The Extended Deterrent Value of Nuclear Weapons

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Three questions are addressed in this study: (1) Does a nuclear retaliatory capability contribute to extended deterrence against a nonnuclear power? (2) If so, is the deterrent value of nuclear weapons contingent upon the prior credible threat of conventional armed engagement by the defender? (3) Or, is the deterrent impact of nuclear weapons so potent that the conventional balance of forces has little deterrent impact? Competing hypotheses are formulated and then tested by probit analysis. The empirical findings indicate that (a) nuclear weapons do contribute to extended deterrence success, but (b) that effect is not contingent upon the prior threat of conventional armed conflict, and (c) there is an inverse relationship between the conventional balance of forces and the extended deterrent role of nuclear weapons.

The utility of nuclear threats in deterring conventional military attacks on third parties is a controversial question that has been extensively debated by academics and policymakers.[1] Scholarly research and policy debates have typically focused on the relationship between mutual assured destruction (MAD) and the credibility of extended nuclear deterrence and crisis stability. For example, analysts have asked questions such as: Are limited counterforce

1. The entire literature is too extensive to cite here, but the most important early works and more recent studies would include: Betts (1987), Blechman and Hart (1982), Blechman and Kaplan (1978), Brams (1985), Bundy (1984, 1989), Glaser (in press), Halperin (1987), Jervis (1989), Kugler (1984), McNamara (1983), Mueller (1988), Organski and Kugler (1980), Powell (1987; 1989a,b), Russett (1988, 1989), Schelling (1960, 1966), Snyder (1961), Weede (1983), and Zagare (1987).

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nuclear options essential to bolster extended deterrent threats in MAD? What effect will increased strategic counterforce capabilities have on preemptive incentives in MAD?

This article, however, will examine the extended deterrent role of nuclear weapons in international confrontations not characterized by MAD. Three interrelated questions will be addressed:

1. Does the possession of the capability to deliver a nuclear strike by a defender increase the probability of extended deterrence success?
2. If nuclear weapons do contribute to extended deterrence success, is this contingent upon the prior credible threat of conventional armed engagement by the defender?
3. Is the extended deterrent value of nuclear weapons so potent that the balance of conventional military forces between attacker and defender has little deterrent impact?

Based on empirical results, this study concludes that: nuclear weapons have contributed to extended deterrence success, although that deterrent impact has varied significantly across historical cases; the extended deterrent value of nuclear weapons, however, was not closely linked to the prior credible threat of conventional armed conflict involving the defender; and the contribution of nuclear weapons to extended deterrence has not mitigated the importance of the conventional balance of military forces in explaining deterrence success and failure. The extended deterrent value of nuclear weapons is greatest in cases where the conventional balance of forces ranged from a clear advantage for the potential attacker to approximate equality between attacker and defender. When the defender enjoyed superiority in conventional forces, however, nuclear weapons had little deterrent value.

I first formulate hypotheses on the extended deterrent role of nuclear weapons, which draw on experimental findings in cognitive psychology as well as the crisis bargaining literature. The hypotheses then are tested by probit analysis and the emprical results discussed. The concluding section examines policy implications regarding nuclear alerts.

HYPOTHESES ON EXTENDED NUCLEAR DETERRENCE

The theoretical question to be addressed is as follows: What extended deterrent role do nuclear weapons play in interstate confrontations in which the potential attacker is either a nonnuclear power or does not possess an assured destruction capability, and the defender's own territorial integrity is

not directly threatened? Contending hypotheses on the extended deterrent impact of nuclear weapons and how they interact with conventional military forces will be formulated for empirical testing. The conceptual foundation for the competing hypotheses is that opposing conclusions can be drawn about how the decision makers of a potential attacker will respond to low probability, but very costly, threats.[2] These opposing conclusions are consistent with the experimental findings of cognitive psychologists on individual choice under varying conditions of risk: Individuals either ignore or overweight outcomes that are considered quite unlikely but nevertheless very consequential (Kahneman and Tversky, 1979: 279, 282-283, 286; Quattrone and Tversky, 1988: 730-731).[3]

The credibility of extended deterrence depends upon the potential attacker's assessment of whether the defender possesses (1) military capabilities sufficient to inflict substantial military costs on the attacker in the event of armed conflict; and (2) whether the defender would actually use those capabilities if an ally was attacked. I will not attempt to identify the full range of political and military factors that could influence extended deterrence credibility. Instead, the focus is more narrowly on what impact possession of a nuclear retaliatory capability has on credibility.[4] The assumption underlying the hypotheses to be tested is that the likelihood of the defender retaliating with nuclear weapons to protect an attacked ally is likely to be considered quite low by a potential attacker for two reasons. First, the collateral damage to civilians resulting from a nuclear attack will generate domestic protest as well as international censure, particularly when the defender's territory is not directly threatened by the attacker. Second, the longer-term military costs may be very high as the incentives for other countries to develop or expand their own nuclear forces will increase. As a result, the short-term political as well as long-term military costs to the defender will typically be more salient than the immediate tactical military benefits or coercive value of nuclear retaliation (Gaddis, 1986:136-138; Huth, 1988a:428).

2. Conceptually, the same general problem of credibility exists for a nuclear defender in extended deterrence cases in which the potential attacker possesses a secure second-strike nuclear capability.

3. Another important experimental finding, with interesting implications for international relations, is that individuals are more likely to take risks to avoid anticipated losses than to achieve potential gains. The implications of this finding for deterrence theory will not be addressed in this article.

