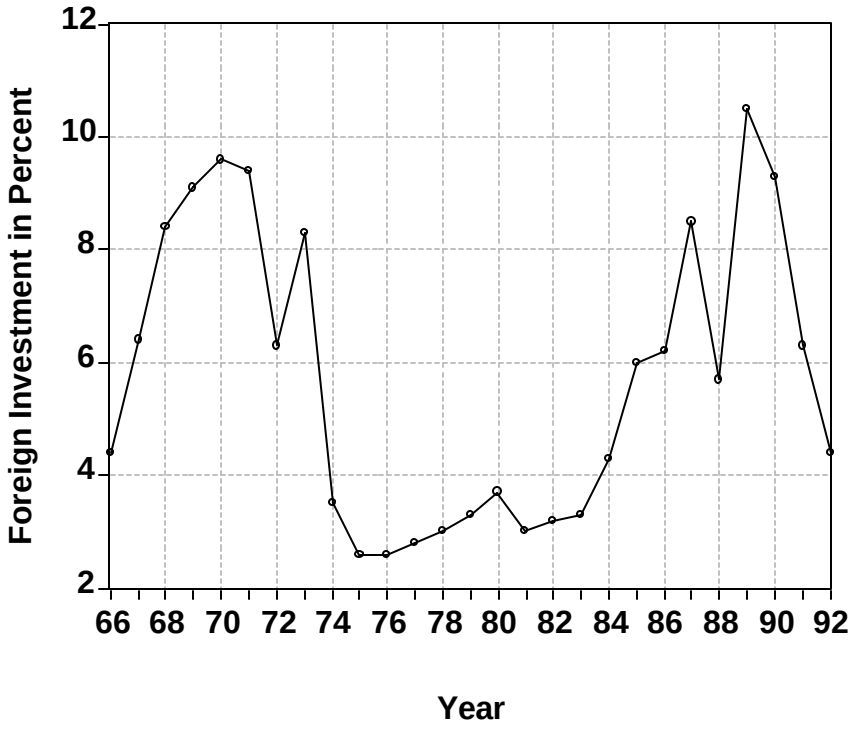
4. Taiwan's Annual Foreign Investment as Percentage of GDCF

Foreign investment is seen by many as a prerequisite for economic growth and an amount of 10% of GNP has been suggested as a threshold necessary for economic takeoff (Rostow 1960). In this dissertation, foreign investment is measured in annual percentage terms based on *Taiwan's Statistical Data Book 1997* i.e., the total amount of foreign

investment divided by the total amount of Taiwan's Gross Domestic Capital Formation (GDCF) times 100 (see Figure 4-5).

According to *Taiwan's Statistical Data Book*, the United States, Japan, Hong Kong, and overseas Chinese communities have been the most important sources of imported capital, as each of these sources provided between 18% and 28% of cumulative foreign investment in Taiwan over the postwar period (Huang 1989; Chan and Clarke 1992). However, as argued above, there seems to exist a psychological linkage between the perceived "riskiness" of a state and foreign investment. This might explain in part the fluctuations in the total amount of foreign investment over time illustrated in Figure 4-5.

Figure 4-5 Taiwan's Foreign Investment as Percentage of GDCF, 1966-1992



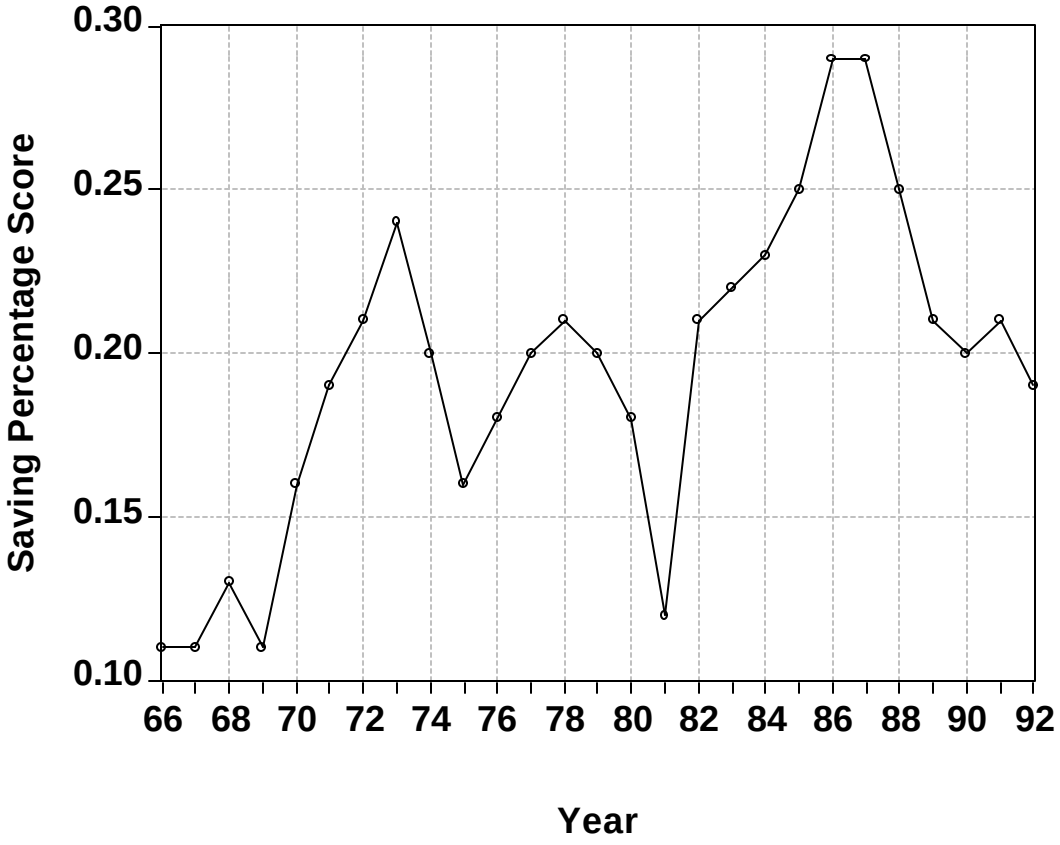
Chan and Clarke (1992) note that Taiwan's foreign investment peaked at just under 10% of Gross Domestic Capital Formation (GDCF) from 1968 to 1971, and then fell

substantially (to about 3%) during the 1970s and the early 1980s, before climbing again (to about 7%) in the late 1980s. A possible explanation for the rapid drop in foreign investment from 1972 to 1979 might be that Nixon's visit to Beijing in 1972 symbolized the change of US foreign policy toward China. This caused international investors to worry about the security of Taiwan and to hesitate to invest in Taiwan. The international economic recession caused by oil crises in 1973 and 1979 also might help to explain the huge decrease in foreign investment during this period.

5. Taiwan's Annual Saving Rate

Economic development requires investment and savings. Capital formulation increases labor productivity and economic growth. To accumulate capital, it is necessary to save (Parkin 1998). Taiwan's saving rates, even at the lowest troughs, are high, exceeding 10% (see Figure 4-6). This provides a clue not only to its economic miracle but also to its high military spending. Smith (1977) notes, wealthier states should have a greater need and incentive for maintaining demand because they will be driven by increasing domestic needs to seek more natural resources from abroad. A wealthy country also simply has more financial support and material power to deal with external threats than otherwise would be the case. Therefore, states with higher saving rates are able to afford greater defense burdens than less prosperous ones.

Figure 4-6 Taiwan's Annual Saving Rate, 1966-1992



The calculation and data of average propensity to save are collected from *Taiwan's Statistical Data Book 1997* as follows:

$$\text{Saving Propensity Score} = \frac{\text{(Household Savings)}}{\text{(Household Disposable Income)}}$$

As shown in Figure 4-6, the saving rate quickly escalated from about 12% in the 1960s to over 24% at the beginning of the 1970s where it has remained except in 1975 and 1981. During the 1980s, Taiwan's saving rate increased to around 30% until falling in 1989, probably due to the impact of the Tiananmen incident. The heightened tensions between China and the United States due to China's brutal suppression of students'

democratic demonstration seemed to affect economic activities throughout the region. It is plausible that the economic downturn at that time is one of the major reasons for the drastic decline in the Taiwanese saving rate.

Myers (1984) suggests that Taiwan's remarkable saving rate results from a variety of factors such as the popularity of opening small businesses, a culture that encourages industrious work and saving, and policy incentives regarding tax and interest rates. However, the external threat should not be ignored as an influence on the individual's willingness to save. It may be conjectured that when people feel insecure, they will more likely save money in the event of an emergency instead of spending their money without any other resources as security. Kim (1995) further points out that war cramps luxury spending. He adds that, historically, people have spent less money during time of war because they are nervous about what the future may bring. Thus, they control their spending more closely.

6. Volatility in the US-China Conflict Index

To analyze the nature of the US-China relationship and its impact on Taiwan's military spending, this study also employs a volatility variable, which measures fluctuations in the extent of conflict in US-China relations. Specifically, the variable is the variance of the sum of conflict scores in each year (see Figure 4-7). Figure 4-8 further illustrates the annual mean US-China conflict scores from 1966 to 1992 and the frequencies for each year. Using these mean scores, I calculate standard deviations and variances for each year.

Figure 4-7 Volatility in US-China Conflict Index, 1966-1992

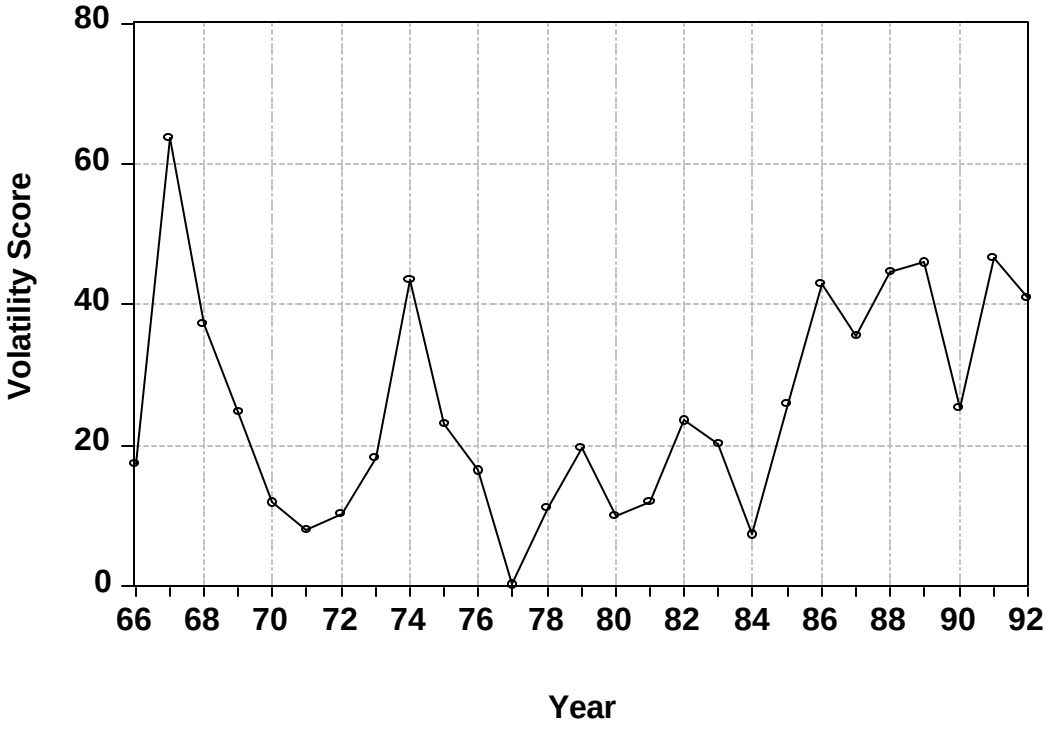
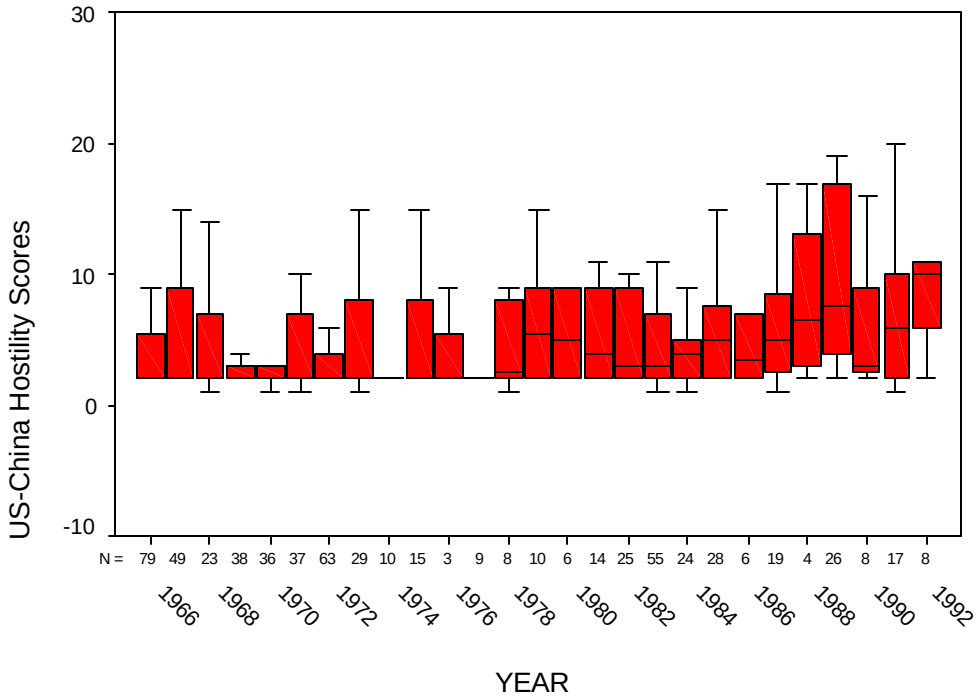


Figure 4-8 US-China Conflict Scores: Means and Ranges



The formula for the volatility calculation is:

$$s = (1/n\text{-}1\sum_{i=1}^{n}(m\text{-}x_i)^2)^{1/2}$$

Where: s = standard deviation, or historical volatility
n = number of occurrences (bars)
m = mean scores of US-China hostility
x_i = hostility score changes

For any given year, a larger variance indicates a more volatile or unstable US-China relationship. As shown in Figure 4-8, the normalization of US-China relationship in 1979 was in actuality very unstable because of its large standard deviation of US-China conflict scores. A possible explanation is that the US enactment of the Taiwan Relations Act in the same year resulted in a number of protests by China. This, in turn, explains the reason why a large standard deviation occurred, and reveals the conflictual nature of US policy toward China and Taiwan.

In contrast, Reagan signed the second Shanghai Communiqué in 1982, which enjoined the United States to restrict arms sales to Taiwan so long as the balance of military power between China and Taiwan is preserved. However, in his visit to China in 1984, Reagan stated that Washington would not pressure Taiwan's government to negotiate with China or to serve as an intermediary between the two governments, and would ensure that Taiwan had the weaponry needed to defend itself (Chao and Myers 2000, Clough 1999, Gong 2000, Harding 1992, Lasater and Yu 2000, Mann 2000, Sheng 2001b). These conflictual gestures to great extent explain the large mean US-China conflict scores in the years 1984 and 1985.

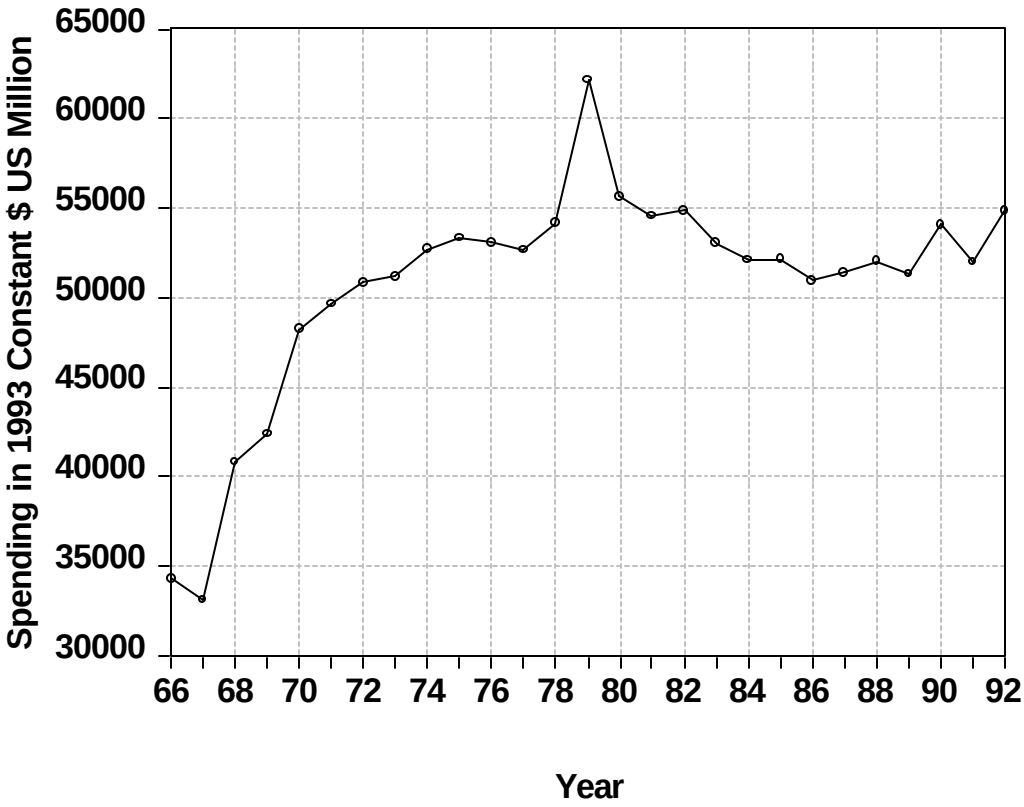
The Tiananmen incident was the main factor prompting the surge in mean US-

China conflict scores in 1989. Although the Bush administration was criticized for cuddling the Beijing dictatorship, China's brutal suppression of student demonstrations was an explosive factor that led Washington to adopt a series of economic sanctions and indirectly led to the sale of F16 warplanes to Taiwan in 1992.

