A Unified Theory and Test
of Extended Immediate Deterrence

Curtis S. Signorino
Ahmer Tarar∗
University of Rochester

Work in progress
Comments welcome

March 29, 2004

Abstract

We present a unified theory and test of extended immediate deterrence — unified in the sense that we employ our theoretical deterrence model as our statistical model in the empirical analysis. The theoretical model is a straightforward formalization of the extended immediate deterrence logic in Huth (1988) and in Huth and Russett (1984, 1988), coupled with private information concerning utilities. Our statistical analysis suggests that the potential attacker’s and defender’s decisions are influenced by the immediate and short-term balance of forces, possession of nuclear weapons, military alliances, arms transfers, foreign trade, and regime types of those involved. Many of these findings contradict previous research by Huth (1988) and by Huth and Russett (1988). Our model correctly predicts over 96% of the potential attacker’s actions and over 93% of the crisis outcomes. We also illustrate our results with three case studies: the Russo-Japanese crises over Manchukuo (1937–1938), the Berlin Blockade (1948), and the Sino-US crisis over the Taiwanese islands of Quemoy and Matsu (1955).

∗Department of Political Science, University of Rochester, Rochester, NY 14627. Email: sign@troi.cc.rochester.edu, ahmt@troi.cc.rochester.edu. Earlier versions of this paper were presented at the 2000 annual meetings of the American Political Science Association, the Midwest Political Science Association, and the Peace Science Society (International). Helpful comments were also received during seminar presentations at Emory University, the University of Wisconsin–Madison, and Yale University, and by participants in the University of Rochester’s Watson Center seminar series. In particular, we would like to thank Stuart Bremer, Charles Franklin, Stephen Gent, Arman Grigorian, Paul Huth, Kris Ramsay, Branislav Slantchev, Alan Stam, and Robert Walker for their helpful comments; Kris Ramsay, Dustin Tingley, and Kuzey Yilmaz for their research assistance; and Paul Huth for providing his data. We gratefully acknowledge support from the National Science Foundation (Grants # SES-9817947 and SES-0213771) and from the Watson Center for Conflict and Cooperation.
1 Introduction

What factors affect deterrence success or failure? The deterrence literature is one of the most exhaustive in international relations, and the logic of deterrence has been extensively studied within both government and academia by scholars from a variety of disciplines. Scholars have investigated the impact of conventional and nuclear balance of forces, interests at stake, reputation from past crises, crisis bargaining strategies, military alliances, geographic contiguity, degree of uncertainty, international system structure, and domestic politics (Alexandroff and Rosencrance 1977; Betts 1985, 1987; Fearon 1994a; George and Smoke 1974; Hopf 1994; Huth 1988, 1990; Huth and Russett 1984, 1993; Huth, Gelpi, and Bennett 1993; Langlois 1991; Mearsheimer 1983; Mueller 1989; Paul 1995; Waltz 1981, 1990; Weber 1990).\(^1\) The logic of deterrence is continuously put under the microscope of rigorous empirical testing, and subsequently refined. It is no wonder, then, that even the informal rational deterrence literature tends to be transparent in its logic, with much attention paid to the sequencing of moves and to the incentives and expected behavior of other states (see, for example, George and Smoke 1974, 101-3).

Recent research by Signorino (1999) and Signorino and Yilmaz (2000), however, suggests that previous empirical tests of deterrence theories are highly problematic. The heart of the problem is that deterrence is generally considered to be a strategic interaction, but is empirically investigated using non-strategic statistical models such as logit and probit.\(^2\) Signorino (1999) demonstrates how failure to incorporate strategic interaction into statistical tests results in faulty inferences. Signorino and Yilmaz (2000) mathematically prove that using logit to analyze data generated by strategic interaction induces the equivalent of omitted variable bias. The upshot of this recent methodological research is that a statistical model needs to be structurally consistent with the theory it is testing. Strategic models imply a particular structural relationship between the regressors and the dependent variable. Typical logit and probit models imply a different structural relationship.