4. The variable of credibility will not be directly observed. Several indicators of credibility will be measured and then tested, and inferences about credibility will be drawn on the basis of the empirical findings. See Huth (1988a,b) for a more complete analysis of the conditions that affect the credibility of extended deterrent threats.

One possible implication to be drawn from this assumption is that, despite the low probability of nuclear use, the very large economic and military costs that a nuclear strike would inflict on an attacker enhance the credibility of the defender's deterrent threat. The potential costs to the attacker of misjudging the intentions of the defender and suffering the consequences of a nuclear strike are too devastating to be heavily discounted. Accordingly, decision makers will be very attentive to quite unlikely but potentially high losses. Indeed, the large costs that the defender could impose on the potential attacker will distort the potential attacker's assessment of the probability of nuclear retaliation by the defender: a bias toward inflating the likelihood of retaliation will be introduced.

The implication is that the defender's nuclear threat will be more credible to the potential attacker than an objective calculation of costs × probability would predict (in the literature, this is often referred to as the existential deterrent value of nuclear weapons; see Bundy, 1969). Hypothesis 1 can be stated as follows:

> Because the costs of suffering a nuclear strike are likely to be greater than the costs of conventional armed conflict, the threat of nuclear retaliation will have a greater extended deterrent impact than the conventional balance of forces, or military actions that signal the defender's intent to retaliate with conventional forces.[5]

The potential attacker will look beyond the prospect of victory in a conventional armed conflict and be more concerned with the possible threat of escalation to the nuclear level (Jervis, 1989: chap. 5; Schelling, 1966: 92-105).

If Hypothesis 1 is supported by empirical testing, there should be significant differences in the estimated coefficients for variables that measure the impact of the balance of conventional military forces and conventional military preparations, which signal the threat to intervene, in nuclear versus nonnuclear cases. In the nonnuclear cases, the balance of conventional forces and military preparations should have a strong positive impact on deterrence outcomes, whereas in the nuclear cases, those same variables should have a weaker, if not, insignificant deterrent impact. In contrast, the estimated coefficient of a dummy variable for possession of a nuclear retaliatory capability should be positive and significant.

5. The potential attacker typically is assessing the costs of conventional war in terms of what are the prospects for achieving a quick and decisive military victory or the seizure of disputed territory and not the costs of victory in a war of attrition (see Huth, 1988b: chaps. 3-4). The relevant comparison therefore is between the costs of a nuclear strike and the costs of a short but perhaps intense conventional armed conflict.

An alternative theoretical argument, however, to the existential deterrent impact of nuclear weapons can be developed. As with Hypotheses 1 the assumption is that the probability that a defender would use nuclear weapons in defense of other countries against a nonnuclear attacker or much smaller nuclear power is very low. Hypothesis 2 can be stated as follows:

> The possession of a nuclear retaliatory capability will not contribute to extended deterrence success unless prior military actions by the defender credibly threaten conventional military engagement with the attacker.

The reaction of policymakers considering an attack, contrary to the logic underlying Hypothesis 1 is to discount heavily the threat of nuclear retaliation despite the potentially high costs. In other words, a probability estimate of the intention to use force by an adversary that approaches zero is, in practice, treated as equivalent to zero by policymakers. As a result, the unequaled destructive power of nuclear weapons will not enhance the credibility of the defender's extended deterrent threat. Instead, deterrence success or failure will depend critically on the conventional balance of forces.

A theoretical answer to the problem of an incredible extended deterrent nuclear threat can be derived from the literature on crisis bargaining: If the nuclear threat is to have a deterrent impact, then there must be some form of coupling between the defender's conventional forces and the decision to escalate to the use of nuclear weapons. If the defender can convince the potential attacker that there is a connection between conventional and nuclear retaliation, the potential attacker will increase the probability estimate of nuclear use by the defender to such a level that it is viewed as significant and therefore cannot continue to be treated as equivalent to zero.

For example, if the potential attacker has initiated conventional military preparations for the use of force, it would be crucial for the defender to reciprocate with equivalent conventional military preparations (a tit-for-tat response). When the defender's conventional military forces are in position to intervene as a result of a tit-for-tat policy, this would signal to the attacker the defender's intent to use conventional forces to defend its ally. Once the conventional forces of the defender are perceived as committed to the defense of an ally, the political-military stakes at risk for the defender in the confrontation with the attacker have significantly increased. The threat to cross the nuclear threshold by the defender as a result of a carefully reasoned and debated decision by the central political leadership, or as a quicker decision based on a response to conditions rapidly changing on the battlefield is more credible given the heightened interests at stake (Schelling, 1966: 49-59). The threat to escalate is particularly credible if the defender is faced with an unfavorable local balance of conventional forces (for example, some analysts

argue that U.S. conventional forces played a trip-wire role in NATO's policy of massive retaliation during the 1950s).[6]

If Hypothesis 2 is supported by empirical testing, the coefficient for an interactive dummy variable, which captures those cases in which the defender is a nuclear power and adopts a tit-for-tat policy, should be positive and significant, contrary to the expected results that follow from Hypothesis 1. The dummy variable for possession of a nuclear retaliatory capability, also in contrast to Hypothesis 1, should have a smaller coefficient than the interactive dummy variable because the nuclear-capable defender adopts a tit-for-tat policy in only half of the cases to be tested.