7. China's Annual Military Spending

Similar to Taiwan's military spending, China's military spending data also are collected in the ACDA data set. Waller (1997) indicates that the official Chinese defense budget is significantly lower than actual military spending.

Figure 4-9 China's Annual Military Spending, 1966-1992



For example, revenue raised and spent independently by PLA's industry (e.g., proceeds derived from arms sales) is not counted (Waller 1997). Similarly, Sun and Yu (1999) argue that it is not convincing to study China's military spending based on the official Chinese data because a significant portion of this spending is excluded from the defense budget and funded under other headings.

Here, China's annual military spending data are calculated in constant 1993 US dollars (see Figure 4-9). As this figure illustrates, there was a huge spike in China's military spending in 1979, which then rapidly declined. A possible explanation of this sudden increase might be the occurrence of the border war between Vietnam and China in 1979. After the war, the Chinese leaders revised their policies and assigned top priority to economic development (Sun and Yu 1997). The rapprochement between China and the United States allowed Beijing to lessen its military spending burden. The reduction lasted until 1988 (see Figure 4-9). The Tiananmen event in 1989 increased the PRC leadership's sense of insecurity, as reflected in the small increase in military spending in the 1990s.

4.3 Stationarity Tests

As noted above, stationarity is a very important property of time series data because assuming time series are stationary when, in fact, they are non-stationary can produce very misleading results (Durr 1993, Ostrom and Smith 1993, Williams 1993, Box-Steffensmeier and Smith 1996). The situation where both the dependent variable and the independent variables are non-stationary invites "spurious regressions." Regression coefficients can appear to be statistically significant even when, in fact, the variables

being analyzed are totally unrelated (Granger and Newbold, 1986). So before conducting any meaningful statistical analysis, one needs to check the stationarity of each series of interest. For this purpose, Augmented Dickey-Fuller tests are used.[2] The results are as follows:

1. Taiwan's annual military spending (T_MILEXP) is a non-stationary time series as demonstrated by the outcome from the ADF test as shown in Table 4-1. A first difference renders the series, Δ(T_MILEXP), stationary because the ADF test statistic –5.468 exceeds the critical value –4.37 at the .01 level, thereby leading one to reject the null hypothesis of non-stationarity.

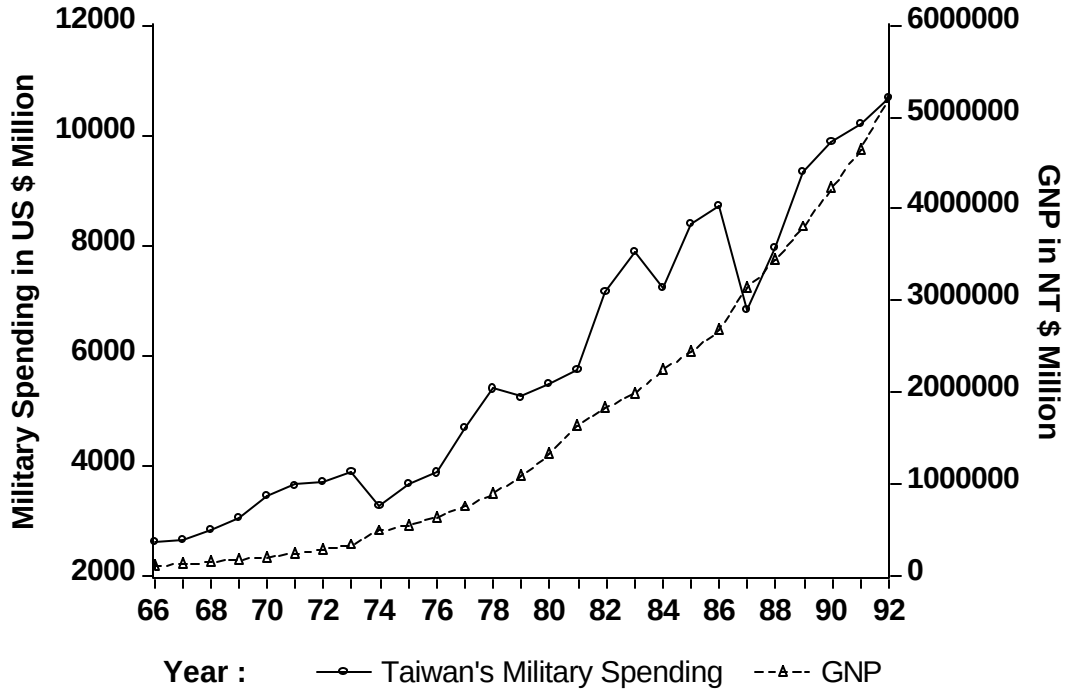
2. US-China Conflict Levels (UC_HOSTILITY) is a stationary time series as demonstrated in the Dickey-Fuller Test in Table 4-2. The ADF test statistic –3.546 is less than the critical value –2.985 at the .05 level, thus rejecting the null hypothesis that UC_HOSTILITY is non-stationary. Thus, UC_HOSTILITY will be incorporated in the model in level form to investigate its impact on Taiwan's military spending.

3. Taiwan's annual GNP growth is a non-stationary time series as demonstrated by the ADF test in Table 4-3. As noted, Taiwan's annual GNP growth trended upward from 1966 until 1992, the last year in the study (see Figure 4-3). However, the graphical analysis only provides an auxiliary measure to identify the stationarity of the series. To further confirm the non-stationarity of the T_GNP, we need to go further to conduct the ADF test. The ADF test statistic, –3.85, is less than the critical value –3.60, thus rejecting the null hypothesis of non-stationarity.

Figure 4-10 shows both T_MILEXP and T_GNP are non-stationary but trending together; therefore, one needs to determine if these two series cointegrate, i.e., to test if

there is a linear combination of them that is a stationary variable.[3]

Figure 4-10 Taiwan's Military Spending and GNP, 1966-1992



For this purpose, I employ a Johansen test (Kenndy 1992, Harris 1995, Charemza and Deadman 1997). The result of testing of the two series for cointegration is congruent with the graph and theory indicating that they are cointegrated. The first row in the upper Jonhansen test (see Table 4-5, Appendix) examines the hypothesis of no cointegration, i.e., that is, the T_MILEXP and T_GNP have no attractor that keeps them in proportion to each other in the long-run. As shown in Table 4-5 the hypothesis is strongly rejected in favor of cointegration, which further justifies the application of the error correction model (ECM) in this dissertation.

4. The Error Correction Mechanism of GNP and Military Spending is stationary as registered in Table 4-6 (see Appendix). The ADF test statistic –2.73 is less than –2.63 at

the level of 0.1 and thus it is a weak stationary series and will be tested at its level form in regression analysis.

5.Taiwan's Annual Foreign investment as percentage of GDCF (T_ FORINV) is a non-stationary time series as shown in Table 4-7. After first differencing, the Δ(T_FORINV) became strongly stationary and the ADF test statistic –6.05 is far less than –3.73 at the level of .01. Thus, this series will be incorporated in the general equation as a first differenced form.

6. Taiwan's Annual Saving Propensity Rate is a non-stationary series too (see Table 4-8). Similar to Taiwan's foreign investment, the T_SAVING needs first differencing to render it stationary. For the differenced Δ(T_SAVING), the ADF test statistic is –4.61. This is less than the critical value –3.72 at the .01 level. Thus, it will be incorporated into the equation in first difference form.

7. The US-China Mean Scores for Volatility (UC_VARIANCE) is stationary as shown in Table 4-9. The ADF test statistic –2.75 is lower than the critical value –2.63 at the level of .01. This indicates that it can be incorporated in the model based in level form.

8. China's Annual Military Spending is nonstationary as shown in Table 4-10. It needs to be first differenced before it can be incorporated in the model.

Having checked the stationarity of all series of interest, I can now test the hypotheses that guided the specification of the model of Taiwan's military spending. This is the task of the next chapter.

Endnotes

1. See Taiwan's 400 Year History published on website http://members.home.net/wchen88/chronology.htm

2. I employed the Dickey-Fuller test where the null hypothesis is that a series has a unit-root. For example, let Taiwan's military spending, $T\_MILEXP = \alpha(T\_MILEXP)_{t-1} + e_t$ then the unit-root test is to identify whether the absolute value of α is equal to or less than 1. If $|\alpha| < 1$ then T_MILEXP is stationary, but if $|\alpha| = 1$ then T_MILEXP is nonstationary. Thus formal tests of stationarity are tests for $\alpha = 1$, and because of this are referred to as tests for a unit root. The case of $|\alpha| > 1$ is ruled out as being unreasonable because it would cause the series T_MILEXP to explode (Kennedy 1992). Rejection of the null hypothesis implies that T_MILEXP is stationary.

   It should be noted that although the Dickey-Fuller test statistic is a simple t-ratio, its critical values for the test are non-standard, and vary depending upon whether one includes a constant or deterministic trend in the regression analysis that generates the unit-root test statistic (Kennedy 1992). The software package, EView, employed in this dissertation, will automate the unit-root testing procedure, providing menus of tests and test options, and displaying critical values at given probability values.

   If the unit-root tests suggest that two or more series are non-stationary, the next step is to determine if they cointegrate. A suitable procedure to test if Taiwan's military spending and Taiwan's GNP cointegrated is to regress one series on the other. The regression is $T\_MILEXP = C_0 + C_1\ T\_GNP$. If both series are cointegrate, it is expected that this regression will have a large R^2 and the estimated coefficient C_1 will be statistically significant and properly signed (Engle and Granger 1987). For the next step, I need to perform a unit-root test on the residuals of the regression (a linear combination of T_MILEXP and T_GNP) to determine if they constitute a stationary series.

3. However, there may be a possible simultaneity problem existing between military spending and GNP growth as suggested by theory. I thus employed a Granger Causality Test to identify which arrow direction derives better predictive power: Whether GNP growth drives the increases in military spending or vice versa?

   According to the outcomes of the Granger Causality Test in Table 4-4, Taiwan's GNP growth evidently Granger causes Taiwan's military spending. The T_GNP does not Granger cause T_MILEXP statistically significant at level .001 thus the null hypothesis is strongly rejected. On the other hand, T_MILEXP has little predictive power for T_GNP and the hypothesis of no Granger causality is easily accepted. This finding is interesting because it is contrary to most previous findings, which maintain that Taiwan's high military spending leads to its rapid economic growth instead of the other way around as suggested by this study.

CHAPTER 5

METHODS AND RESULTS

5.1 Basic Concepts

This chapter first reviews some basic methodological concepts applied in the statistical analysis of the theoretical model of Taiwan's military spending. Model parameters are estimated using OLS regression procedures. The OLS assumptions are very important to ensure unbiasedness, efficiency, and consistency crucial for making useful statistical inferences.[1] The OLS assumptions (Gujarati 1978) are:

1. Zero Mean: $E(e_t) = 0$, for all t which implies that $\mu_e = 0$.

2. Constant Variance: $Var(e_t) = \delta_e^2$, for all t.

3. No Autocorrelation: $E(e_t e_v) = 0$, for $t \neq v$ which implies that $cov_{etev} = 0$.

4. Nonstochastic Regressors: $E(e_t x_t) = 0$, for all e_t and x_t.

5. Linearity: the relationship between Y and X is linear.

6. Normality: the error term is normally distributed.

The variables studied in this dissertation are all time series data that are typical examples of longitudinal observations. Longitudinal observations may be integrated, thus being no longer stationary. From the graphical analyses, Taiwan's annual military spending and GNP likely are nonstationary series due to their upward trending features as illustrated in Figure 4-10. The testing results of ADF tests in Chapter Four further verified both series are nonstationary.

Box and Jenkins (1976) demonstrate that if a series is characterized by a stochastic trend, then differencing it will render it stationary. However, there is a price to pay for

differencing variables, namely any long-run relationships between them are obliterated (Beck 1992). It seems that we are in a dilemma caught between the methodological "Scylla" of spurious regression and the theoretical "Charybdis" of ignoring long-term relationships (Clarke and Whiteley 1998). Engle and Granger (1987) prove that it is possible to analyze nonstationary series that are cointegrated by using an error correction model specification (ECM). Simply stated, cointegrated series are in a state of dynamic equilibrium such that they travel together in the long-run (Clarke and Whiteley 1998).

Thus, if Taiwan's military spending and Taiwan's GNP series are in equilibrium while growing over time, they will not drift apart or significantly diverge from each other in the long-run. Cointegrating series have the property that a linear combination of them is a stationary variable. It is important to emphasize that cointegration cannot be assumed or inferred from a graphical analysis alone, but must be demonstrated empirically through formal diagnostic tests such as the Johansen test as exhibited in Table 4-5 in the Appendix. If one concludes that nonstationary series cointegrate, then an ECM specification is warranted (Clarke and Whiteley 1998).

5.2 Testing Procedures for ECM

Following the procedures, I conclude that both T_MILEXP and T_GNP series are nonstationary and cointegrate. Thus, it is appropriate to model them in error correction form. This allows me to study both short- and long-term relationships between the variables as shown in the following equation:

$$\Delta T\_MILEXP_t = B_0 + B_1 \Delta T\_GNP_t - \alpha(T\_MILEXP - C_1 T\_GNP)_{t-1} + E_t$$

1) ΔT_MILEXP_t and ΔT_GNP_t are stationary variables.

2) $\alpha(T\_MILEXP - C_1 T\_GNP)_{t-1}$ is the error correction mechanism (ECM), which is a stationary linear combination of Taiwan's GNP and military spending. The ECM operates with a lag of 1 period, and it captures the long-term relationship between both the dependent variable and the independent variable while ΔT_GNP captures the short-term relationship.

3) As described above, α must carry a negative sign implying that shocks to T_MILEXP will be adjusted or re-equilibrated in subsequent periods by the cointegrating relationship between T_GNP and T_MILEXP. The adjustment rate is determined by the magnitude of α, which ranges between negative 1 and 0.

5.3 Diagnostic Tests

A series of diagnostic tests were conducted to determine whether the models of interest are consistent with the basic assumptions of OLS. OLS procedures in EViews provide the following test statistics.

1. The t-statistic, the ratio of coefficient to its standard error, is a test statistic for the hypothesis that a coefficient has a particular value. If the t-statistic exceeds 2 in magnitude it is at least 95 percent probable that the coefficient is not zero (Gujarati 1978). Normally, probabilities lower than .05 are taken as strong evidence of rejection of the null hypothesis.

2. The R^2 or adjusted R^2 measures the success of the regression in predicting the values of the dependent variable within the sample. R^2 is the percentage of the variance of the dependent variable explained by the independent variables ranging between positive one and zero (Gujarati 1978). The adjusted R^2 is less than R^2 when there is more than one

independent variable.

3. The Durbin-Watson statistic is a test statistic for first-order autocorrelation. If it is less than 2 and close to 0, there is evidence of positive autocorrelation, and if it is greater than 2 and close to 4, there is evidence of negative autocorrelation. When a lagged endogenous variable is incorporated, then the Durbin h test and the Ljung-Box Q are superior to the Durbin-Watson test (Doti and Adibi 1998; Kennedy 1993; Gujarati 1978; see also EViews User's Guide 1995).

4. The Breusch-Godfrey Serial Correlation LM Test is an alternative to the Ljung-Box Q for testing autocorrelation. The test belongs to the class of asymptotic tests known as Lagrange multiplier (LM) tests. Unlike the Durbin-Watson statistic for first-order autocorrelation or AR(1) errors, the LM test may be used to test for higher order ARMA processes, and is applicable regardless of whether there are lagged dependent variables. The null hypothesis of the LM test is that there is no serial correlation up to lag order p, where p is a pre-specified integer (Harvey 1990, Pindyck and Rubinfeld 1991).