In this study, we present the first unified theory and test of extended immediate deterrence — unified in the sense that we employ our theoretical deterrence model as our statistical model in the empirical analysis. The theoretical model is a straightforward formalization of the extended immediate deterrence logic in Huth (1988) and Huth and Russett (1984, 1988), coupled with private information concerning utilities. We construct our deterrence model in such a way that it guarantees positive probabilities over all actions and outcomes and, therefore, can be used in statistical estimation. That is, our theoretical model is our statistical model.

\(^1\)For a collection of articles that illustrate the diverse array of approaches that have been used to study deterrence, see also Stern, Axelrod, Jervis, and Radner (eds.) 1989.
\(^2\)We use the term “strategic” in the usual game-theoretic sense where players must condition their behavior on the expected behavior of others.
We analyze this model using data from Huth (1988) and Huth and Russett (1988). Contrary to Huth (1988), our empirical analysis suggests that alliances, the long-term balance of forces, nuclear weapons, military arms transfers, and foreign trade all affect deterrence success. In contrast to Huth and Russett (1988), we find that the latter three variables, as well as the immediate balance of forces, influence the defender’s decision to defend its protege. We find that democratic defenders are more likely to fight to defend their proteges, a finding consistent with Fearon’s (1994b) argument that leaders who face high domestic audience costs are less likely to back down in public crises. In terms of model fit, our model correctly predicts over 96% of the potential attacker’s actions and over 93% of the crisis outcomes. That our model fares so well, both statistically and substantively, indicates that the likelihood of deterrence success and of war are not monotonically related to the variables involved in the deterrence calculus. This contradicts a fundamental structural assumption of previous studies using logit, probit, and binary selection models with monotonic link functions.

The paper proceeds as follows. In the next section we present our theoretical model. Following that, we specify the utilities of the model in terms of regressors. Using data from two previous studies of extended immediate deterrence, we then conduct the empirical analysis. We discuss the factors that influence deterrence success and the decision to go to war, and assess model fit. Employing the estimated model, the effects of immediate and short-term balance of forces, as well as nuclear capability, are then addressed in three case studies: the Russo-Japanese crises over Manchukuo (1937–1938), the Berlin Blockade (1948), and the Sino-US crisis over the Taiwanese islands of Quemoy and Matsu (1955). We conclude by summarizing the results and noting possible avenues for future research.

2 A Strategic Model of Extended Immediate Deterrence

A distinct advantage of the relatively transparent rational deterrence logic is that it allows for straightforward translation into a formal model. An excellent example is the literature on extended immediate deterrence (Huth 1988, 1990; Huth and Russett 1984, 1988). In extended immediate deterrence, a “defender” nation is trying to deter a potential aggressor from attacking one of its allies or “proteges.” Henceforth, we will refer to the defender nation simply as the “defender,” the potential aggressor as the “attacker,” and the defender’s ally or protege that is being threatened simply as the “protege.” The deterrence situation is considered “extended” in that the defender is trying to deter an attack on a third nation rather than on itself (the defender is extending its deterrence umbrella over another nation), and “immediate” in that the attacker has made threats and the defender counterthreats, so that the deterrence attempt takes place in a crisis atmosphere in which the use of force may be imminent (for the distinction between “immediate” and “general” deterrence, see Morgan 1983; Danilovic 2001). Of primary interest in this literature
Figure 1: An Extended Immediate Deterrence Model. Here, a (potential) attacker must decide whether to use force against the defender’s protege. If deterrence succeeds and the attacker does not attack (∼A), the status quo (SQ) results. If deterrence fails and the attacker attacks the protege, then the defender must decide whether to aid its protege. Defending against the attacker results in war (War). Not defending results in capitulation (Cap).

is the interaction between the attacker and the defender.

Figure 1 displays this interaction in the form of a simple extensive form game. Here, the (potential) attacker can either attack (A) or not attack (∼A) the protege. If the attacker chooses not to attack, the deterrence success results in a status quo (SQ) outcome. If, on the other hand, the attacker chooses to attack, deterrence has clearly failed, and the defender must decide whether to come to the aid of its protege. If the defender chooses to defend (D) against the attacker, war (War) results. If the defender does not defend (∼D) its protege, then we regard the defender as having capitulated (Cap).