DATA ANALYSIS

The hypotheses will be tested on 56 cases of extended-immediate deterrence from 1885 to 1983 (for a complete listing of the cases see Huth, 1988b: 23-27[7], a full list of documentation data on all variables will appear in Oye, in press). Previous research on these cases tested several hypotheses on how the conventional balance of forces, bargaining strategies, and past behavior influenced deterrence outcomes (Huth, 1988 a, b). The empirical results of this previous work are presented in Table 1.[8] The principal conclusions drawn from the probit analysis were: (1) The military capability of the defender to prevent a quick and low-cost conventional victory and to signal its intent to protect its protege's interests through reciprocity in diplomatic and military actions contributed to extended deterrence success; (2) in contrast, if in a previous confrontation between the defender and potential attacker either side suffered a diplomatic defeat, then extended deterrence failure was more likely.

6. Currently, the credibility of the threat of tactical nuclear use by NATO, as a component of flexible response, is increased by the close integration of nuclear forces into the conventional force structure and operational plans of NATO and thus the potential problems of command and control of nuclear forces (see Bracken, 1983, and Charles, 1987). The hypothesis on the importance of the threat of conventional armed engagement in enhancing the deterrent role of nuclear weapons does not require that nuclear forces be tightly integrated into the defender's conventional force posture, as is the case with NATO. In this study, none of the nuclear cases (see Table 2) closely approximate the extensive coupling of conventional and nuclear forces that characterizes NATO.

7. Two cases have been deleted from the original population of 58 based on new evidence that the defender did not attempt to deter the potential attacker. The data set I have utilized as the basis for testing hypotheses on extended deterrence has been critically analyzed by Lebow and Stein (1990) and I have responded to their arguments (Huth and Russett, 1990).

8. There are no significant statistical differences or changes in the substantive interpretation of the probit results because of the deletion of the two cases.

TABLE 1
Probit Analysis of Deterrence Outcomes

Explanatory Variable	*Estimated Coefficient*	*Standard Error*
Constant	-1.54	–
Conventional military balance		
Immediate balance of forces	0.55	0.30*
Short-term balance of forces	0.78	0.37**
Bargaining behavior of defender		
Firm-but-flexible diplomacy	0.91	0.46*
Tit-for-tat military escalation	1.06	0.48**
Past behavior of defender		
Capitulation to potential attacker	-1.21	0.64*
Intransigence toward potential attacker	-0.92	0.50*

NOTES: A detailed discussion of the coding rules for measurement of the variables listed below is presented in Huth (1988b, 57-71). Definitions for each of the variables are as follows:

1. Immediate balance of forces: The ratio of the ground forces of the defender and protégé in position to repulse an attack directly and those ground forces of the potential attacker in position to initiate an attack directly.
2. Short-term balance of forces: The ratio of the mobilized strength of standing ground and airforce manpower plus first class of trained reserves between defender and protégé and potential attacker.
3. Firm-but-flexible diplomacy: The defender adopts a mixed policy of refusing to concede to the repeated demands and threats of the potential attacker while also proposing to compromise based on reciprocal concessions.
4. Tit-for-tat military escalation: The defender responds to the conventional military actions of the potential attacker with equal levels of military preparedness.
5. Capitulation to potential attacker: The defender retreats under the coercive pressure of the potential attacker and concedes on the critical issues in dispute in order to avoid becoming involved in a direct military confrontation.
6. Intransigence toward potential attacker: The defender adopts a bullying bargaining strategy or forces the potential attacker to make critical concessions in order to avoid armed conflict, or both.

Percentage of predictions correct = 84; log-likelihood function = -22.412 with 6 d.f.; number of cases = 56.

*Significant at the 95% confidence level, one-tailed test.

**Significant at the 97.5% confidence level, one-tailed test.

Previous work empirically tested for the extended deterrent impact of nuclear weapons by including a single dummy variable in the probit analysis. If a dummy variable is included in the equation presented in Table 1 for those cases in which the defender possessed the means to deliver (by aircraft or land and sea based ballistic missiles) a nuclear strike against the potential

attacker (n = 15) and the probit analysis is redone, the estimated coefficient for the nuclear dummy variable is positive but not statistically significant (b = 0.44, t-ratio = 0.85). These previous probit results and similar findings led to the conclusion that nuclear weapons do not seem to play an important extended deterrent role in the historical cases analyzed (Huth and Russett, 1984, 1988; Huth, 1988a,b).

Model specification for testing the extended deterrent impact of nuclear weapons, however, is incomplete if it only includes a dummy variable for possession of a nuclear retaliatory capability in a probit equation. The reason is that the potential interactive effects of nuclear weapons, the conventional balance of forces, and tit-for-tat escalation cannot be tested.

The 15 cases that involved a nuclear power as defender are listed in Table 2. In 14 of the 15 cases, the potential attacker did not possess the capability to deliver nuclear weapons against the territory of the nuclear defender. The only exception was the 1979 case of China threatening Vietnam with the Soviet Union as defender. This case was included in the analysis because the Chinese nuclear force (ICBMs, SRBMs, and bombers) was quite small (between 215 and 295 warheads; see Arkin and Fieldhouse, 1985: 44) and quite vulnerable to a Soviet first strike (at that time the Chinese did not have a SLBM force). As a result, the Soviet-Chinese nuclear balance in 1979 was not characterized by MAD.[9]

To test Hypotheses 1 and 2, three interactive variables should be included in the probit analysis in addition to the dummy variable (D_1) for possession of a nuclear retaliatory capability (Hanushek and Jackson, 1977: 127-129):

I_1 = Possession of nuclear retaliatory capability × immediate balance of conventional forces
I_2 = Possession of nuclear retaliatory capability × short-term balance of conventional forces
I_3 = Possession of nuclear retaliatory capability × tit-for-tat conventional military escalation.