Autocorrelation is a very important issue that has to be dealt with in time series analysis. Autocorrelation means that the succeeding observations in the data depend on each other. This means that there is less information in the data than what one thought, since the current values of the time series depend in some way on past ones. If present, autocorrelation will suppress the standard error and inflate t-ratios, which in turn will prompt one to commit Type I errors, i.e., rejection of true hypotheses.

5. The Standard Error of the Regression is a summary measure of the size of the prediction errors. It has the same units as the dependent variable and is a measure of the magnitude of the residuals (for details see Greene 1990, Gujarati 1978, Kennedy 1993,

Kmenta 1997).

6. A collinearity test such as the Pearson correlation matrix helps to identify whether the measured variables are too highly intercorrelated to allow precise analysis of their individual effects (Greene 1990). The existence of collinearity will inflate the standard errors and result in suppression of t-statistics, therefore inviting Type II errors, i.e., a failure to reject the false hypothesis.

7. The Jarque-Bera Test tests whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution (Gujarati 1978). Under the null hypothesis of a normal distribution, the Jarque-Bera statistic is distributed according to the degrees of freedom. The reported probability is the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null—a small probability value such as less than .05 leads to the rejection of the null hypothesis of a normal distribution (Kennedy 1993; Doti and Adibi 1998).

The normality of sampling distribution allows the time series analysis to obtain asymptotic properties and convergence in distribution (Gujarati 1978). The former helps us to find our estimators that eventually concentrate around the true value of the parameter as the sample size increases. The latter is the criteria for the classical linear regression model with fixed regressors and normally independently and identically distributed (i.i.d.) errors are distributed normally for any sample size T. This allows one to conduct hypothesis tests over the t and F distributions. The violation of normality will result in inefficient and asymptotically biased estimates (Harvey 1990, Pindyck and Rubinfeld 1991).

8. The Autoregressive Conditional Heteroskedastic (ARCH) test is employed in this dissertation to identify and estimate conditionally heteroskedastic series (Engle 1982, Harvey 1990, Enders 1996). Heteroskedasticity in the error term, just like autocorrelation, invalidates the conventional standard error formulas and the associated inference procedure as the Type I error described above.

The use of the ARCH test for heteroskedasticity is motivated by the observation that in working with military spending and GNP series, as illustrated in Figure 4-10, the size of residuals appeared to be related to the size of recent residuals. The test is based on the regression of squared residuals on lagged, squared residuals. The output from this test is an F-statistic, and a T (sample size)*R^2 statistic, which is distributed as a chi-square with degrees of freedom equal to the number of lags (Kennedy 1993). The violation of heteroskedasticity will result in an inefficient but unbiased estimate.

9. White's Heteroskedasticity test is employed to examine whether the error variance is affected by any of the regressors, their squares or their crossproducts (Harvey 1990, Pindyck and Rubinfeld 1991). This test is based on the augmented regression and its output is an F-statistic and an asymptotic chi-square distribution with degrees of freedom equal to the number of independent variables on the right-hand side. The statistic provides a test of the hypothesis that the coefficients of the variables in the augmented regression are all zero (Doti and Adibi 1998).

The White test is also a general test for model misspecification, since the null hypothesis underlying the test assumes that the errors are both homoskedastic and independent of the regressors and that the linear specification of the model is correct. Failure of any one or more of these conditions could lead to a significant test statistic.

Conversely, a nonsignificant test statistic would be very reassuring since it implies that none of the three conditions described above is violated (EViews User's Guide p. 224).

10. Ramsey's RESET Test is an omnibus test for autocorrelation, heteroskedasticity and non-normal disturbances. It helps one to identify specification errors such as 1) omitted variables, i.e., the right-hand side variables do not include all relevant variables; 2) incorrect functional form, for instance, some or all of the variables in Y and X should be transformed to logs, powers, reciprocals or in some other way; 3) correlation between independent variable and the error term, which may be caused by such things as measurement error in the independent variable, simultaneity, incorporation of lagged endogenous variable and autocorrelation (Eviews User's Guide pp. 228-229). The Ramsey RESET Test is applicable only to an equation estimated with least squares, and a violation of specification assumptions will lead to an asymptotically biased and inconsistent OLS estimator, which will invalidate the conventional inference procedures (Eviews User's Guide).

The statistical analyses in this dissertation will employ these testing procedures.

5.4 Results and Discussion

1. Discussing the Statistical Results

Preliminary statistical analyses (see Table 5-2 on the next page) pertaining to the two competing models posited in this dissertation suggest that the error correction model (ECM) fares better than the budgetary incremental model (BIM). A battery of diagnostic tests such as standard error of regression, Akaike's criteria (AIC), Durbin-Watson statistic, and adjusted R^2 suggests the ECM is superior to the BIM. In addition, the ECM

not only is able to capture the short-run effects of GNP but also the long-run ones, which are ignored in the BIM. Therefore, the following discussion will focus mainly on the empirical evidence provided by the error correction model (ECM) as demonstrated in Table 5-1.

Table 5-1 ECM Estimates on Taiwan's Military Spending, 1966-1992

Dependent Variable: D(T_MILEXP)
Method: Least Squares
Date: 12/06/01 Time: 09:46
Sample(adjusted): 1968 1992
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔTaiwan's GNP(-1)	0.003074	0.000383	8.032618	0.0000
ECM(-1)	-0.293872	0.097832	-3.003843	0.0095
Index of US-China Hostility	1.463099	0.668489	2.188667	0.0461
ΔTaiwan's Saving	4081.057	1487.720	2.743162	0.0159
ΔTaiwan's Foreign Investment	93.10624	26.84120	3.468781	0.0038
YR1977	500.1026	241.2861	2.072654	0.0571
YR1984	-769.7153	259.4940	-2.966217	0.0102
YR1987	-2255.457	277.7492	-8.120484	0.0000
YR1991	-665.9224	256.9485	-2.591657	0.0213
Volatility in US-China Conflict Index (-1)	-8.371837	3.773091	-2.218827	0.0435
C	-53.63775	136.8916	-0.391827	0.7011
R-squared	0.942112	Mean dependent var		319.9200
Adjusted R-squared	0.900764	S.D. dependent var		687.9171
S.E. of regression	216.7057	Akaike info criterion		13.89514
Sum squared resid	657459.0	Schwarz criterion		14.43144
Log likelihood	-162.6892	F-statistic		22.78482
Durbin-Watson stat	1.903713	Prob(F-statistic)		0.000001

As shown in the table, all independent variables except China's annual military spending are statistically significant with appropriate signs. The adjusted R^2 indicates that the ECM model can explain more than 90% of variance in Taiwan's military spending.

Table 5-2 A Summary Test Report

Variables	ECM	BIM
ΔTaiwan's GNP_{t-1}	0.003***	0.0028***
ECM_{t-1}	-0.29**	
ΔTaiwan's Military $Spending_{t-1}$		-0.16
Index of US-China Conflict	1.46*	1.69*
ΔSaving Propensity Rate	4018.1*	3866.6*
ΔForeign Investment as % of GDCF	93.1**	100.5**
YR1977	500.1*	641.9*
YR1984	-2255.5*	-1095.9**
YR1987	-769.7***	-2726.7**
YR1991	-665.9*	-538.3
Volatility in US-China Conflict Index	-8.37*	-2.02
S.E. of regression	216.7	242.6
AIC	13.895	14.1
D-W statistic	1.903	1.97
Adjusted R^2	0.901	0.87
Significance level	* at 0.05 **at 0,01	*** at 0.001

The findings shown in Table 5-2 strongly suggest the following points: first and foremost, the dyadic interactions show that the US-China hostility has a statistically significant impact ($p<.05$) on Taiwan's defense spending. Not China's military outlays but the level of hostility between the United States and China is the major external factor affecting Taiwan's military expenditures. In other words, the US-China hostility has a contemporaneous positive impact on Taiwan's military spending--greater hostility between China and the United States will lead Taiwan to increase its military spending, immediately. This implies that a deteriorating US-China relationship is not good for Taiwan in the same calendar year because the latter must spend more funds on its annual military budget, which is not good news for its economic prosperity in the long-term perspective.

This latter finding is interesting because, unlike the United States, Taiwan's annual fiscal year starts on July 1st. This allows Taiwan's military spending to respond to the level of external threat in a very timely way. That is, any critical conflicts between the United States and China in the first half of a fiscal year will be more likely to boost Taiwan's military spending in that calendar year. For instance, in the wake of the Taiwan Strait crisis in 1996 from March 8 to 25, Taiwan immediately increased military spending by purchasing the Patriot II anti-ballistic missile system from the United States to defend itself from possible PRC missile attacks.

This finding also implies that the higher the hostility in the US-China relationship, the more apt Taiwan would be to increase military spending to avoid the risk of entrapment, which occurs when a state is drawn by an ally into a conflict it otherwise would have avoided (Sorokin 1994). It also may imply that Taiwan would be more likely to obtain sophisticated weapons from the United States when the US-China relationship turns sour. This might explain in part why there exists a positive relationship between US-China hostility and Taiwan's military spending. For instance, during the EP3 collision accident, House of Representatives Foreign Relations Committee chairman, Henry Hyde, said that because China had not released the "hostages," (EP3 crew members) there are a lot of things the United States can do, including selling Taiwan the military weapons it has asked to buy (Sheng 2001 p. 61). This logic may explain why US president George Bush agreed to sell Taiwan eight diesel-powered submarines and four Kidd-class destroyers in the biggest arms package for Taiwan in a decade after the EP3 confrontations.

Second, volatility in the extent of US-China hostility has a statistically significant negative effect on Taiwan's military spending at the time lag t-1. In other words, unstable US-China relations in a previous year would lead to a lower level of Taiwan's military spending in a current year. This finding implies that when the US-China relationship is stable, Taiwan will increase military spending to avoid the risk of abandonment, because Taiwan's leadership will feel more uncertainty about US commitment toward Taiwan. Conversely, when the US-China relationship is unstable, Taiwan's security is perceived to become relatively greater because Taiwan's leadership is more confident that the United States will stick to its defense commitment and will be less likely to put its economic and commercial benefits in China ahead of its security commitment to Taiwan. This also may imply that the volatile US-China relationship in the last year is in Taiwan's favor because Taiwan will decrease its military spending accordingly, which is conducive to its overall economic livelihood.

The most interesting implication of this statistical result concerns Taiwan's status as a pawn in the relationship between China and the United States. A volatile US-China relationship will lead Taiwan to feel more secure due to a higher perceived US commitment or less risk of abandonment. This will lead Taiwan to decrease military spending in response. In addition, a heightened hostility between the United States and China is not good for Taiwan because the latter has to spend more on its military to avoid the risk of entrapment. Taiwan has to tread a fine line between the two superpowers to survive. In other words, Taiwan's security is tied to the tenor of the ongoing US-China relationship. This may well explain why an unstable US-China relationship has negative effects on Taiwan's military spending, while a higher conflictual US-China relationship

has positive ones.

Third, the relation between Taiwan's military spending and GNP registers a very strong significance at a level of 0.00001 with a t-statistic of 8.03. In other words, growth in GNP is found to be strongly significant in determining Taiwan's military expenditure growth. Also, according to the results in Table 5-1, the ECM operating at time t-1 is statistically significant ($p<0.001$), and suggests the re-equilibrating adjustment is 29%. In other words, Taiwan's military spending could be buffered from economic downturn, which would erode 29% of shock each year until the original level of military spending is realized. This finding further supports the assumption of "Wealthy country, strong army" (*Fuquo-Chyangpin*), i.e., the importance of economic effects on military spending or, in more general terms, national security.

Fourth and finally, Taiwan's saving rate is positively related ($p< .02$) to the growth of military expenditures. Facing a constant military threat from China, Taiwan is more willing to save money to support its military buildup to counter external threats. This is consistent with Benoit's (1978) psychological-linkage explanation that people are more likely to save in threatening situations, especially facing the possibility of war. In addition, a high saving rate can be allocated to physical investment or capital provision that further increases a nation's capital stock and reinforces GNP growth that leads to the growth of military spending (Chan and Clarke 1992).

This is analogous to the positive relation between Taiwan's foreign investment ($p<0.01$) and Taiwan's military spending. Foreign investment provides very important support to finance a military buildup to alleviate external threats. The positive

relationship between Taiwan's military spending and foreign investment supports this hypothesis.

The dummies for 1977, 1984, 1987, and 1991 are all statistically significant in the expected directions. The major events that occurred in these years are listed in Table 5-3.

Table 5-3 The Year Variables Control for Major Political Shocks, 1966-1992

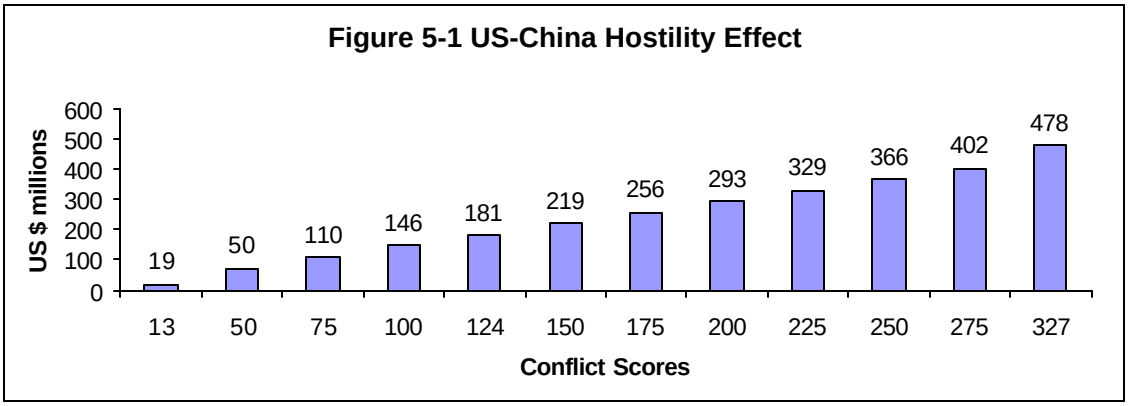
1977	1. Mao Tse-tung died in 1976; 2. Chungli political uprising occurred in Taiwan.
1984	1. Chiang Nan political incident occurred in the United States; 2. Reagan visited Beijing and restated his six assurances to Taiwan.
1987	1. Den Xiaoping started economic reforms in China; 2. DPP established in 1986; 3. Taiwan lifted martial law; 4. Lee Teng-hui stepped into power.
1991	1. Strait Exchange Foundation (SEF) in Taiwan and Association for Relations Across the Taiwan Strait (ARATS) in China were established; 2. Taiwan renounced the use of force for the pursuit of national unification.

These political events as listed above, except in 1977, all have negative effects on the growth of Taiwan's military spending. The political events listed in 1977, because they created higher perceived threats to Taiwan's external and internal security, resulted in a higher level of military spending as argued and supported by this dissertation.

In sum, the error correction model provides a clear picture of Taiwan's military spending, which is strongly affected by external perceived threats as well as internal economic factors. The hypotheses posited by this dissertation so far are strongly supported by the statistical outcomes. However, before final conclusions are drawn, the size of effects, model specification and diagnostic tests are required.