It is certainly true that more complicated formal deterrence models have been developed than that depicted in Figure 1 (see, for instance, Fearon 1994; Kilgour and Zagare 1991; Kugler and Zagare 1987; Powell 1990; Werner 2000; Zagare and Kilgour 1993, 2000). However, we employ this model for a number of reasons. First, we believe that it most closely represents the logic of the extended immediate deterrence literature (Huth 1988, 1990; Huth and Russett 1984, 1988, 1993; Wu 1990). Second, not only has this literature undertaken rigorous empirical testing, but data exists for testing the model in Figure 1. This is not a trivial issue, given that most data collection in international relations (and political science more generally) has been undertaken without regard to the structure of formal models. Third, given that this study represents the first instance of a unified theory and test of deterrence, we prefer to begin with a simple model rather than a more
Figure 2: The Deterrence Model with Uncertainty Concerning Utilities. The utilities shown in the figure represent each player’s true utilities, broken into their observable $U_i(\cdot)$ and unobservable $\pi_{ij}$ components. For example, let the defender’s true utility for war be written as $U_d^*(\text{War}) = U_d(\text{War}) + \pi_{d4}$. The attacker observes $U_d(\text{War})$, but knows only the distribution of the unobserved $\pi_{d4}$. We assume that the analyst also does not observe the $\pi_{ij}$.

complex one. Achen and Snidal (1989, 151) verbally describe this model, calling it “the simplest version of rational deterrence theory.” Zagare and Kilgour (2000, Ch 3) formally analyze complete and incomplete information versions of this model. Therefore, this seems to be a good place to start. Finally, although selection effects are always an issue in samples generated by individuals making choices, Signorino (2001) suggests that correctly modeling strategic calculations is generally more important than modeling correlated errors (as in typical selection models). In other words, failure to model the correlation between decisions in this model and the choices made prior to it is usually far less deleterious than failure to model the strategic deterrence calculations within Figure 1. As we will demonstrate later, this simple model actually appears to go a long way in explaining extended immediate deterrence outcomes. However, before proceeding to the empirical analysis, we must further specify the model.

2.1 Uncertainty Concerning Utilities

It is unlikely that the participants of a deterrence crisis (or almost any situation, for that matter) perfectly observe each other’s utilities. It is also unlikely that the analyst, in conducting the empirical analysis, can perfectly specify the actors’ utilities. Fortunately, relaxing this assumption not only provides a model that is more satisfying theoretically, but also one that can be used as the basis of our statistical estimation.
Figure 2 displays the same strategic situation as in Figure 1, but assumes that the attacker and defender do not perfectly observe each other’s utilities. We also assume that the analyst does not perfectly observe the actors’ utilities. Instead, we assume that the true utility for an outcome can be represented as consisting of an observable component and an unobservable (or private) component. For example, let the defender’s utility for war be represented as

\[ U^*_d(War) = U_d(War) + \pi_{d4} \]

where \( U^*_d(War) \) is the defender’s true utility for war, \( U_d(War) \) is the component of the true utility that the attacker and the analyst observe, and \( \pi_{d4} \) is the component that is private information to the defender. From the attacker’s and analyst’s perspective, \( \pi_{d4} \) is a random variable. We assume that the attacker and the analyst know only the distribution of \( \pi_{d4} \).