In Table 3, column 1, the results of the probit analysis that included D_1 and each of the three interactive variables is presented. To determine whether the nuclear dummy and interactive variables as a group in Table 3 were significantly different from the findings in Table 1, where no variables were included to test for the extended deterrent impact of nuclear weapons, a

9. Since 1983 the Chinese have had several submarines carrying nuclear warheads, which most likely provides China with an assured destruction capability against the Soviet Union. See Arkin and Fieldhouse (1985: 44). The inclusion or exclusion of this case makes no difference in the statistical significance of the probit results reported in Table 3 or their substantive interpretation.

TABLE 2
Cases of Extended-Immediate Deterrence with Defender as Nuclear Power, 1946-1983

Year	*Potential Attacker*	*Protégé*	*Defender*	*Outcome*
1946	Soviet Union	Iran	United States	Success
1946	Soviet Union	Turkey	United States	Success
1948-49	Soviet Union	West Berlin	United States	Success
1950	China	Taiwan	United States	Success
1954-55	China	Quemoy-Matsu	United States	Success
1957	Turkey	Syria	Soviet Union	Success
1961	Iraq	Kuwait	Britain	Success
1961	North Vietnam	Laos	United States	Success
1964-65	Indonesia	Malaysia	Britain	Failure
1964-65	North Vietnam	South Vietnam	United States	Failure
1971	India	Pakistani Kashmir	China	Success
1975	Guatemala	Belize	Britain	Success
1977	Guatemala	Belize	Britain	Success
1979	China	Vietnam	Soviet Union	Failure
1983	Libya	Chad	France	Success

NOTE: Cases of extended-immediate deterrence are defined as follows:

1. A potential attacker issues verbal threats, and/or initiates military preparations against a state (protégé).
2. Policymakers of another state (the defender) are aware of this threat to the protégé.
3. Policymakers of the defender state threaten the use of retaliatory force in an attempt to prevent the use of force by the potential attacker against the protégé.

Deterrence success is defined as the absence of sustained use of military force by the potential attacker and the refusal of the defender to capitulate to the demands of the potential attacker. Deterrence failure is defined as a resort to the sustained use of military force by the potential attacker or the attainment of primary goals short of war by coercive intimidation. See Huth (1988b, 23-27) for a more detailed discussion of coding rules.

comparison of the log-likelihood function values weighted by the degrees of freedom was necessary (Maddala, 1983: 39-40; McKelvey and Zavonia, 1975).[10] The difference in the log-likelihood functions of the two models was significant at the 97.5% confidence level (14.86, 4 d.f.), which indicated that nuclear weapons did have a statistically significant impact on extended deterrence outcomes, contrary to the previously reported findings.

The large positive coefficient (b = 5.94) for the nuclear-capable dummy variable is consistent with Hypothesis 1 that the threat of nuclear weapons

10. The formula is as follows: -2[log-likelihood function x_1 – log-likelihood function x_2] with $x_2 - x_1$ degrees of freedom, and where x_1 and x_2 represent models 1 and 2, respectively. The significance level for the calculated value is then checked on the chi-square distribution.

TABLE 3

Probit Analysis of the Impact of Nuclear Weapons on Deterrence Outcomes

Explanatory Variable	*(1)*		*(2)*		*(3)*		*(4)*	
	Coefficient	*Standard Error*	*Coefficient*	*Standard Error*	*Coefficient*	*Standard Error*	*Coefficient*	*Standard Error*
Constant	−4.53	—	−3.61	—	−4.55	—	−4.52	—
Conventional military balance								
Immediate balance of forces	1.99	(0.79)[c]	1.78	(0.73)[c]	1.89	(0.79)[b]	1.84	(0.75)[c]
Short-term balance of forces	1.97	(0.84)[b]	1.53	(0.62)[c]	2.25	(0.97)[b]	2.25	(0.98)[b]
Bargaining behavior of defender								
Firm-but-flexible diplomacy	1.76	(0.81)[b]	1.67	(0.75)[b]	2.24	(1.00)[b]	2.25	(1.00)[b]
Tit-for-tat military escalation	2.03	(0.89)[b]	1.36	(0.66)[b]	1.39	(0.79)[a]	1.39	(0.80)[a]
Past behavior of defender								
Capitulation to potential attacker	−1.71	(0.94)[a]	−1.96	(0.90)[b]	−2.22	(1.04)[b]	−2.21	(1.04)[b]
Intransigence towards potential attacker	−1.81	(0.87)[b]	−1.57	(0.75)[b]	−1.67	(0.96)[a]	−1.64	(0.95)[a]
Nuclear weapons								
Possession of nuclear retaliatory capability (D_1)	5.94	(2.34)[c]	3.92	(1.40)[c]	2.06	(1.67)	1.74	(0.80)[b]
Retaliatory capability × immediate balance (I_1)	−3.60	(1.29)[d]	−3.48	(1.23)[d]	−0.49	(2.19)		
Retaliatory capability × short-term balance (I_2)	−1.25	(1.27)						
Retaliatory capability × tit-for-tat escalation (I_3)	−1.84	(1.44)						

(continued)

TABLE 3 Continued

Explanatory Variable	*(1)*		*(2)*		*(3)*		*(4)*	
	Coefficient	*Standard Error*	*Coefficient*	*Standard Error*	*Coefficient*	*Standard Error*	*Coefficient*	*Standard Error*
Percentage of predictions correct	85		86		87		87	
Log-likelihood function	−14.98		−15.97		−12.25		−12.28	
Degrees of freedom	10		8		8		7	
Number of cases	56		56		55		55	