2.Assessing the Size of Effects

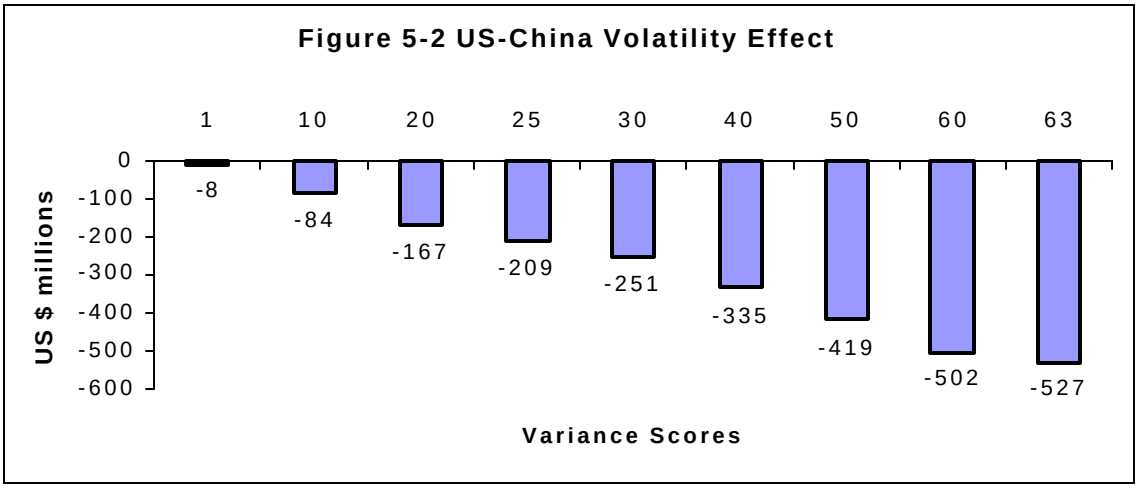
In addition to the above discussion of significance of variables, one also should assess the substantive importance of these statistics by examining the effects of changes in the independent variables on the dependent variable. This procedure is warranted, since a significant or non-zero effect can still be quite trivial in terms of its coefficient and size of effect. However, examination of substantive importance is no easy task because of the various measurements and variability existing in the independent variables of interest. Fortunately, the coefficients in the error correction model (ECM) estimated in Table 5-1 are a linear function; therefore, the calculation of size of major effects is straightforward as illustrated as follows:



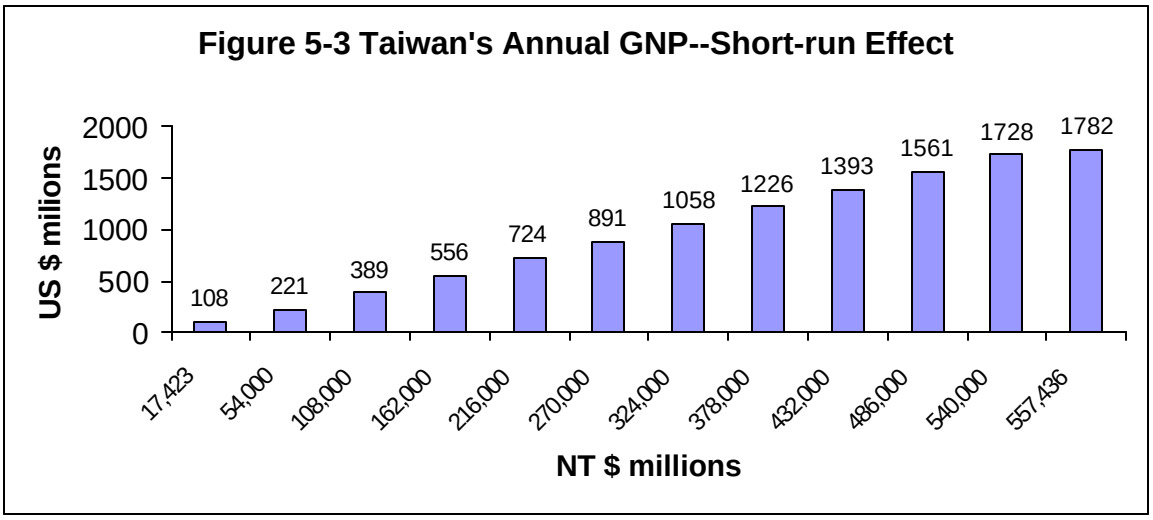
As shown above, the US-China Conflict Index exercises a substantial effect. The mean (range: 13-327) is 124, reporting impact of .181 billion (US dollars) on Taiwan's military spending. This coefficient indicates that a 1 score increase in US-China hostility would make Taiwan's military spending rise by 1.46 million. The difference between the smallest conflict score 13 to the largest score 327 would be associated with an almost .459 billion increase in Taiwan's military spending over time.

Second, the mean volatility expressing the unstable relationship between China and

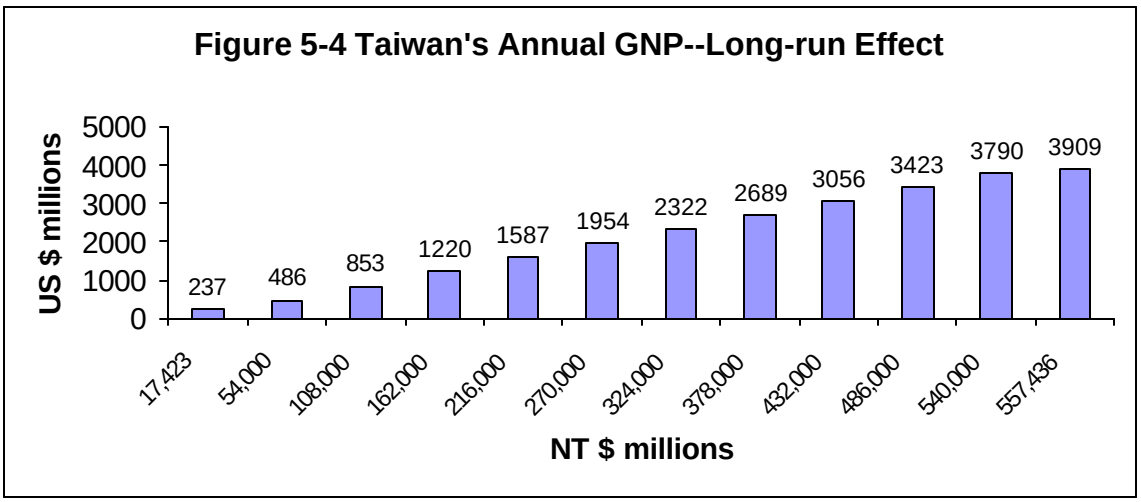
the United States is 25 (range 1-63), which would lead to a .209 billion decrease in Taiwan's military spending (see Figure 21). On average, a 1 unit increase of volatility in US-China relationship would make Taiwan's military spending drop by 8.24 million. The difference between the largest score and the smallest score would be associated with a .519 billion decrease in Taiwan's military spending over time.



Third, the magnitude of GNP effects, short-run and long-run, should be taken into account separately. The long-run is a state of cointegrating equilibrium where GNP and Taiwan's military spending are in balance and there is no tendency to change, while the short-run depicts the disequilibrium state where adjustment to the equilibrium is occurring (Hariss 1995 p. 25). The calculation of GNP's short-run impact is relatively easier to estimate than the long-run one (see Figure 22). To estimate GNP's long-run effect, one needs to calculate the coefficient parameters in the ECM in advance (see Figure 23).[2]

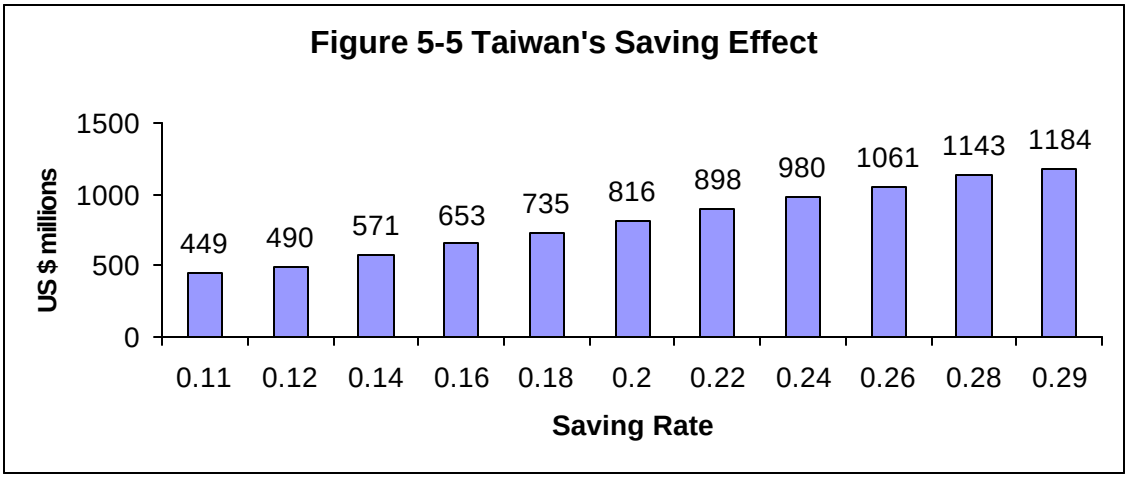


As shown above, an increase in Taiwan's GNP (short-run effect) from a value of .17423 trillion to 5.57436 trillion (NT dollars) would increase Taiwan's military spending by .108 billion (US dollars) in the first year, and by 1.782 billion over time. In contrast to the long-run effect, I derive a coefficient β_1= .0068 of long-run effect relative to .0031 of the short-run one (see footnote 4 for details in mathematical calculation). Judged from almost the double magnitude of the long-run coefficient than that of the short-run, one can predict that the long-run impact should be larger than that of the short-run.



Here one can see that if the GNP coefficient estimate accurately takes the error correction mechanism (cointegrating relationships) into account, the minimum impact of the parameter change would be from .108 billion to .237 in the first year. The over-time impact of that consideration would be about a 3.909 billion increase in Taiwan's military spending. The difference between the long-run effects and short-run effects is about 2.127 billion over time. Such a huge difference further justifies the adequacy of the ECM employed in this dissertation.

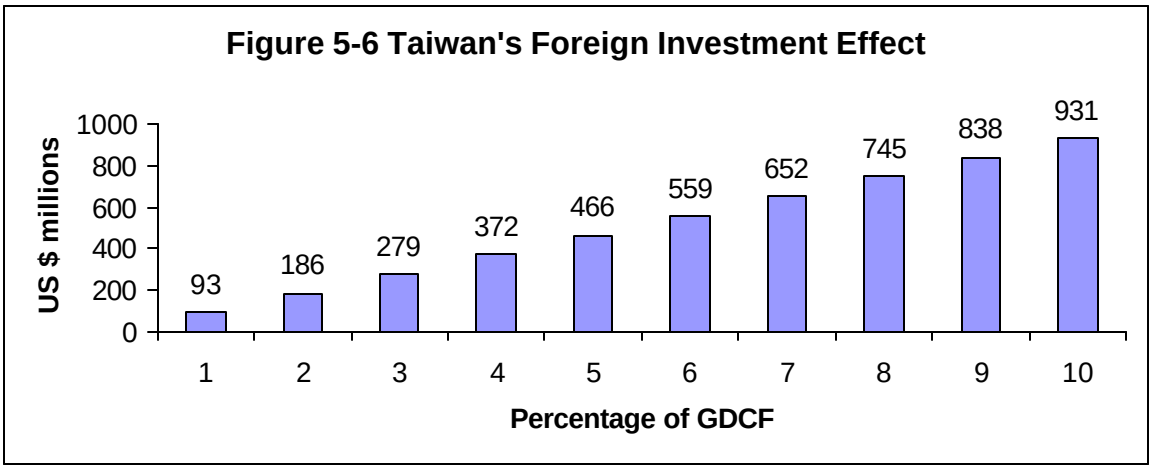
Fourth, the control variables, Taiwan's Saving Rate (range: 0.11-0.29) and Foreign Investment Percentage (range: 1-10), appear to exert substantial effects on Taiwan's military spending as expected.



As shown in Figure 24, the difference between the smallest saving rate during this time .11 to the largest .29 would be associated with almost a .735 billion increase in Taiwan's military spending over time. This also indicates that on average, a 1 percent increase in saving rate would drive Taiwan's military spending up by 40.83 million.

From Figure 25 one sees that an increase in Taiwan's foreign investment rate per 1 unit would result in an increase in Taiwan's military spending by 93.11 million on

average. The over-time impact of this parameter would be associated with an increase in Taiwan's military spending by about .838 billion.



Finally, one should note that any sizable change in Taiwan's military spending would often be the result of changes in different combinations of these major variables and control variables when other things are held equal. Nonetheless, examinations of the substantive importance of each parameter do convincingly demonstrate that many of the independent variables analyzed in this study have decidedly nontrivial effects on Taiwan's military spending.

3.Intepreting Diagnostics of ECM

The ECM has an outstanding fit, as shown in Table 5-2. The adjusted R^2 is .901 and the standard error of estimate is 216.7. For a check of first-order serial correlation, note that Durbin-Watson's d in Table 5-1 is equal to 1.903, very close to the benchmark value 2. This means there is no first-order serial correlation difficulty. The correlograms of residuals and residuals squared in figures 5-7 and 5-8 also support that the residuals of the ECM model are all well behaved within the bounds of two standard errors.

Furthermore, the Breush-Godfrey Serial Correlation LM test, the F statistic, is 1.02 with probability of .476 as registered in Table 5-4. This statistical finding further rejects the possibility of any higher order serial correlation existing among the lagged residuals.

The Jarque-Bera test for normality in Figure 5-9 indicates the residuals are normally distributed. The probability level assured with the test statistic is 0.75, which is far greater than the critical level of .05. The first-order autoregressive conditional heteroskedasticity (ARCH) F-statistic is 0.176 with a probability of .68 as registered in Table 5-5. The finding suggests that the null hypothesis, that the coefficients of the lagged squared residuals are all zero, cannot be rejected, that is, there is no first-order ARCH in residuals of the ECM. White's Heteroskedasticity test is also employed. As shown in Table 5-6, White's F statistic is .244 with a probability of .99, which strongly indicates that one cannot reject the null hypotheses that errors are homoskedastic. Ramsey's RESET Test examines the specification and stability of the model. The F-statistic in Table 5-7 is .038 with a probability of .85, which strongly suggests that the model's linear functional form is adequate. Finally, a multicollinearity check reveals there are no collinearity problems among the independent variables. As shown in Table 5-8, the highest correlation is 0.46 found between Taiwan's GNP and saving rate.

In sum, the results of the several diagnostic tests suggest that the ECM model performs very well. There is also evidence that it is preferable to the budgetary incremental model. A summary of results and model specifications is reported in Table 5-2, which provides a comparison between the two competing models, ECM and BIM.[3]

In Table 5-2, ECM not only has a smaller standard error, a smaller Akaike Information Criterion (AIC), and a higher adjusted R-squared but also has all

independent variables with significant and appropriate coefficient signs as suggested by theories discussed above. Therefore, this study strongly suggests that ECM is a more robust model of the two providing better explanatory and predictive powers on unraveling the puzzle of the dynamics of Taiwan's military spending.[4]

Endnotes

1. (1) Unbiasedness is the best-known desirable property of an estimator. An unbiased estimator is one that has a sampling distribution with a mean equal to the parameter to be estimated. It provides the information about the distance between the estimates and the value of the parameter; the sum of all negative and positive distances should be equal to zero. If the sampling distribution is symmetric, then an estimator being unbiased implies that half of all possible estimates are higher and half are lower than the value of the parameter (Kmenta 1997). An unbiased estimator gives on average a perfect estimated result.

   (2) Efficiency is a further desirable property of an estimator. It is a property concerned with the distances of the values of an estimator from the value of the parameter. A generally accepted definition of efficiency is if we restrict our consideration to unbiased estimators only; the most efficient estimator is one that has the smallest dispersion or, in specific, the smallest variance among the estimators (Kmenta 1997).

   (3) Consistency is another desirable property. This property focuses on changes in the sampling distribution as sample sizes are increased. An estimator is said to be consistent if its sampling distribution tends to become concentrated on the true value of the parameter as sample size reaches to infinity. Consistency is an important property because it guarantees that our estimates improve with sample size that is we can have greater reliability by increasing our sample size (Kmenta 1997).

2. The calculation of the long-run effect is as follows:

   $\Delta Y_t = B_0 + B_1\Delta X_t - \alpha(Y-C_0- C_1X)_{t-1} + E_t$

   $Y_t - Y_{t-1} = B_0 + B_1(X_t - X_{t-1}) - \alpha Y_{t-1} + \alpha C_0 + \alpha C_1 X_{t-1}$

   $Y_t = Y_{t-1} + B_0 + B_1X_t - B_1X_{t-1}- \alpha Y_{t-1} + \alpha C_0 + \alpha C_1 X_{t-1}$

   $Y_t = (1- \alpha) Y_{t-1} + B_0 cX_t + (\alpha C_1 - B_1) X_{t-1}+ \alpha C_0$

   short-run effect = $B_1 = 0.0031$

   long-run effect= $B_1^* = B_1 + (\alpha C_1 - B_1)/ (1- \alpha) = \alpha C_1 / (1- \alpha)$

   Given ECM coefficient $\alpha = -.2939$ and $C_1 = .0016$

   $\therefore B_1^* = .2939 * .0016/ (1- .2939) = .0068$

3. (1) Equation for ECM:

   D(T_MILEXP) = 0.003074265136*D(T_GNP(-1)) - 0.2938716404*ECM(-1) + 1.463098935*UC_HOSTILITY + 4081.056869*D(T_SAVING) + 93.10623569*D(T_FORINV) + 500.1026204*YR1977 - 769.7152907*YR1984 - 2255.457421*YR1987 - 65.9223963* YR1991 - 8.37183725*UC_VARIANCE(-1) - 53.63775458

   (2) Equation for Incremental Model (BIM):

D(T_MILEXP) = 0.002803570366*D(T_GNP(-1)) - 0.1608206196*D(T_MILEXP(-1)) + 1.693025137*UC_HOSTILITY + 3866.676107*D(T_SAVING) + 100.5635099*D(T_FORINV) + 641.9664948*YR1977 - 1095.984018*YR1984 - 2726.781185*YR1987 - 538.2968161 *YR1991 - 2.018289027*UC_VARIANCE(-1) - 126.035663

4. For more detailed statistical information of the incremental model, please see Table 5-9 to Table 5-18 and Figures 5-10 to 5-15 in the Appendix.