If, as depicted in Figure 2, we make this assumption concerning each of the players’ utilities, we can derive equilibrium choice probabilities for each of the actions and outcomes in the game (see Signorino 2000 for details on deriving the choice probabilities of various strategic probit models). We assume that the payoff perturbations (i.e., the \( \pi_{ij} \)’s) are independently and identically distributed \( N(0, \sigma^2) \). Let \( p_d \) denote the probability that the defender defends its protege and \( p_a \) the probability that the attacker attacks the protege. Conversely, let \( p_d^\prime \) and \( p_a^\prime \) denote the probabilities that the defender does not defend and that the attacker does not attack, respectively. Assuming that the actors maximize their true (expected) utility at their decision nodes, the strategic probit choice probabilities for the deterrence model in Figure 2 are easily derived as

\[
p_d = \Phi\left[ \frac{U_d(War) - U_d(Cap)}{\sqrt{2\sigma^2}} \right]
\]

\[
p_a = \Phi\left[ \frac{p_d U_a(War) + p_d U_a(Cap) - U_a(SQ)}{\sigma^2 (p_d^2 + p_a^2 + 1)} \right]
\]

where \( \Phi(\cdot) \) is the standard Normal cumulative distribution function, and where \( p_a^\prime = 1 - p_a \) and \( p_d^\prime = 1 - p_d \).

Notice that the equilibrium choice probabilities reflect the extended immediate deterrence logic of the extensive form game and the uncertainty of the players concerning each other’s payoffs. The numerators of Equations 1 and 2 express the difference in observed expected utility for the options associated with each decision node. For example, the probability \( p_d \) (from the perspective of the attacker and analyst) that the defender aids its protege is a function of the difference in the defender’s observed utility for war and its observed utility for capitulation: the higher the defender’s observed utility for war relative to capitulation, the higher the probability (from the attacker’s and analyst’s perspective) that the defender will defend its protege.
Similarly, the numerator of Equation 2 is simply the difference between the attacker’s observed expected utility for attacking and its observed utility for not attacking. The attacker’s observed expected utility for attacking, $EU_a(A)$, is a lottery over the capitulation and war outcomes, based on the attacker’s belief $p_d$ about whether the defender will defend its protege: $EU_a(A) = p_d U_a(War) + p_d U_a(Cap)$. The higher the attacker’s observed expected utility for attacking relative to its observed utility for the status quo, the higher the probability (from the analyst’s perspective) that the attacker will attack.

The denominator of each probability equation is a variance term, reflecting the amount of uncertainty regarding the unobserved component of the true utilities. A large $\sigma^2$ relative to the observable components reflects greater uncertainty on the part of the actors and the analyst, resulting in strategic choice probabilities closer to a coin toss over the options at each decision node. When the players and the analyst have more accurate information about the true utilities — i.e., when $\sigma^2$ is small — the choice probabilities approach 0 and 1, and the deterrence model in Figure 2 approaches that of a game of perfect and complete information. Note that when $\sigma^2 = 0$, the game is exactly one of perfect and complete information, and our assumption that states maximize their utility at each decision node implies subgame perfection.

It should also be noted that Equations 1 and 2 do not represent mixed strategies. Rather, they are the beliefs of the attacker and the analyst, based on their assumptions of utility maximizing behavior, uncertainty concerning the $\pi_{ij}$, and the structure of the game. $p_d$ is the belief of both the attacker and the analyst about whether the defender will fight. $p_a$ represents the analyst’s belief about whether the attacker will attack, given the attacker’s (and analyst’s) belief about whether the defender will defend. Except in a few knife-edge situations, the underlying behavioral model assumes that the attacker and the defender play pure strategies from their perspective. The twist (relative to conventional game theory) is that the empirical analyst is assumed to know only the distribution of the $\pi_{ij}$. Therefore, the analyst can only make probabilistic statements about the equilibrium choices.

With that said, the equilibrium outcome probabilities follow directly from the action probabilities. Let $p_{sq}$, $p_{cap}$, and $p_{war}$ be the probabilities of the status quo, capitulation, and war outcomes, respectively. Because of the independence assumption, the probability of any given outcome is simply the product of the action probabilities along its path. Hence,

$$p_{sq} = p_d$$  \hspace{1cm} (3)

$$p_{cap} = p_a p_d$$  \hspace{1cm} (4)

$$p_{war} = p_a p_d$$  \hspace{1cm} (5)

3The defender chooses $D$ if and only if $U_d^*(War) > U_d^*(Cap)$. The attacker chooses $A$ if and only if $p_d U_a(War) + p_d U_a(Cap) > U_a^*(SQ)$. 