NOTE: For variable definitions of conventional balance, bargaining behavior, and past behavior, see note to Table 1. Variable D_1 is coded as 1 for those cases in which the defender possessed a nuclear retaliatory capability and 0 otherwise; variables I_1 and I_2 assume the values of the immediate and short-term conventional balance when the defender is a nuclear power and 0 otherwise; and I_3 is coded as 1 when the defender is a nuclear power and adopts a tit-for-tat policy and 0 otherwise.

a. Significant at the 95% confidence level, one-tailed test.

b. Significant at the 97.5% confidence level, one-tailed test.

c. Significant at the 99% confidence level, one-tailed test.

d. Significant at the 99% confidence level, two-tailed test.

does contribute to extended deterrence despite the low probability of nuclear retaliation. The negative signs on all three of the estimated coefficients for the interactive variables also are consistent with Hypothesis 1. The negative signs indicated that the immediate and short-term balance of conventional forces and tit-for-tat conventional military escalation had less of a deterrent impact in the nuclear versus nonnuclear cases. For example, to determine the impact of the short-term balance of conventional forces in nuclear cases, the coefficient for I_2 (b = −1.25) was added to the short-term balance coefficient (b = 1.97), which was estimated in all 56 cases. The result is that the coefficient is much smaller (b = 0.72) for the nuclear cases than it was for the non-nuclear cases. The conclusion to be drawn is that the short-term balance of conventional forces had a weaker extended deterrent impact in cases where the defender was a nuclear power.

Similarly, if the coefficient for I_3 (b = −1.84) is added to the coefficient for tit-for-tat escalation (b = 2.03), we find that tit-for-tat conventional military escalation has a much weaker deterrent impact (b = 0.19) when the defender is nuclear-capable than in nonnuclear cases. The individual t-ratios for variables I_2 and I_3 (0.98 and 1.28), however, are not statistically significant at even the 90% confidence level, which suggests that any conclusions about the substantive impact of these variables should be treated with considerable caution.

As a further statistical check on variables I_2 and I_3 another equation was run with those two variables deleted while variables D_1 and I_1 were retained. The log-likelihood function value for this equation (column 2 of Table 3) was then compared to the same value for the first equation in Table 3. A comparison of the log-likelihood values revealed that the two equations were not significantly different (1.98, 2 d.f.) and thus variables I_2 and I_3 can be dropped from the equation. The probit results indicate, therefore, that there is no solid evidence that the extended deterrent value of nuclear weapons is contingent upon the prior threat of conventional armed conflict by the defender, as proposed by Hypothesis 2. If Hypothesis 2 had been supported by the probit results, then the coefficient for I_3 would have been positive, significant, and larger than the coefficient for variable D_1.

The probit results also did not lend firm support to the conclusion that tit-for-tat conventional escalation or the short-term balance of conventional forces had less of a deterrent impact in nuclear versus nonnuclear cases as Hypothesis 1 proposed. The negative values for the estimated coefficients of I_2 and I_3, as noted, were consistent with Hypothesis 1 but were not statistically significant.

The remaining interactive variable (I_1) in equations (1) and (2) of Table 3 is significant and has a negative value. The substantive interpretation of the

coefficient for this variable, however, is not straightforward. If the coefficient for I_1 in equation (2) (b = −3.48) is added to the coefficient for the immediate balance of forces (b = 1.78), the result is a negative coefficient (−1.70), which would mean that the probability of extended deterrence success decreases as the balance of immediate forces shifts to the advantage of the nuclear-capable defender. This finding would not be consistent with Hypothesis 1 that the immediate balance of forces should have a weaker, if not insignificant, deterrent impact in nuclear cases, and does not intuitively seem plausible. An examination of the predicted versus actual values for each of the 15 nuclear cases revealed that one case was badly mispredicted: the attempt by the United States in 1964-65 to deter North Vietnam from committing its regular armed forces to the support of the Viet Cong in South Vietnam (the observed value was 0, or failure, the predicted 0.71).[11] The Vietnam case was also a clear outlier on the variable for the immediate balance of forces among the nuclear cases (see Figure 1). Despite a greater than two-to-one advantage in the immediate balance of conventional forces, the United States failed to deter North Vietnam.

The probit analysis was rerun with the Vietnam case deleted to determine whether that particular case was having a significant impact on the estimated coefficient for the interactive variable I_1. The results presented in column 3 of Table 3 indicate that the Vietnam case indeed was making an important difference in the probit analysis. The coefficient for I_1 remained negative, but the value changed from −3.48 in column 2 to just −0.49, and the t-ratio was only 0.22. At the same time, the significance level of the dummy variable for possession of a nuclear retaliatory capability dropped just below the 90% confidence interval.

If variable I_1 is deleted from the equation and the probit analysis is re-run (column 4 of Table 3), the coefficient of the one remaining variable, the possession of the capability to deliver a nuclear strike, is positive and significant. Furthermore, when the log-likelihood function value for column 4 was compared with the same value for the identical equation in column 4 but with variable D_1 deleted, the difference in the log-likelihood functions for the two equations was significant at the 97.5% level (5.76, 1 d.f.). The overall conclusion is that possession of a nuclear retaliatory capability did enhance the prospects of extended deterrence success although this effect was not so strong as to render the conventional balance of forces unimportant

11. North Vietnamese regular armed forces had been infiltrating South Vietnam since late 1964, although they had been held back from combat with South Vietnamese and U.S. forces (see Thies, 1980: 273-274, 328, fn. 54). The United States was attempting to deter the commitment to the armed struggle of North Vietnamese troops already within South Vietnam, not a conventional large-scale invasion from the North.