CHAPTER 6

CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

6.1 Conclusions

As suggested by this dissertation, the US-China relationship has statistically significant, substantively important effects on Taiwan's military spending. According to the findings, Taiwanese perceptions of external threat, along with domestic economic strength, are the key factors in determining the dynamics of Taiwan's military spending. I used the US-China relationship as the major independent variable and specified an error correction model to estimate its dynamic effects on Taiwan's military spending.

The contemporaneous and positive impact of the US-China hostility on Taiwan's military spending implies that a hostile US-China relationship is not good for Taiwan because the latter must spend more funds on military buildup, which is bad news for its economic prosperity. In other words, a better US-China relationship is beneficial to Taiwan in the short-term perspective because the hostility has an immediate impact on Taiwan's military spending in the same calendar year as suggested by this dissertation.

In contrast, the US-China volatility has a lagged (time t-1) and negative impact on Taiwan's military spending, implying that a volatile US-China relationship is in Taiwan's favor because it may prompt Taiwan to decrease its military spending, which, in turn, is conducive to its overall security and economy in the long-term perspective. These two statistical findings indicate the complexity of the US-China relationship on Taiwan's military spending. As mentioned in the beginning of this study, three contrasting scholarly views are heatedly debated, and answers to these questions have baffled

policymakers in Washington, Beijing, and Taipei. However, the empirical evidence provided by this study suggests that the timely effect is the key factor to better understanding the whole picture regarding the impact of US-China relations on Taiwan's military spending. That is, a hostile US-China relationship is harmful to Taiwan in the same calendar year while the volatile US-China relationship of this year is in Taiwan's favor as it would be associated with a lower level of military spending in the next year. This finding may explain why the 1979 US-China normalization indicated a lower degree of hostility but a high volatility between the United States and China. As expected, this did result in a decrease in Taiwan's military spending the following year (1980). In other words, the immediate impact of hostility alone cannot fully capture the dynamic interactions between the United States and China; one also needs to take the impact of historical volatility into account in order to get the whole picture of the effects of US-China relations on Taiwan's military spending.

According to these statistical findings, this study further suggests that if the well-being of Taiwan is a key consideration, the United States should establish cooperative instead of competitive relations with China while forging stronger and closer ties with Taiwan. The former will reduce Taiwan's perception of the risk of entrapment, and the latter will relax Taiwan's worries about the risk of abandonment. Furthermore, an improved US-China relationship and stronger US commitment to Taiwan's security will encourage Taiwan more confidently to engage with China politically as well as economically. This not only will lead Taiwan to spend less on military buildup and prevent a possible arms race from taking place but also will promote mutual understanding and cooperation between China and Taiwan. An improved China-Taiwan

relationship, in turn, is in the United States favor because it will greatly reduce the dangerous possibility of direct military confrontation between the United States and China, and will eventually contribute to the security and stability of the whole Asia-Pacific region.

As far as methodology is concerned, the error correction model is a part of cointegration methodology designed to describe the tendency of Taiwan's military spending and GNP to move together over time. As shown in Figures 5-3 and 5-4, the error correction mechanism captured not only the short-run effects of GNP growth on Taiwan's military spending but also the long-run ones that indicates the better fit of the ECM relative to the BIM. In addition, a Granger Causality test also was employed to investigate the impact of GNP on Taiwan's military spending. As shown in Table 4, Taiwan's military spending can be better predicted by using values of GNP in addition to its own past history than by the latter alone.

Overall, as the theoretical diagram shows (see Figure 3-1), the US-China hostility perceived as an external threat to Taiwan and a function of changes in the level of external threat has a statistically significant positive impact on Taiwan's military spending. Fears of the higher external threat because of a higher risk of possible entrapment emanated from a higher conflictual US-China hostility; Taiwan would increase military spending in response.

US-China volatility as reflected through perceptions of US commitment has statistically significant negative effects on Taiwan's military spending. The higher volatility in the US-China relationship perceived as a stronger US commitment will decrease Taiwan's military spending because of the perceived lower risk of abandonment

from the United States. This also may imply that Taiwan might try to avoid provoking China when the US-Taiwan relationship is being cemented Taiwan, a pawn caught between China and the United States, has to tread a fine line between these two big powers to survive.

It is noteworthy that Taiwan with high security concerns, volatility in US-China relations, matters more than the direct China military threats. The latter measured by China's annual military spending did not reach a statistically significant result as suggested by this study (see Table 5-14). Moreover, Taiwan's fears of abandonment or entrapment flowing from dyadic interactions between the United States and China can mitigate or magnify Taiwan's perceptions of threat, leading to behavior not predicated by arms race's action-reaction theory.[1]

In contrast, the domestic economic factors such as GNP growth, foreign investment, and saving rate all obtain a statistically significant impact on Taiwan's military spending in the expected direction. That is, the greater the economic strength, Taiwan will have more resources to support its military spending (other conditions held constant). In other words, *Fuquo-Chyangpin* or "Rich nation; strong army" is applicable to the case of Taiwan. This finding also may imply that an economic slowdown would lead to a decrease in Taiwan's military spending.

A major implication of this study is that when Taiwan determines that its national security is at stake it will commit significant financial resources in order to attain the weapons it deems necessary to preserve its security. Specifically, the external factor of interactions between the United States and China contributes to the size of Taiwan's military expenditures. This implies that a peaceful US-China relationship perceived as a

lower degree of external threat is conducive to Taiwan because it will lead to an immediate decrease in Taiwan's military spending in the same calendar year. On the other hand, a volatile US-China relationship is in Taiwan's favor because the United States might be more likely to emphasize the instrumental value of Taiwan when it is in jeopardy with Beijing. Meanwhile, Taiwan will be more willing to decrease its military spending when the US commitment is perceived as more reliable and the risk of abandonment is relatively lower. Having said so, Taiwan would avoid further provoking China for its own good, and would decrease its military spending in the following year to mitigate the heightened tension that emanated from a deterioration of US-China relationship. This is due to Taiwan's security and economic livelihood being dependent on a good bilateral relationship with China. That is, Taiwan is caught between the two big powers and has to retain a balancing strategy between them. The confluence of these impacts contributes to a negative correlation between the volatility of US-China relationship and Taiwan's military spending as supported by analyses presented in Chapter Five (see Table 5-2). In short, the findings of this study not only illustrate the pawn status of Taiwan but also support the significant effects of US-China relations on Taiwan's military spending.

Although the Taiwan Relation Act manifests the US security commitment to Taiwan, it provides the United States only with an "option" to defend Taiwan and does not mention the defense of the offshore islands (Hickey 1999). The TRA does not necessarily commit the United States to Taiwan's defense in the future event of war between China and Taiwan (Clough 1999). In other words, there was no clear guiding principle or obligation for the United States to follow when considering defending

Taiwan in the event of war with China. Taiwan is understandably sensitive to even an iota of change in US attitudes toward the island.

This US policy of status quo or strategic ambiguity toward the Taiwan problem is more complicated than often thought because it creates a greater risk of miscalculation between China and Taiwan (Lasater and Yu 2000 p. 234). For example, Beijing's first strike force might raise the danger of preemptive war. On the other hand, Taiwan could decide to renew its efforts to develop the massive destructive weapons such as nuclear weapons and national missile defense and it also could encourage Taiwan to launch a defensive war against China (Gertz 2000). In principle, the success of deterrence is based on transparency and capability rather than ambiguity. Thus, China and Taiwan should be told clearly under what conditions the United States will use force to intervene. This would allow both sides to calculate with accuracy whether to proceed with their desired course of action (Swaine and Mulvenon 2001); therefore, it would greatly reduce both sides seeking to exploit loopholes and cleavages of the policy of ambiguous status quo.

Ironically, the ambiguity of the US commitment toward Taiwan's security helps Taiwan's military forces obtain a lion's share of the governmental budget every year. The threat China poses to Taiwan also gives ammunition for the government of the latter to obtain quantitatively and qualitatively greater levels of weaponry and related military assistance from the United States, and to develop closer political and military relations between Taipei and Washington (Swaine and Mulvenon 2001). However, the risk of abandonment from the United States motivates Taiwan to establish its own defense capabilities, which on the other hand, greatly reduces the US's defense burden. In addition, the US role as a monopolized weapon supplier to Taiwan is not only beneficial

to the US's defense-industry complex but also to its economic prosperity in general. This might further explain why the US foreign policy of strategic ambiguity toward China and Taiwan has been sustained.

In contrast, China also has something to gain from the US's policy of status quo toward Taiwan. "Beijing's communist government needs an adversary to remain in power. That is the justification for violations of their own constitution exalting freedom and other concepts and the pervasive police apparatus that keep them in power" (Gertz 2000 p. 170). Furthermore, a democratic and prosperous Taiwan not only is a beacon of hope for China to peacefully transform its political institutions but also helps to accelerate its economic development. To a great extent, the Taiwan problem also motivates China's efforts to ameliorate relations with Washington and, in particular, to obtain a pledge to oppose Taiwan's political independence and to reduce its level of military assistance to Taiwan (Clough 1999). In turn, a good US-China relationship also helps China to mitigate its defense burdens due to military threats from China's potential rivals such as Russia, India, Vietnam, and Japan. This is good for China's continual economic livelihood and prosperity. Furthermore, a wealthy China will be a society dominated by a large and better-educated middle class. Such a society is much more likely to become democratic than the poor peasant societies of China's past and more likely to respect human rights and to avoid war (Vogel 1997 p. 160).

With these common interests in mind, the status quo policy is the only acceptable formula that Beijing-Taipei-Washington can live with so far. Therefore, in the foreseeable future, if other things are held equal, this study expects that the US-China relationship will continue to be the most important external factor along with domestic

GNP growth, savings rate, and foreign investment that determine the dynamics of Taiwan's military spending.

6.2 Recommendations for Future Research

The findings discussed above prompt recommendations for future research. First, the WEIS data set should be updated to the present allowing a much larger time frame for analysis. Meanwhile different sources of data such as military expenditures and US-China dyadic interactions should be employed to crosscheck the robustness of empirical evidence reached by the error correction model introduced by this dissertation.

In this study, I used the military expenditures data collected by the US Arms Control and Disarmament Agency (ACDA). However, other available data sources such as China's and Taiwan's official statistical data books and the Stockholm International Peace Research Institute (SIPRI) data also should be employed to provide multiple measures of military spending.

US-China dyadic interactions data collected from the WEIS data set should be compared with the Brecher and Wilkenfeld International Crisis Behavior Project data set from 1918 to 1997, available from the Inter-university Consortium for Political and Social Research (ICPSR). In addition, Azar's (1980) Conflict and Peace Data Bank (COPDAB) from 1948 to 1978 could be merged with the WEIS data set. Thus a longer time span can be created to solve the over-determination or too many variables and too small a sample size problem. By using and comparing different sources of data, future studies can re-estimate and extend the research presented in this dissertation.

Second, although this dissertation suggests that China's military spending does not

have statistically significant effects on Taiwan's military spending, it is remiss to say that China's military capability has no relationship with Taiwan's security. Perhaps, the focus of military capability is not military spending *per se* but weapons counts (Bolks and Stoll 2000). It is plausible that China does not necessarily change its military expenditures the same way Taiwan changes its expenditures or vice versa. For example, China often reacts to an increase in Taiwan's military spending by improving weapon destructiveness without showing any apparent increase in its military budget (Li, Hu and Zhong 1998, Sun and Yu 1999). Given China's deliberate deception about its level of its military spending (Sun and Yu 1999), one must be skeptical about findings based on analyses of China's military spending in the previous studies.

Huntington (1983) points out that normally rival states engaging in an arms race will focus on the type of military force with which they are best able to harm each other (see also Bolks and Stoll 2000). Future studies may start with the approach that weapon stockpiles--in particular the number of ballistic missiles aimed at Taiwan--better reflect China's military capability and intention than military expenditures as a single measure of the external threat posed by the PRC to Taiwan.

Third, the results published in this dissertation should be investigated by additional statistical analyses. If it is true that Taiwan is only a pawn state of the United States as described by this dissertation, then Taiwan's interactions with China should be affected by US-China dyadic interactions. For future studies, the Weak Exogeneity Test should be employed to investigate whether the US-China relationship is exogenous to the Taiwan-China relationship. In contrast, if the United States is more likely to sell sophisticated weapons to Taiwan when the US-China relationship is unstable, then there

should exist a negative correlation between the total amount of US arms sales to Taiwan and the volatility of the US-China relationship. In other words, a simple negative correlation coefficient should be observed between them.

Fourth, the uncertain reliability of US commitment has caused Taiwan to probe the strength of US resolve to defend Taiwan. In future studies, it is important to investigate factors--American public opinion, congressional involvement in the Taiwan issue, regime changes, human rights effects--that directly led to US intervention in the Taiwan Strait, and which are apt to increase or decrease the probability of future US intervention in the Taiwan Strait. Both questions are obviously related to Taiwan's security and Taiwan's military spending.

Fifth, apart from the United States, Japan's role in Taiwan security also should have some effects on Taiwan's military spending. Japan has been one of Taiwan's most important supporters second to the United States, given the fact that Taiwan is one of Japan's most important economic partners and a former colony. Under the revision of 1978 guidelines, Japan can provide support, including the supply of fuel and the transport of soldiers, for US forces in areas surrounding Japan when the country's peace and security is threatened (Clough 1999, Gong 2000, Lasater and Yu 2000, Sheng 2001b, Swaine and Mulvenon 2001). Thus, Japan's attitude and commitment toward the Taiwan dispute is another external factor that should be further explored in future studies.

The sixth and last recommendation is to construct a forecasting model. For example, one might employ a transfer function model (Box and Jenkins 1970) where the US-China relationship is the input variable and Taiwan's military spending is an output one. This model is designed to capture the input-output relationship between time series,

thereby being able to establish the dynamic nature of the process between US-China relationship and Taiwan's military spending. By manipulation of the input variable, one can know by how much and over how many years Taiwan's military spending is going to change as a result of increases in the levels of hostility between the United States and China.[2]

6.3 A Final Word

In this dissertation, I have shown that Taiwan's military spending is shaped by external factors, the perceived risks of abandonment and entrapment emanating from the ongoing US-China relationship, and internal factors, a set of domestic economic constraints such as GNP growth, saving rate, and foreign investment. The empirical findings of this study reinforce the belief that both internal and external factors have to be considered simultaneously if one is to fully understand the dynamics of Taiwan's military spending. The ECM recommended by this study has aided researchers in understanding the short-run and long-run effects of GNP on Taiwan's military spending. This has been ignored in previous studies adopting the BIM. This study has sought to address Taiwan's security in general and to investigate the variation of Taiwan's military spending specifically. The findings presented here do fully explain the interplaying effects of international and domestic environments on Taiwan's military spending, and single out Taiwan's pawn status caught between an aggressive China and an assertive America. However, for future research, there is a great deal of effort, as suggested, waiting to be made.

Endnotes

1. (1) Abandonment is the fear that the ally may leave the alliance, may not live up to explicit commitment, or may fail to provide support in contingencies where support is expected (Mandelbaum 1981, pp. 151-52; Snyder 1984, p. 467; Cha 2000, p. 265).

   (2) Entrapment occurs when an alliance commitment turns detrimental to one's interests (Snyder 1984, p. 467; Cha 2000, p. 265).

2. To carry out the transfer function model we should follow the steps as below.
   (1) Diagnose an appropriate univariate ARIMA model for the input variable(s) and output variable.
   (2) Identify the Transfer Function including a prewhitening step and Cross-Correlate Functions (CCF).
   (3) Estimate the parameters in the transfer function model.
   (4) Diagnose on the residuals whether they are white noise.
   (5) If not white noise, remodify model and start over again.

   Following these steps we can derive a best single forecasting equation by examining the residuals based on acf and pacf. Then we compute a forecasted value for Taiwan's military spending based on the available values of independent variable(s).

APPENDIX

Yield (01)

011. Surrender, yield or order, submit to arrest, etc. This category requires explicit statement of surrender, or yield to a command or an order, or of submission to arrest.
012. Yield position, retreat; evacuate. This category involves actual physical movement.
013. Admit wrongdoing; retract statement.

Comment (02)

021. Explicit decline to comment. This category is reserved for an expressed "decline to comment" statement by an official spokesperson. This category does not include a reported "failure to comment."
022. Comment on situation--pessimistic. This category is used only when the actor explicitly expresses the feeling that the situation is adverse or foreboding.
023. Comment on situation--neutral.
024. Comment on situation--optimistic. This category is used only when the actor explicitly expresses the feeling that the situation is favorable.
025. Explain policy or future position. This category is used when governments express their goals, hopes, policies, or future plans to others.

Consult (03)

031. Meet with at neutral site, or send note. This category is used for meetings at an unspecified or neutral site, or between a resident ambassador and the host country. This category applies, in addition, when notes are sent between nations but their content is unknown.
032. Visit; go to.
033. Receive visit; host.

Approve (04)

041. Praise, hail, applaud, condole. This category includes the "politeness" events such as expressions of gratitude, condolences, and ceremonial salutations.
042. Endorse other's policy or position; give verbal support.

Promise (05)

051. Promise own policy support.
052. Promise material support. This category specifies men and/or resource aid forthcoming.
053. Promise other future support action.
054. Assure; reassure. This category is used for expressions or reiterations of earlier pledges.

Grant (06)

061. Express regret; apologize.
062. Give state invitation.
063. Grant asylum. This category includes both the announcement of a policy and reported cases of granting of refuge to nationals of other countries.
064. Grant privilege, diplomatic recognition; DE FACTO relations, etc.
065. Suspend negative sanctions; truce.
066. Release and/or return persons or property.

Reward (07)

071. Extend economic aid (as gift and/or loan).
072. Extend military assistance. This category includes both men and material, in addition, joint military training exercises are coded in this category.
073. Give other assistance.

Agree (08)

081. Make substantive agreement.
082. Agree to future action or procedure; agree to meet, to negotiate. This category includes the acceptance of invitations from other states.

Request (09)

091. Ask for information.
092. Ask for policy assistance.
093. Ask for material assistance.
094. Request action; call for. This category includes bids from United Nations membership and requests for asylum.
095. Entreat; plead; appeal to; help me. This category applies to requests made from a distinctly suppliant position, the actor nation pleading for aid or support.

Propose (10)

101. Offer proposal.
102. Urge or suggest action or policy.

Reject (11)
111. Turn down proposal; reject protest demand, threat, etc.
112. Refuse; oppose; refuse to allow.

Accuse (12)
121. Charge; criticize; blame; disapprove.
122. Denounce; denigrate; abuse. This category often applies when derogatory adjectives embellish the accusation.

Protest (13)
131. Make complaint (not formal).
132. Make formal complaint or protest. Protests are assumed to be formal unless otherwise stated.

Deny (14)
141. Deny an accusation.
142. Deny an attributed policy, action role or position.

Demand (15)
150. Issue order or command; insist; demand compliance; etc.

Warn (16)
160. Give warning. Occasionally the words "demand" or "threaten" are used in news items which should be coded as warnings.

Threaten (17)
171. Threat without specific negative sanctions.
172. Threat with specific non-military negative sanctions.
173. Threat with force specified.
174. Ultimatum; threat with negative sanctions and time limit specified.

Demonstrate (18)
181. Non-military demonstration; to walk out on. This category applies to activities such as marching, picketing, stoning, etc., when they are performed by citizens of one nation against another nation. The category also includes occasions when representatives to international meetings walk out in protest.

182. Armed force mobilization. Exercise and/or display routine ceremonial displays such as weapons parades and "fly bys" are not included in this category.

Reduce Relations(as negative sanctions)(19)

191. Cancel or postpone planned event.
192. Reduce routine international activity; recall officials; etc. Events coded in this category must be connected with some ongoing international problem, thus the usual rotations of foreign service officers or normal changes in foreign aid are not regarded as "reduction of relations." Embargoes, bans, and smaller activities do fall within this category.
193. Reduce or halt aid.
194. Halt negotiations.
195. Break diplomatic relations.

Expel (20)

201. Order personnel out of country. This category includes the expulsion of foreign individuals and the declaration of individuals as PERSONA NON GRATA.
202. Expel organization or group.

Seize (21)

211. Seize position or possessions. The category also may be used when a nation militarily takes or occupies another's territory.
212. Detain or arrest person(s).

Force (22)

221. Non-injury obstructive act. When actual physical destruction is reported, demonstrations are coded in this category.
222. Non-military injury-destruction. This category also includes acts not committed by organized military forces such as terrorist bombings.
223. Military engagement. Notice that this category may often be "double-coded" because when two nations battle, each is an actor and each is a target of force.

APPENDIX II: CUDYAD/CTDYAD VARIABLE RECODING SCHEME

```
if (var3='REJ1') dyad=01.
if (var3='REJ2') dyad=02.
if (var3='ACC1') dyad=03.
if (var3='ACC2') dyad=04.
if (var3='PTT1') dyad=05.
if (var3='PTT2') dyad=06.
if (var3='DNY1') dyad=07.
if (var3='DNY2') dyad=08.
if (var3='DMD1') dyad=09.
if (var3='WRN1') dyad=10.
if (var3='THR1') dyad=11.
if (var3='THR2') dyad=12.
if (var3='THR3') dyad=13.
if (var3='THR4') dyad=14.
if (var3='DEM1') dyad=15.
if (var3='DEM2') dyad=16.
if (var3='RDC1') dyad=17.
if (var3='RDC2') dyad=18.
if (var3='RDC3') dyad=19.
if (var3='RDC4') dyad=20.
if (var3='RDC5') dyad=21.
if (var3='EXP1') dyad=22.
if (var3='EXP2') dyad=23.
if (var3='SZE1') dyad=24.
if (var3='SZE2') dyad=25.
if (var3='FOR1') dyad=26.
if (var3='FOR2') dyad=27.
if (var3='FOR3') dyad=28.
```

TABLES

Table 4-1 Augmented D-F Test on D(T_MILEXP)

ADF Test Statistic	-5.468540	1% Critical Value*	-4.3738
		5% Critical Value	-3.6027
		10% Critical Value	-3.2367

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(T_MILEXP,2)
Method: Least Squares
Date: 12/04/01 Time: 11:30
Sample(adjusted): 1968 1992
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_MILEXP(-1))	-1.152055	0.210670	-5.468540	0.0000
C	134.2576	307.1251	0.437143	0.6663
@TREND(1966)	16.55598	19.73368	0.838971	0.4105

R-squared	0.576176	Mean dependent var	16.60000
Adjusted R-squared	0.537647	S.D. dependent var	1032.228
S.E. of regression	701.8799	Akaike info criterion	16.05757
Sum squared resid	10837979	Schwarz criterion	16.20383
Log likelihood	-197.7196	F-statistic	14.95417
Durbin-Watson stat	2.145321	Prob(F-statistic)	0.000079

Table 4-2 Augmented D-F Test on UC_HOSTILITY

ADF Test Statistic	-3.546394	1%	Critical Value*	-3.7204
		5%	Critical Value	-2.9850
		10%	Critical Value	-2.6318

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UC_HOSTILITY)
Method: Least Squares
Date: 12/04/01 Time: 14:21
Sample(adjusted): 1968 1992
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UC_HOSTILITY(-1)	-0.724551	0.204306	-3.546394	0.0018
D(UC_HOSTILITY(-1))	-0.286901	0.162515	-1.765385	0.0914
C	73.36723	28.78151	2.549110	0.0183

R-squared	0.587838	Mean dependent var	-9.840000
Adjusted R-squared	0.550369	S.D. dependent var	108.7998
S.E. of regression	72.95515	Akaike info criterion	11.52973
Sum squared resid	117094.0	Schwarz criterion	11.67600
Log likelihood	-141.1217	F-statistic	15.68857
Durbin-Watson stat	1.695090	Prob(F-statistic)	0.000058

Table 4-3 Augmented D-F Test on D(T_GNP)

ADF Test Statistic	-3.854601	1%	Critical Value*	-4.3738
		5%	Critical Value	-3.6027
		10%	Critical Value	-3.2367

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(T_GNP,2)
Method: Least Squares
Date: 12/04/01 Time: 15:01
Sample(adjusted): 1968 1992
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_GNP(-1))	-0.917236	0.237959	-3.854601	0.0009
C	-58221.32	30444.21	-1.912394	0.0689
@TREND(1966)	17543.05	4419.670	3.969313	0.0006

R-squared	0.421240	Mean dependent var	21600.52
Adjusted R-squared	0.368625	S.D. dependent var	77880.36
S.E. of regression	61883.02	Akaike info criterion	25.01605
Sum squared resid	8.42E+10	Schwarz criterion	25.16231
Log likelihood	-309.7006	F-statistic	8.006150
Durbin-Watson stat	1.853252	Prob(F-statistic)	0.002441

Table 4-4 Granger Causality Tests on T_MILEXP and T_GNP

Pairwise Granger Causality Tests
Date: 12/04/01 Time: 15:33
Sample: 1966 1992
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
T_MILEXP does not Granger Cause T _GNP	25	1.29366	0.29625
T_GNP does not Granger Cause T_MILEXP		9.26510	0.00142

Table 4-5 The Johansen Cointegration Test on T_MILEXP and T_GNP

Date: 12/14/01 Time: 17:41
Sample: 1966 1992
Included observations: 25
Test assumption: Linear deterministic trend in the data
Series: T_MILEXP T_GNP
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.431310	19.26780	15.41	20.04	None *
0.186404	5.157278	3.76	6.65	At most 1 *

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Unnormalized Cointegrating Coefficients:

T_MILEXP	T_GNP
0.000252	-1.00E-07
-0.000229	7.26E-07

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

T_MILEXP	T_GNP	C
1.000000	-0.000396	-5156.834
	(0.00058)	
Log likelihood	-492.2358	

Table 4-6 Augmented D-F Test on ECM

ADF Test Statistic	-2.735206	1%	Critical Value*	-3.7343
		5%	Critical Value	-2.9907
		10%	Critical Value	-2.6348

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ECM)
Method: Least Squares
Date: 12/05/01 Time: 11:14
Sample(adjusted): 1969 1992
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	-0.572374	0.209262	-2.735206	0.0124
D(ECM(-1))	0.177454	0.211592	0.838661	0.4111
C	33.69806	121.9873	0.276242	0.7851

R-squared	0.269067	Mean dependent var	-0.612413
Adjusted R-squared	0.199454	S.D. dependent var	664.4841
S.E. of regression	594.5354	Akaike info criterion	15.72991
Sum squared resid	7422919.	Schwarz criterion	15.87716
Log likelihood	-185.7589	F-statistic	3.865196
Durbin-Watson stat	1.870057	Prob(F-statistic)	0.037215

Table 4-7 Augmented D-F Test on D(T_FOEINV)

ADF Test Statistic	-6.053469	1%	Critical Value*	-3.7343
		5%	Critical Value	-2.9907
		10%	Critical Value	-2.6348

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(T_FORINV,2)
Method: Least Squares
Date: 12/05/01 Time: 11:29
Sample(adjusted): 1969 1992
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_FORINV(-1))	-1.283054	0.211954	-6.053469	0.0000
C	0.053624	0.407356	0.131638	0.8965

R-squared	0.624858	Mean dependent var	-0.208333
Adjusted R-squared	0.607806	S.D. dependent var	3.168584
S.E. of regression	1.984338	Akaike info criterion	4.288103
Sum squared resid	86.62713	Schwarz criterion	4.386274
Log likelihood	-49.45723	F-statistic	36.64449
Durbin-Watson stat	1.850287	Prob(F-statistic)	0.000004

Table 4-8 Augmented D-F Test on D(T-SAVING)

ADF Test Statistic	-4.612952	1%	Critical Value*	-3.7204
		5%	Critical Value	-2.9850
		10%	Critical Value	-2.6318

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(T_SAVING,2)
Method: Least Squares
Date: 12/05/01 Time: 11:46
Sample(adjusted): 1968 1992
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_SAVING(-1))	-0.971111	0.210518	-4.612952	0.0001
C	0.003084	0.006969	0.442570	0.6622

R-squared	0.480570	Mean dependent var	-0.000800
Adjusted R-squared	0.457986	S.D. dependent var	0.046986
S.E. of regression	0.034592	Akaike info criterion	-3.813788
Sum squared resid	0.027521	Schwarz criterion	-3.716278
Log likelihood	49.67235	F-statistic	21.27933
Durbin-Watson stat	1.958582	Prob(F-statistic)	0.000122

Table 4-9 Augmented D-F Test on UC_VARIANCE

ADF Test Statistic	-2.757092	1%	Critical Value*	-3.7204
		5%	Critical Value	-2.9850
		10%	Critical Value	-2.6318

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(UC_VARIANCE)
Method: Least Squares
Date: 12/05/01 Time: 12:18
Sample(adjusted): 1968 1992
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UC_VARIANCE(-1)	-0.520659	0.188843	-2.757092	0.0115
D(UC_VARIANCE(-1))	0.046006	0.178030	0.258420	0.7985
C	12.08941	5.222900	2.314692	0.0303

R-squared	0.313897	Mean dependent var	-0.908816
Adjusted R-squared	0.251524	S.D. dependent var	14.08015
S.E. of regression	12.18137	Akaike info criterion	7.949860
Sum squared resid	3264.489	Schwarz criterion	8.096125
Log likelihood	-96.37324	F-statistic	5.032580
Durbin-Watson stat	1.770093	Prob(F-statistic)	0.015859

Table 4-10 Augmented D-F Test on D(C_MILEXP)

ADF Test Statistic	-6.745572	1%	Critical Value*	-4.3738
		5%	Critical Value	-3.6027
		10%	Critical Value	-3.2367

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(C_MILEXP,2)
Method: Least Squares
Date: 12/05/01 Time: 12:51
Sample(adjusted): 1968 1992
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(C_MILEXP(-1))	-1.349797	0.200101	-6.745572	0.0000
C	3881.593	1336.584	2.904115	0.0082
@TREND(1966)	-197.4126	82.66972	-2.387967	0.0260

R-squared	0.674088	Mean dependent var	163.2400
Adjusted R-squared	0.644459	S.D. dependent var	4672.518
S.E. of regression	2786.093	Akaike info criterion	18.81483
Sum squared resid	1.71E+08	Schwarz criterion	18.96110
Log likelihood	-232.1854	F-statistic	22.75142
Durbin-Watson stat	1.686383	Prob(F-statistic)	0.000004

Table 5-4 Breusch-Godfrey Serial Correlation LM Test on ECM

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.018711	Probability	0.475905
Obs*R-squared	10.82793	Probability	0.093842

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/06/01 Time: 18:03

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_GNP(-1))	0.000497	0.000457	1.088832	0.3079
ECM(-1)	-0.013549	0.127883	-0.105946	0.9182
UC_HOSTILITY	-0.208177	0.831494	-0.250366	0.8086
D(T_SAVING)	1094.394	1980.788	0.552504	0.5957
D(T_FORINV)	15.23684	34.69072	0.439220	0.6721
YR1977	-383.2755	320.7296	-1.195012	0.2663
YR1984	-38.16891	556.4740	-0.068591	0.9470
YR1987	163.0975	309.0208	0.527788	0.6120
YR1991	-84.87261	265.7122	-0.319416	0.7576
UC_VARIANCE(-1)	0.109792	4.164351	0.026365	0.9796
C	-27.20259	158.5358	-0.171586	0.8680
RESID(-1)	-0.265748	0.426506	-0.623081	0.5506
RESID(-2)	-0.193631	0.555549	-0.348540	0.7364
RESID(-3)	0.021942	0.432498	0.050733	0.9608
RESID(-4)	-0.994299	0.431673	-2.303362	0.0502
RESID(-5)	-0.421069	0.566260	-0.743597	0.4784
RESID(-6)	-0.236447	0.630061	-0.375276	0.7172

R-squared	0.433117	Mean dependent var	1.36E-14
Adjusted R-squared	-0.700648	S.D. dependent var	165.5117
S.E. of regression	215.8420	Akaike info criterion	13.80754
Sum squared resid	372702.1	Schwarz criterion	14.63637
Log likelihood	-155.5942	F-statistic	0.382017
Durbin-Watson stat	1.723726	Prob(F-statistic)	0.951748

Table 5-5 ARCH Test on ECM

ARCH Test:

F-statistic	0.175790	Probability	0.679082
Obs*R-squared	0.190251	Probability	0.662708

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/06/01 Time: 19:14
Sample(adjusted): 1969 1992
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	29592.15	10617.38	2.787142	0.0107
RESID^2(-1)	-0.098617	0.235210	-0.419273	0.6791

R-squared	0.007927	Mean dependent var	27381.96
Adjusted R-squared	-0.037167	S.D. dependent var	44334.14
S.E. of regression	45150.51	Akaike info criterion	24.35305
Sum squared resid	4.48E+10	Schwarz criterion	24.45122
Log likelihood	-290.2366	F-statistic	0.175790
Durbin-Watson stat	1.837120	Prob(F-statistic)	0.679082

Table 5-6 White Heteroskedasticity Test on ECM

White Heteroskedasticity Test:

F-statistic	0.243548	Probability	0.992163
Obs*R-squared	8.188703	Probability	0.943049