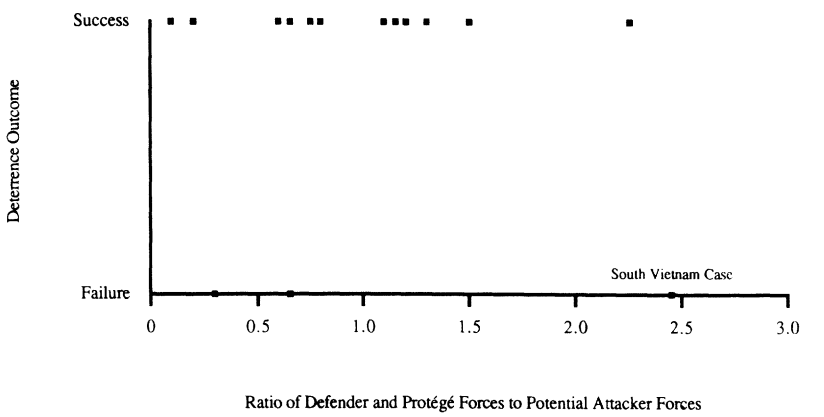

Figure 1: The Immediate Balance of Forces and Deterrence Outcomes, Nuclear Cases Only

as an explanatory variable. Indeed, in column 4 of Table 3, the size of the coefficient for possession of a nuclear retaliatory capability is a bit smaller than the coefficients for the immediate and short-term balance of conventional forces.

In Table 4, the marginal contribution of the conventional balance of forces and possession of a nuclear retaliatory capability to extended deterrence success is presented. The results underscore the general point just made: A nuclear retaliatory capability increases the likelihood of extended deterrence success, but the conventional balance of forces remains quite important. For example, while holding all other variables in column 4 of Table 3 constant, the addition of a nuclear retaliatory capability for the defender increased the chances of extended deterrence success by 9%. Changes in the immediate balance of forces, while holding other variables constant, had a stronger impact. Extended deterrence success was 42% more likely as the balance of immediate forces shifted from a one-to-four disadvantage for the defender to an equal balance. When the short-term balance changed from an equal balance to a two-to-one advantage for the defender, the probability of deterrence success increased by 21%.

Table 4 provides useful information on the average effects of a nuclear retaliatory capability and changes in the balance of conventional forces on extended deterrence success, but further refinements in interpretation are necessary. In Table 5, the extended deterrent impact of nuclear weapons under varying configurations of the conventional balance of forces is pre-

TABLE 4
The Impact of the Balance of Conventional Forces and Possession of Nuclear Retaliatory Capability on Deterrence

Variable	*Value*		*Change in Probability of Deterrence Success (%)*
Immediate balance of forces (defender and protégé forces relative to attacker)	0.25		
		>------	+42
	1.00		
		>------	+8
	2.00		
Short-term balance of forces (defender and protégé forces relative to attacker)	0.25		
		>------	+40
	1.00		
		>------	+21
	2.00		
Possession of nuclear retaliatory capability	No		
		>------	+9
	Yes		

NOTE: The marginal impact of each variable is calculated by changing its value while holding all other variables in the model (Table 3, column 4) at their mean value. The change in the location on the cumulative standard normal distribution then is converted into the percentage change in the probability of successful deterrence.

sented. Nuclear weapons had a very strong deterrent impact when the conventional balance clearly favored the potential attacker (a two-to-one advantage in both the immediate and short-term balance) or when there was an equal balance — 44% and 52% increases, respectively, in the likelihood of extended deterrence success. When a defender, however, had a clear advantage in conventional forces (a two-to-one advantage in both the immediate and short-term balance), then nuclear weapons had no discernible extended deterrent impact. In sum, there is an inverse relationship between the extended deterrent value of nuclear weapons and the extent to which the balance of conventional forces favors the defender.

The results presented in Table 5 suggest that the extended deterrent impact of nuclear weapons has, in fact, varied a good deal across the cases listed in Table 2. In several cases, the possession of a nuclear retaliatory capability seems to have compensated for the defender's lack of conventional forces that were capable of denying the attacker its territorial or military objectives

TABLE 5
The Deterrent Impact of Nuclear Weapons under Different Configurations of the Conventional Balance of Forces

Ratio of Immediate and Short-Term Balance of Conventional Forces (Defender/Protégé Forces: Attacker Forces)	*Possession of Retaliatory Capability*	*Change in Probability of Deterrence Success (%)*
0.50 for both	No	
	>------	+44
0.50 for both	Yes	
1.00 for both	No	
	>------	+52
1.00 for both	Yes	
2.00 for both	No	
	>------	0
2.00 for both	Yes	

NOTE: To calculate the deterrent impact of possession of a nuclear retaliatory capability for each configuration of the immediate and short-term balance of conventional forces, all other variables in the model (Table 3, column 4) were set at their mean value. The change in the location on the cumulative standard normal distribution then was converted into a percentage change in the probability of successful deterrence.

or both. Examples would include cases involving the United States as defender against the Soviet Union or China in the early postwar period when it found itself in a weak position regarding the balance of local or short-term conventional forces (Iran 1946, Turkey 1946, Berlin 1948-49, Taiwan 1950, Quemoy-Matsu 1955).

For example, in 1946 the Soviet Union enjoyed a clear advantage in local ground forces within Iran and could have easily increased that advantage by additional reinforcements. Indeed, during March approximately 15 armored brigades and several hundred tanks moved into Northern Iran from the Soviet Union and then deployed along the main road to Teheran.[12] The United States issued verbal deterrent warnings (Kuniholm, 1980: 325; and U.S. Department of State, 1962: 186-189) but it lacked the conventional forces to counter the Soviet military presence within and around Iran. Similarly, in the Berlin

12. See Great Britain Foreign Office (1946), series 371 E2114/5/34; E2262/5/34; E2356/5/34; E2390/5/34; E2400/5/34; E2464/5/34; E2487/5/34; E2545/5/34; E2550/5/34; E2912/5/34.

blockade crisis of 1948-49, Soviet local conventional military superiority was decisive over the that of the United States. Nevertheless, the United States pledged its commitment to uphold its rights in the western sector of Berlin (Carlyle, 1952: 586-588). In both cases the Soviet Union refrained from further military actions even though the United States could not have responded locally.