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/06/01 Time: 19:18
Sample: 1968 1992
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	27539.71	105954.6	0.259920	0.8015
D(T_GNP(-1))	0.472294	0.951724	0.496251	0.6331
(D(T_GNP(-1)))^2	-8.70E-07	2.14E-06	-0.406311	0.6952
ECM(-1)	-25.41348	59.80793	-0.424918	0.6821
ECM(-1)^2	0.004100	0.047418	0.086457	0.9332
UC_HOSTILITY	543.8027	1025.334	0.530366	0.6103
UC_HOSTILITY^2	-2.036441	3.553838	-0.573026	0.5824
D(T_SAVING)	66772.35	679457.4	0.098273	0.9241
(D(T_SAVING))^2	-13022822	13738769	-0.947889	0.3709
D(T_FORINV)	-2718.180	11794.68	-0.230458	0.8235
(D(T_FORINV))^2	-984.7221	2588.504	-0.380421	0.7135
YR1977	-40056.44	79731.33	-0.502393	0.6289
YR1984	-36627.05	101443.6	-0.361058	0.7274
YR1987	-27938.38	93432.29	-0.299023	0.7725
YR1991	-56669.86	90754.75	-0.624429	0.5497
UC_VARINCE(-1)	-2813.831	3566.716	-0.788914	0.4529
UC_VARINCE(-1)^2	31.14528	55.19965	0.564230	0.5881

R-squared	0.327548	Mean dependent var	26298.36
Adjusted R-squared	-1.017356	S.D. dependent var	43737.56
S.E. of regression	62122.05	Akaike info criterion	25.13216
Sum squared resid	3.09E+10	Schwarz criterion	25.96099
Log likelihood	-297.1519	F-statistic	0.243548
Durbin-Watson stat	1.772277	Prob(F-statistic)	0.992163

Table 5-7 Ramsey RESET Test on Specification and Stability of ECM

Ramsey RESET Test:

F-statistic	0.038121	Probability	0.848218
Log likelihood ratio	0.073203	Probability	0.786729

Test Equation:
Dependent Variable: D(T_MILEXP)
Method: Least Squares
Date: 12/06/01 Time: 19:40
Sample: 1968 1992
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_GNP(-1))	0.002962	0.000700	4.228060	0.0010
ECM(-1)	-0.280583	0.122103	-2.297915	0.0388
UC_HOSTILITY	1.389946	0.787542	1.764918	0.1010
D(T_SAVING)	3974.828	1634.813	2.431366	0.0303
D(T_FORINV)	90.77839	30.26133	2.999815	0.0102
YR1977	484.8203	261.9934	1.850506	0.0871
YR1984	-788.5143	285.6138	-2.760771	0.0162
YR1987	-2368.394	646.0791	-3.665796	0.0029
YR1991	-632.4980	316.5429	-1.998143	0.0671
UC_VARIANCE(-1)	-8.007584	4.332084	-1.848437	0.0874
C	-47.82844	144.9381	-0.329992	0.7467
FITTED^2	3.33E-05	0.000171	0.195247	0.8482

R-squared	0.942282	Mean dependent var	319.9200
Adjusted R-squared	0.893443	S.D. dependent var	687.9171
S.E. of regression	224.5571	Akaike info criterion	13.97221
Sum squared resid	655536.7	Schwarz criterion	14.55727
Log likelihood	-162.6526	F-statistic	19.29380
Durbin-Watson stat	1.939041	Prob(F-statistic)	0.000003

Table 5-8 Correlation Matrices for Multi-Collinearity Check on ECM

	ECM	FIV	GNP	SAV	UC-H	UC-V	1977	1984	1987	1991
ECM	1	-0.29	-0.01	0.34	0.04	-0.41	0.07	0.13	-0.33	-0.13
FIN	-0.29	1	0.09	0.01	0.39	0.25	-0.22	-0.11	0.21	0.04
GNP	-0.01	0.09	1	0.46	-0.09	0.4	-0.12	0.06	0.18	0.38
SAV	0.34	0.01	0.46	1	-0.15	0.03	0.01	0.13	0.39	0.05
UCH	-0.04	0.39	-0.09	-0.15	1	0.29	-0.23	-0.04	0.04	0.03
UCV	-0.41	0.25	0.4	0.03	0.29	1	-0.32	-0.23	0.12	0.26
1977	0.07	-0.22	-0.12	0.01	-0.23	-0.32	1	-0.04	-0.04	-0.04
1984	-0.13	-0.11	0.06	0.13	-0.04	-0.23	-0.04	1	-0.04	-0.04
1987	-0.33	0.21	0.18	0.39	0.04	0.12	-0.04	-0.04	1	-0.04
1991	0.13	0.04	0.38	0.05	0.03	0.26	-0.04	-0.04	-0.04	1

Table 5-9 Incremental Model Estimates on Taiwan's Military Spending, 1966-1992

Dependent Variable: D(T_MILEXP)
Method: Least Squares
Date: 12/06/01 Time: 09:57
Sample(adjusted): 1968 1992
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_GNP(-1))	0.002804	0.000422	6.651034	0.0000
D(T_MILEXP(-1))	-0.160821	0.076945	-2.090066	0.0553
UC_HOSTILITY	1.693025	0.753004	2.248360	0.0412
D(T_SAVING)	3866.676	1660.767	2.328247	0.0354
D(T_FORINV)	100.5635	30.49754	3.297430	0.0053
YR1977	641.9665	264.0816	2.430939	0.0291
YR1984	-1095.984	253.7602	-4.318975	0.0007
YR1987	-2726.781	262.1508	-10.40157	0.0000
YR1991	-538.2968	289.6426	-1.858486	0.0843
UC_VARIANCE(-1)	-2.018289	3.504782	-0.575867	0.5738
C	-126.0357	148.9366	-0.846237	0.4117

R-squared	0.927443	Mean dependent var	319.9200
Adjusted R-squared	0.875617	S.D. dependent var	687.9171
S.E. of regression	242.6144	Akaike info criterion	14.12101
Sum squared resid	824064.5	Schwarz criterion	14.65731
Log likelihood	-165.5126	F-statistic	17.89524
Durbin-Watson stat	1.974879	Prob(F-statistic)	0.000003

Table 5-10 Breusch-Godfrey Serial Correlation LM Test on Incremental Model

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.827214	Probability	0.087922
Obs*R-squared	16.98823	Probability	0.009327

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/14/01 Time: 09:33

Variable	Coefficient	Std. Error	T-Statistic	Prob.
D(T_GNP(-1))	0.000140	0.000328	0.428454	0.6796
D(T_MILEXP(-1))	0.045790	0.063798	0.717735	0.4933
UC_HOSTILITY	-0.212097	0.720513	-0.294369	0.7760
D(T_SAVING)	-1140.486	1744.988	-0.653578	0.5317
D(T_FORINV)	1.036671	25.63670	0.040437	0.9687
YR1977	-250.2598	261.8625	-0.955691	0.3672
YR1984	-801.9719	318.9125	-2.514708	0.0361
YR1987	142.8977	212.6421	0.672010	0.5205
YR1991	-34.10233	237.0935	-0.143835	0.8892
UC_VARIANCE(-1)	-3.370420	2.914410	-1.156467	0.2809
C	121.9923	131.2927	0.929162	0.3800
RESID(-1)	-0.234309	0.292252	-0.801735	0.4459
RESID(-2)	-0.213905	0.288056	-0.742582	0.4790
RESID(-3)	-0.612769	0.302689	-2.024422	0.0775
RESID(-4)	-0.661821	0.334748	-1.977073	0.0834
RESID(-5)	-0.835682	0.330126	-2.531401	0.0352
RESID(-6)	0.577561	0.366760	1.574766	0.1540

R-squared	0.679529	Mean dependent var	2.50E-14
Adjusted R-squared	0.038588	S.D. dependent var	185.2998
S.E. of regression	181.6895	Akaike info criterion	13.46304
Sum squared resid	264088.5	Schwarz criterion	14.29188
Log likelihood	-151.2880	F-statistic	1.060205
Durbin-Watson stat	1.645194	Prob(F-statistic)	0.490326

Table 5-11 ARCH Test on Incremental Model (BIM)

ARCH Test:

F-statistic	0.847396	Probability	0.367275
Obs*R-squared	0.890145	Probability	0.345438

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/14/01 Time: 16:44
Sample(adjusted): 1969 1992
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	27921.52	14221.27	1.963363	0.0624
RESID^2(-1)	0.194003	0.210749	0.920541	0.3673

R-squared	0.037089	Mean dependent var	33972.81
Adjusted R-squared	-0.006679	S.D. dependent var	61574.71
S.E. of regression	61780.00	Akaike info criterion	24.98020
Sum squared resid	8.40E+10	Schwarz criterion	25.07837
Log likelihood	-297.7624	F-statistic	0.847396
Durbin-Watson stat	1.957087	Prob(F-statistic)	0.367275

Table 5-12 White Heteroskedasticity Test on BIM

White Heteroskedasticity Test:

F-statistic	0.639235	Probability	0.787850
Obs*R-squared	14.02772	Probability	0.596648

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/14/01 Time: 16:50
Sample: 1968 1992
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	212923.6	105774.4	2.012996	0.0789
D(T_GNP(-1))	-0.342351	0.613999	-0.557575	0.5924
(D(T_GNP(-1)))^2	9.53E-07	1.48E-06	0.644189	0.5375
D(T_MILEXP(-1))	19.17150	27.34460	0.701107	0.5031
(D(T_MILEXP(-1)))^2	-0.001269	0.029585	-0.042901	0.9668
UC_HOSTILITY	-615.5328	1211.326	-0.508148	0.6251
UC_HOSTILITY^2	0.989405	4.281026	0.231114	0.8230
D(T_SAVING)	-277061.8	647331.9	-0.428006	0.6799
(D(T_SAVING))^2	-4886745.	12368688	-0.395090	0.7031
D(T_FORINV)	11443.25	10275.90	1.113600	0.2978
(D(T_FORINV))^2	-624.4457	2897.650	-0.215501	0.8348
YR1977	-82808.56	86497.04	-0.957357	0.3664
YR1984	-42898.42	84072.17	-0.510257	0.6236
YR1987	4594.570	91755.79	0.050074	0.9613
YR1991	-14872.00	108605.1	-0.136937	0.8945
UC_VARIANCE(-1)	-7265.056	3823.039	-1.900336	0.0939
UC_VARIANCE(-1)^2	86.46988	60.92837	1.419205	0.1936

R-squared	0.561109	Mean dependent var	32962.58
Adjusted R-squared	-0.316673	S.D. dependent var	60489.52
S.E. of regression	69409.53	Akaike info criterion	25.35400
Sum squared resid	3.85E+10	Schwarz criterion	26.18284
Log likelihood	-299.9250	F-statistic	0.639235
Durbin-Watson stat	1.938494	Prob(F-statistic)	0.787850

Table 5-13 Ramesy RESET Test on Specification and Stability of BIM

Ramsey RESET Test:

F-statistic	0.498836	Probability	0.492477
Log likelihood ratio	0.941353	Probability	0.331930

Test Equation:
Dependent Variable: D(T_MILEXP)
Method: Least Squares
Date: 12/14/01 Time: 16:53
Sample: 1968 1992
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_GNP(-1))	0.002383	0.000734	3.248273	0.0063
D(T_MILEXP(-1))	-0.130591	0.089288	-1.462586	0.1673
UC_HOSTILITY	1.347271	0.909789	1.480860	0.1625
D(T_SAVING)	3399.039	1816.298	1.871410	0.0840
D(T_FORINV)	90.80400	33.99370	2.671201	0.0192
YR1977	552.2144	297.4504	1.856492	0.0862
YR1984	-1113.642	259.6344	-4.289269	0.0009
YR1987	-3138.405	641.0408	-4.895796	0.0003
YR1991	-417.7957	340.7584	-1.226076	0.2419
UC_VARIANCE(-1)	-1.380383	3.681751	-0.374926	0.7138
C	-97.14950	157.0935	-0.618418	0.5470
FITTED^2	0.000145	0.000205	0.706284	0.4925

R-squared	0.930125	Mean dependent var	319.9200
Adjusted R-squared	0.870999	S.D. dependent var	687.9171
S.E. of regression	247.0771	Akaike info criterion	14.16335
Sum squared resid	793612.0	Schwarz criterion	14.74841
Log likelihood	-165.0419	F-statistic	15.73139
Durbin-Watson stat	2.016349	Prob(F-statistic)	0.000009

TABLE 5-14 Nested Model Estimates on Taiwan's Military Spending, 1966-1992

Dependent Variable: D(T_MILEXP)
Method: Least Squares
Date: 12/15/01 Time: 11:00
Sample(adjusted): 1968 1992
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_GNP(-1))	0.003027	0.000458	6.611874	0.0000
ECM(-1)	-0.247793	0.134008	-1.849084	0.0892
UC_HOSTILITY	1.528061	0.723357	2.112459	0.0563
D(T_SAVING)	4111.073	1589.081	2.587076	0.0238
D(T_FORINV)	96.07135	29.30562	3.278257	0.0066
YR1977	521.1759	261.8165	1.990615	0.0698
YR1984	-809.7294	291.6542	-2.776334	0.0168
YR1987	-2332.127	331.2192	-7.041038	0.0000
YR1991	-634.7557	295.8476	-2.145549	0.0531
D(C_MILEXP(-1))	0.000389	0.017958	0.021689	0.9831
D(T_MILEXP(-1))	-0.051430	0.095296	-0.539683	0.5993
UC_VARIANCE(-1)	-7.375984	4.429885	-1.665051	0.1218
C	-60.34612	152.2765	-0.396293	0.6988

R-squared	0.943538	Mean dependent var	319.9200
Adjusted R-squared	0.887077	S.D. dependent var	687.9171
S.E. of regression	231.1679	Akaike info criterion	14.03020
Sum squared resid	641263.4	Schwarz criterion	14.66401
Log likelihood	-162.3775	F-statistic	16.71116
Durbin-Watson stat	1.918627	Prob(F-statistic)	0.000012

Table 5-15 Breuch-Godfrey Serial Correlation LM Test on Nested Model

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.777576	Probability	0.616089
Obs*R-squared	10.93590	Probability	0.090378

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/15/01 Time: 11:04

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_GNP(-1))	0.000805	0.000817	0.984711	0.3628
ECM(-1)	0.015436	0.355754	0.043390	0.9668
UC_HOSTILITY	-0.397138	1.335155	-0.297447	0.7762
D(T_SAVING)	1652.079	2939.324	0.562061	0.5944
D(T_FORINV)	13.51494	45.94212	0.294173	0.7785
YR1977	-260.4487	403.2413	-0.645888	0.5423
YR1984	-115.3617	1281.784	-0.090001	0.9312
YR1987	227.4067	588.8391	0.386195	0.7127
YR1991	-212.2526	344.9127	-0.615381	0.5609
D(C_MILEXP(-1))	0.025530	0.027702	0.921603	0.3923
D(T_MILEXP(-1))	0.013794	0.184758	0.074662	0.9429
UC_VARIANCE(-1)	-0.528306	7.162394	-0.073761	0.9436
C	-72.60313	204.7297	-0.354629	0.7350
RESID(-1)	-0.258064	0.703375	-0.366894	0.7263
RESID(-2)	-0.541918	0.918894	-0.589750	0.5769
RESID(-3)	-0.015335	0.619929	-0.024736	0.9811
RESID(-4)	-1.013124	0.591849	-1.711793	0.1378
RESID(-5)	-0.528825	0.893300	-0.591991	0.5755
RESID(-6)	-0.070839	1.290000	-0.054914	0.9580

R-squared	0.437436	Mean dependent var	-9.09E-15
Adjusted R-squared	-1.250256	S.D. dependent var	163.4604
S.E. of regression	245.2045	Akaike info criterion	13.93495
Sum squared resid	360751.6	Schwarz criterion	14.86129
Log likelihood	-155.1868	F-statistic	0.259192
Durbin-Watson stat	1.545534	Prob(F-statistic)	0.988092

Table 5-16 ARCH Test on Nested Model (NM)

ARCH Test:

F-statistic	0.002652	Probability	0.959391
Obs*R-squared	0.002893	Probability	0.957105

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/15/01 Time: 11:07
Sample(adjusted): 1969 1992
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	26974.73	11031.87	2.445164	0.0229
RESID^2(-1)	-0.011689	0.226972	-0.051501	0.9594

R-squared	0.000121	Mean dependent var	26713.82
Adjusted R-squared	-0.045329	S.D. dependent var	46956.31
S.E. of regression	48008.75	Akaike info criterion	24.47581
Sum squared resid	5.07E+10	Schwarz criterion	24.57398
Log likelihood	-291.7097	F-statistic	0.002652
Durbin-Watson stat	1.891457	Prob(F-statistic)	0.959391

Table 5-17 White Heteroskedasticity Test on NM

White Heteroskedasticity Test:

F-statistic	0.485830	Probability	0.875394
Obs*R-squared	17.70956	Probability	0.606534

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/15/01 Time: 11:08
Sample: 1968 1992
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	252456.1	158172.4	1.596082	0.1857
D(T_GNP(-1))	-1.172657	1.362065	-0.860940	0.4378
(D(T_GNP(-1)))^2	3.15E-06	3.11E-06	1.012495	0.3686
ECM(-1)	55.41948	100.7792	0.549910	0.6116
ECM(-1)^2	0.001599	0.075946	0.021060	0.9842
UC_HOSTILITY	-508.5565	1376.053	-0.369576	0.7304
UC_HOSTILITY^2	1.830573	4.929904	0.371320	0.7292
D(T_SAVING)	-2269962.	1338257.	-1.696208	0.1651
(D(T_SAVING))^2	17461091	22280886	0.783680	0.4770
D(T_FORINV)	13692.54	17008.55	0.805039	0.4659
(D(T_FORINV))^2	-6892.969	3774.511	-1.826189	0.1419
YR1977	-23481.54	84739.84	-0.277102	0.7954
YR1984	-32367.89	112352.0	-0.288093	0.7876
YR1987	-29413.76	101592.7	-0.289526	0.7866
YR1991	-65687.06	101135.6	-0.649495	0.5514
D(C_MILEXP(-1))	15.98458	10.18206	1.569876	0.1915
(D(C_MILEXP(-1)))^2	-0.003701	0.001799	-2.057202	0.1088
D(T_MILEXP(-1))	17.25317	36.36339	0.474465	0.6599
(D(T_MILEXP(-1)))^2	-0.046787	0.037548	-1.246079	0.2807
UC_VARIANCE(-1)	-6250.976	4628.650	-1.350497	0.2482
UC_VARIANCE(-1)^2	79.55771	69.31685	1.147740	0.3151

R-squared	0.708382	Mean dependent var	25650.54
Adjusted R-squared	-0.749706	S.D. dependent var	46274.06
S.E. of regression	61209.68	Akaike info criterion	24.72942
Sum squared resid	1.50E+10	Schwarz criterion	25.75327
Log likelihood	-288.1177	F-statistic	0.485830
Durbin-Watson stat	2.556984	Prob(F-statistic)	0.875394

Table 5-18 Ramsey RESET Test on Specification and Stability of N M

Ramsey RESET Test:

F-statistic	0.074172	Probability	0.790401
Log likelihood ratio	0.168007	Probability	0.681889

Test Equation:
Dependent Variable: D(T_MILEXP)
Method: Least Squares
Date: 12/15/01 Time: 11:11
Sample: 1968 1992
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(T_GNP(-1))	0.002859	0.000781	3.661228	0.0037
ECM(-1)	-0.228321	0.156753	-1.456562	0.1732
UC_HOSTILITY	1.418057	0.854479	1.659556	0.1252
D(T_SAVING)	3943.544	1764.846	2.234497	0.0472
D(T_FORINV)	92.65008	32.99135	2.808314	0.0170
YR1977	498.7348	284.7250	1.751637	0.1076
YR1984	-836.9813	319.6660	-2.618299	0.0239
YR1987	-2502.962	715.7874	-3.496795	0.0050
YR1991	-585.2100	357.6856	-1.636102	0.1301
D(C_MILEXP(-1))	0.000685	0.018725	0.036609	0.9715
D(T_MILEXP(-1))	-0.050092	0.099321	-0.504340	0.6240
UC_VARIANCE(-1)	-6.808771	5.059854	-1.345646	0.2055
C	-53.16009	160.6952	-0.330813	0.7470
FITTED^2	5.06E-05	0.000186	0.272345	0.7904

R-squared	0.943917	Mean dependent var	319.9200
Adjusted R-squared	0.877636	S.D. dependent var	687.9171
S.E. of regression	240.6371	Akaike info criterion	14.10348
Sum squared resid	636968.4	Schwarz criterion	14.78605
Log likelihood	-162.2935	F-statistic	14.24126
Durbin-Watson stat	1.966049	Prob(F-statistic)	0.000048

FIGURES

Figure 4-4 Error Correction Mechanism of GNP and T_MILEXP

Figure 5-7 Correlogram of Residuals

Date: 12/06/01 Time: 16:56
Sample: 1968 1992
Included observations: 25

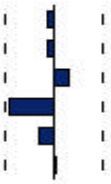
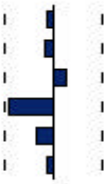
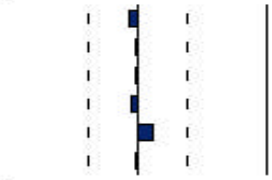
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.043	-0.043	0.0520	0.820
		2	-0.056	-0.058	0.1450	0.930
		3	0.116	0.112	0.5587	0.906
		4	-0.364	-0.364	4.8157	0.307
		5	-0.123	-0.146	5.3281	0.377
		6	0.023	-0.049	5.3472	0.500

Figure 5-8 Correlogram of Residuals Squared

Date: 12/06/01 Time: 17:02
Sample: 1968 1992
Included observations: 25



	AC	PAC	Q-Stat	Prob
1	-0.081	-0.081	0.1861	0.666
2	-0.012	-0.019	0.1905	0.909
3	-0.023	-0.026	0.2074	0.976
4	-0.045	-0.050	0.2738	0.991
5	0.117	0.110	0.7381	0.981
6	-0.011	0.005	0.7424	0.994

Figure 5-9 Jarque-Bera Test for Normality on ECM

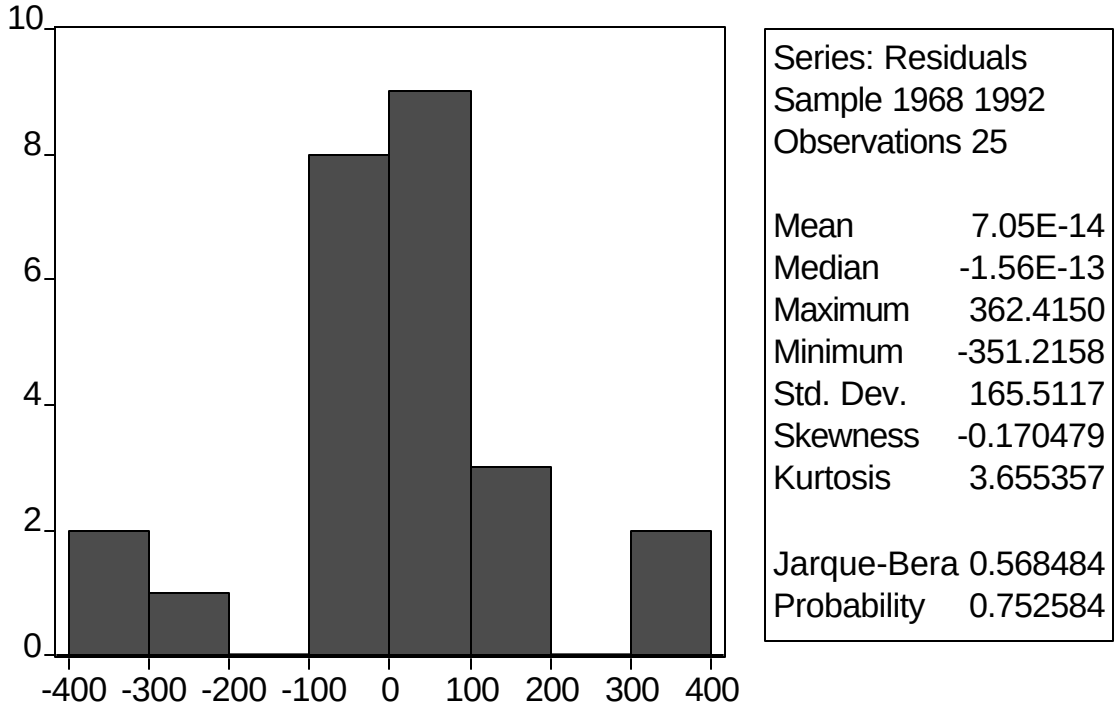
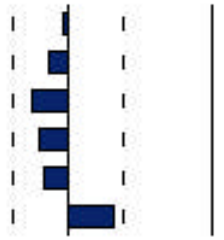
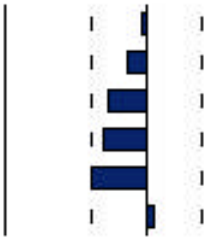


Figure 5-10 Correlogram of Residuals for BIM

Date: 12/14/01 Time: 17:07
Sample: 1968 1992
Included observations: 25

	AC	PAC	Q-Stat	Prob
1	-0.039	-0.039	0.0417	0.838
2	-0.145	-0.147	0.6577	0.720
3	-0.266	-0.284	2.8227	0.420
4	-0.216	-0.304	4.3290	0.363
5	-0.173	-0.395	5.3368	0.376
6	0.327	0.047	9.1438	0.166

Figure 5-11 Correlogram of Residuals Squared for BIM

Date: 12/14/01 Time: 17:12
Sample: 1968 1992
Included observations: 25

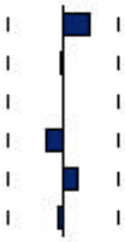
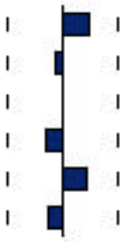
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.189	0.189	1.0085	0.315
		2	-0.015	-0.052	1.0147	0.602
		3	-0.005	0.008	1.0155	0.797
		4	-0.124	-0.131	1.5133	0.824
		5	0.108	0.167	1.9070	0.862
		6	-0.039	-0.114	1.9607	0.923

Figure 5-12 Jargue-Bera Test for Normality on BIM

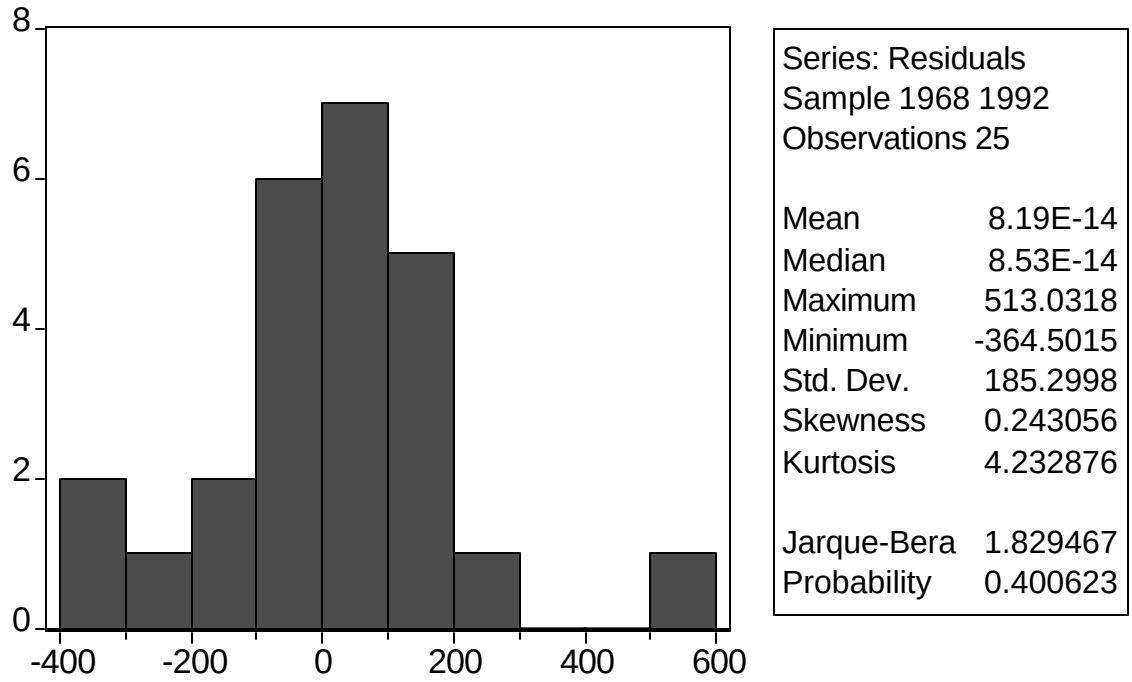
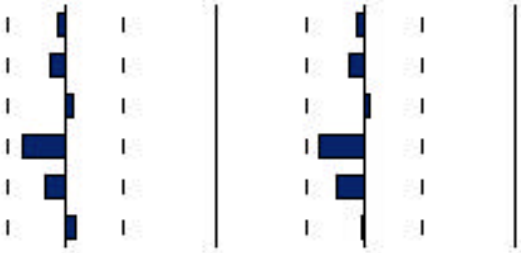


Figure 5-13 Correlogram of Residuals for NM

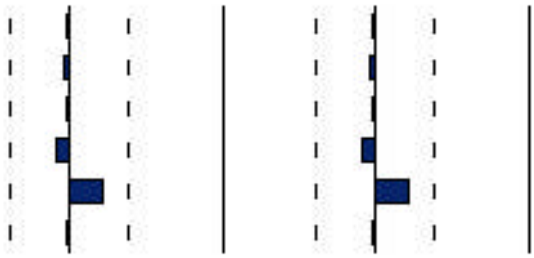
Date: 12/15/01 Time: 11:16
Sample: 1968 1992
Included observations: 25



	AC	PAC	Q-Stat	Prob
1	-0.042	-0.042	0.0490	0.825
2	-0.100	-0.102	0.3414	0.843
3	0.042	0.033	0.3944	0.941
4	-0.297	-0.308	3.2252	0.521
5	-0.147	-0.181	3.9508	0.557
6	0.070	-0.022	4.1273	0.659

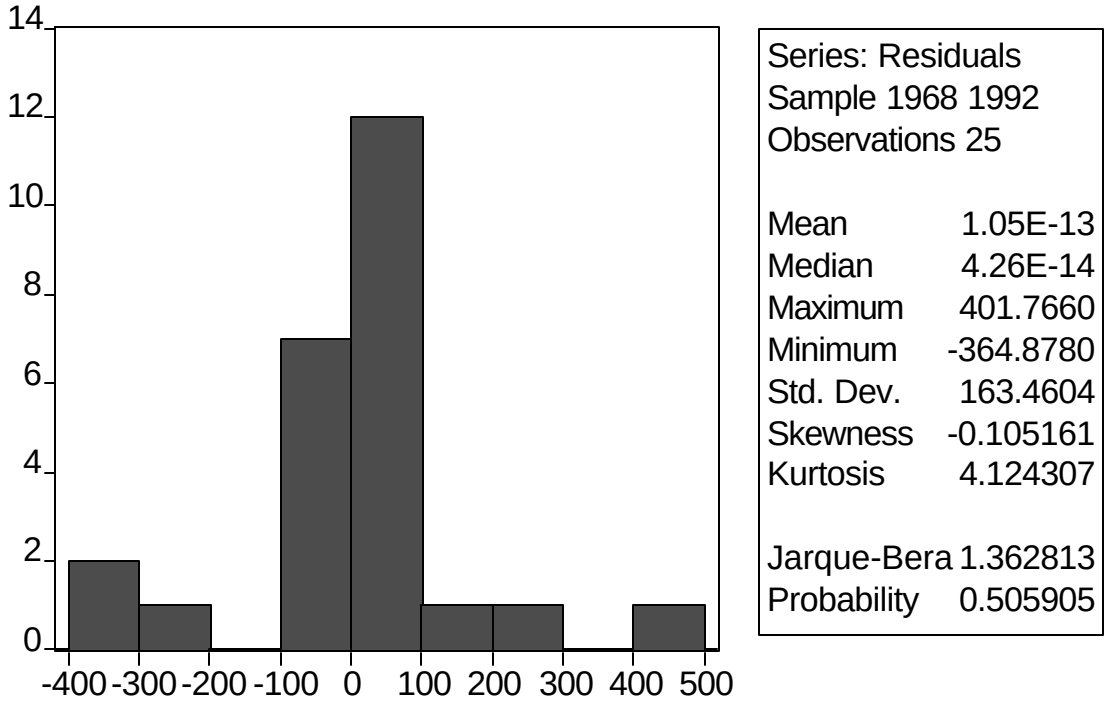
Figure 5-14 Correlogram of Residuals Squared for NM

Date: 12/15/01 Time: 11:20
Sample: 1968 1992
Included observations: 25



		AC	PAC	Q-Stat	Prob
1		-0.012	-0.012	0.0039	0.950
2		-0.037	-0.037	0.0443	0.978
3		-0.019	-0.020	0.0559	0.997
4		-0.083	-0.085	0.2780	0.991
5		0.229	0.228	2.0528	0.842
6		-0.015	-0.021	2.0611	0.914

Figure 5-15 Jargue-Bera Test for Normality on NM



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