In several other cases, however, the defender did possess adequate conventional forces to rebuff the potential attacker and undertook timely military preparations to signal its intentions to do so. For these cases it is difficult to believe that the nuclear threat played a deterrent role (Syria 1957, Kuwait 1961, Belize 1975 and 1977, and Chad 1983). For example, British reinforcements of ground forces were quickly sent to Belize in both cases in response to verbal threats and military movements by Guatemala (*Keesing's*, 1976: 27574; 1977: 28618; and Foreign Broadcast Information Service: Latin America, 1975: 11/6,P3; 11/7,P8; 11/11,P2 and 1977:6/28,P1; 7/6,P5; 7/8,P1,P8; 7/13,P3; 7/15,P3). In the Chadian civil war of 1983, the threatened advance of Libyan forces on the capital was countered by the rapid introduction of French forces into Chad and the formation of a forward defense line to protect the capital (Huth, 1988b: 97-104).

Politically, the explicit threat of nuclear weapons would have ignited strong domestic protest and denunciation in Britain and France, and internationally as well. Even more important, the threat to resort to a higher level of military escalation was not necessary because Britain and France had the local conventional military capabilities to successfully turn back the attacker. More generally, the threat of nuclear use is not the first option of military response for a defender, but a second option if conventional defense begins to fail or is expected to be very costly. In at least five cases, the first option of conventional defense for the defender was quite credible, and therefore it is doubtful that the potential attacker considered the nuclear threat a salient factor in its final decision, given that the costs of conventional armed conflict were likely to be high.

CONCLUSION

The general conclusion to be drawn from the probit analysis is that possession of a nuclear retaliatory capability has contributed to extended deterrence success and that deterrent effect was not contingent on the prior credible threat of the defender becoming involved in conventional armed conflict. In addition, a closer examination of the individual cases where the

defender was a nuclear power also suggested that the extended deterrent role of nuclear weapons was greatest in cases where the conventional balance of forces varied between a clear disadvantage to approximate parity for the defender.

The cases that provide the strongest evidence in support of the extended deterrent impact of nuclear weapons, because alternative variables that contribute to deterrence success were either weak or absent in those cases, are generally clustered in the early years of the postwar period when the United States enjoyed decisive superiority, if not a monopoly, in nuclear capabilities. As a result, the type of extended deterrence case of greatest interest to many analysts (i.e., a future confrontation between the United States and the Soviet Union in a regional conflict) will take place in a much different strategic environment than that which characterized the cases tested in this study.

Strategic nuclear superiority contributed to extended deterrence success, but such superiority no longer seems possible because each superpower can maintain its assured destruction capability despite its adversary's buildup of strategic offensive forces, defensive forces, or both. A good deal of caution should be exercised in applying these new results regarding the extended deterrent value of nuclear weapons to a future superpower crisis, because in a situation of MAD it is not clear whether the threat of nuclear retaliation by a defender is sufficiently credible to bolster extended deterrent commitments. A tentative conclusion of this study is that even though a defender's nuclear threat in MAD is not very credible, it may still exert an extended deterrent impact because adversaries seem to overweight instead of completely discount low probability but quite costly military threats.[13]

If it is assumed that the nuclear threat retains an extended deterrent impact in MAD, the results of this study do not lead to the conclusion that explicit nuclear threats (verbal threats and/or movement and alerting of nuclear capable forces) by a defender would further enhance the extended deterrent role of nuclear weapons for two reasons. First, this study has not examined the effect of nuclear alerts on extended deterrence but has instead focused on the implicit threat of nuclear retaliation based on the defender's possession of such a capability. Second, the intended deterrent signal to be conveyed by the extensive nuclear alert measures of a defender might not be understood or recognized as such by the other side. Schelling's formulation (1960: 207-229) of the problem of crisis instability due to the fear of surprise attack may be of particular relevance in the current strategic environment in which

13. Powell (1989b), utilizing game theory, also reaches the conclusion that some nuclear threats, despite their low probability of being carried out, can have a powerful deterrent impact.

both superpowers have extensive counterforce capabilities (but see Powell, 1989a), each side's command-and-control systems are vulnerable (Blair, 1985; Bracken, 1983), and both possess operational plans that may reflect the belief that significant damage limitation is possible (Glaser, in press).

The superpowers also do not have the experience of successfully managing a crisis in which both sides have engaged in nuclear alerts. The Soviets have refrained in the past from responding to U.S. nuclear alerts, but continuation of that pattern should not be counted on and some analysts believe that there might be serious problems in one side agreeing to, or both sides coordinating, deescalation from a position of high levels of nuclear alert (Bracken, 1983; Lebow, 1987).[14] Unless the other superpower has initiated nuclear alert measures, it would be in the best interests of both sides to limit their attempts at signaling intentions in a crisis to diplomatic actions and conventional military measures in order to avoid the potential dangers of reciprocated nuclear alerts.

REFERENCES

Arkin, W., and R. Fieldhouse. 1985. *Nuclear battlefields*. Cambridge: Ballinger.

Betts, R. 1987. *Nuclear blackmail and nuclear balance*. Washington, DC: Brookings Institution.

Blair, B. 1985. *Strategic command and control*. Washington, DC: Brookings Institution.

Blechman, B., and D. Hart. 1982. The political utility of nuclear weapons: The 1973 Middle East crisis. *International Security* 7:273-297.

Blechman, B., and S. Kaplan. 1978. *Force without war*. Washington, DC: Brookings Institution.

Bracken, P. 1983. *The command and control of nuclear forces*. New Haven, CT: Yale University Press.

Brams, S. 1985. *Superpower games*. New Haven, CT: Yale University Press.

Bundy, M. 1969. To cap the volcano. *Foreign Affairs* 48:1-20.

Bundy, M. 1984. The unimpressive record of atomic diplomacy. In *The nuclear crisis reader*, edited by G. Prins, 42-54. New York: Random House.

Bundy, M. 1989. *Danger and survival*. New York: Random House.

Carlyle, M., ed. 1952. *Documents on international affairs: 1947-1948*. London: Oxford University Press.

Charles, D. 1987. *Nuclear planning in NATO*. Cambridge: Ballinger.

Foreign Broadcast Information Service. November 1975 and June-July 1977. *Daily report Latin America*. Washington, DC: U.S. Government Printing Office.

Gaddis, J. L. 1986. The long peace: Elements of stability in the postwar international system. *International Security* 10:99-142.

Glaser, C. In press. *Analyzing strategic nuclear weapons policy*. Princeton, NJ: Princeton University Press.

Great Britain Foreign Office. 1946. Documents on Iran, series 371.

14. See Sagan (1985) for an analysis of some of the command-and-control problems encountered by the United States during past nuclear alerts.

Halperin, M. 1987. *Nuclear fallacy*. New York: Harper & Row.

Hanushek, E. A., and J. E. Jackson. 1977. *Statistical methods for social scientists*. New York: Academic Press.

Huth, P. 1988a. Extended deterrence and the outbreak of war. *American Political Science Review* 82:423-443.

Huth, P. 1988b. *Extended deterrence and the prevention of war*. New Haven, CT: Yale University Press.

Huth, P., and B. Russett. 1984. What makes deterrence work? Cases from 1900 to 1980. *World Politics* 36:496-526.

Huth, P., and B. Russett. 1988. Deterrence failure and crisis escalation. *International Studies Quarterly* 32:29-45.

Huth, P., and B. Russett. 1990. Testing deterrence theory: Rigor makes a difference. *World Politics* 42.

Jervis, R. 1989. *The meaning of the nuclear revolution*. Ithaca, NY: Cornell University Press.

Kahneman, D., and A. Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:263-291.

Keesing's Contemporary Archives. 1976. London: Longman.

Keesing's Contemporary Archives. 1977. London: Longman.

Kugler, J. 1984. Terror without deterrence: Reassessing the role of nuclear weapons. *Journal of Conflict Resolution* 28:470-506.

Kuniholm, B. 1980. *The origins of the Cold War in the Near East*. Princeton, NJ: Princeton University Press.

Lebow, R. N. 1987. *Nuclear crisis management*. Ithaca, NY: Cornell University Press.

Lebow, R. N., and J. Gross Stein. 1990. Deterrence: The elusive dependent variable. *World Politics* 42.

Maddala, G. S. 1983. *Limited-dependent and qualitative variables in econometrics*. Cambridge: Cambridge University Press.

McKelvey, R. D., and W. Zavonia. 1975. A statistical model for the analysis of ordinal level dependent variables. *Journal of Mathematical Sociology* 4:103-120.

McNamara, R. 1983. The military role of nuclear weapons. *Foreign Affairs* 62:59-80.

Mueller, J. 1988. *Retreat from doomsday*. New York: Basic Books.

Organski, A. F. K., and J. Kugler. 1980. *The war ledger*. Chicago: University of Chicago Press.

Oye, K., ed. In press. *The deterrence debate*. Ann Arbor: University of Michigan Press.

Powell, R. 1987. Crisis bargaining, escalation, and MAD. *American Political Science Review* 81:717-735.

Powell, R. 1989a. Crisis stability in the nuclear age. *American Political Science Review* 83:61-76.

Powell, R. 1989b. Nuclear deterrence and the strategy of limited retaliation. *American Political Science Review* 83:503-520.

Quattrone, G., and A. Tversky. 1988. Contrasting rational and psychological analyses of political choice. *American Political Science Review* 82:719-736.

Russett, B. 1988. Extended deterrence with nuclear weapons: How necessary, how acceptable? *Review of Politics* (Spring): 282-302.

Russett, B. 1989. The real decline of nuclear hegemony. In *Global changes and theoretical challenges*, edited by E. O. Czempiel and J. N. Rosenau, 177-193. Lexington, MA: D.C. Heath.

Sagan, S. 1985. Nuclear alerts and crisis management. *International Security* 9:99-139.

Schelling, T. 1960. *The strategy of conflict*. Cambridge, MA: Harvard University Press.

Schelling, T. 1966. *Arms and influence*. New Haven, CT: Yale University Press.
Snyder, G. 1961. *Deterrence and defense*. Princeton, NJ: Princeton University Press.
Thies, W. 1980. *When governments collide*. Berkeley: University of California Press.
U.S. Department of State. 1962. *Public papers of the presidents of the United States – Harry Truman 1946*. Washington, DC: U.S. Government Printing Office.
Weede, E. 1983. Extended deterrence by superpower alliance. *Journal of Conflict Resolution* 27:231-254.
Zagare, F. 1987. *The dynamics of deterrence*. Chicago: University of Chicago Press.