8
We now have a strategic deterrence model that is also a statistical (i.e., probabilistic) model. As long as there is some uncertainty concerning the true utilities (on the part of the states and the analyst), we are guaranteed positive probabilities over all actions and all outcomes in the model, and we can use this theoretical model directly in our statistical estimation. In doing so, the deterrence theory and its test are unified.

3 Empirical Analysis

The typical empirical analysis, not only in the deterrence literature but in much of the international relations literature, begins with a list of hypotheses drawn from extant theory. In these cases, the hypotheses to be tested almost invariably involve unconditionally monotonic relationships between the dependent variable and the regressors.\(^4\) In the current context, an example of such a hypothesis would be

\[ H: \text{The likelihood of war decreases as the balance of forces increasingly favors the defender.} \]

As Signorino and Yilmaz (2000) show, even the simplest strategic model often implies nonmonotonic — or at least only conditionally monotonic — relationships between the dependent variable and the regressors.\(^5\) That our strategic theories often imply nonmonotonic or only conditionally monotonic relationships suggests that typical hypothesis statements are problematic, especially when there is no clear link from the hypothesis to a well-specified model.\(^6\) Because of that and because we have a statistical model that is also our theoretical model, we take a slightly different approach here.

In conducting hypothesis tests, we are usually interested in assessing whether some explanatory variable has an effect on the phenomenon of interest. In the present context, we might hypothesize that the balance of military forces or the defender’s possession of nuclear weapons affect the attacker’s decision to attack. Alternatively, we might hypothesize that other variables, such as past crisis behavior or current bargaining behavior, contribute to deterrence success (Huth 1988). Finally, in addition to the effects of particular variables, we may want to assess how well a model explains deterrence outcomes where the model includes everything from the game structure to the included regressors. All of this can be accomplished using the statistical strategic deterrence model.

\(^4\)There are simply too many examples to cite. For examples in the deterrence literature, see Huth (1988); Huth, Gelpi, and Bennett (1993).

\(^5\)The relationship in the above hypothesis is monotonic because it implies that as we increase the value of the explanatory variable, the dependent variable always decreases, holding all other variables constant. The hypothesis is also unconditionally monotonic because it is assumed that the monotonicity and its direction hold for every possible set of values at which the other variables could be held constant. Conditional monotonicity implies monotonicity for every set of values at which the other variables are held, but allows the direction of that monotonic relationship to differ, depending on the values at which the other variables are held.

\(^6\)We are not suggesting that hypothesis testing as a method of inference is problematic, only the (typical) listing of unconditionally monotonic hypotheses with no clear (i.e., derivable) link to a strategic model.
Figure 3: Specification of the Attacker’s and Defender’s Utilities in Terms of Regressors. The figure displays the specification of the observable components of the utilities in terms of regressors. (To simplify the presentation, we have dropped the private $\pi_{ij}$ components.) The attacker’s utility for the status quo is a function $X_{11}\beta_{11}$ of explanatory variables, its utility for capitulation is estimated as a constant $\beta_{130}$, and its utility for war is a function $X_{14}\beta_{14}$ of explanatory variables. The defender’s utility for capitulation is normalized to zero and its utility for war is a function $X_{24}\beta_{24}$ of explanatory variables.

Deciding which variables enter into each of the utilities in the game and how to estimate the parameters associated with those variables are not trivial matters. Ideally, theory should be the guide, not only for the structure of the interaction, but also for the specification of the utilities. In a perfect world, we would have variables representing the “primitives” of state preferences. Indeed, the functional form of the utility equations should also be theoretically justified. With little else to go on, our approach is to specify the set of utilities for a player as simply as possible and with an eye towards differences in utilities, since it is the size of the utilities relative to each other that determine the equilibrium choice probabilities.

Figure 3 shows the general specification of the utilities employed in the subsequent data analysis. Here, the attacker’s observed utility for the status quo is a linear function $X_{11}\beta_{11}$ of explanatory variables, where $\beta_{11}$ is a vector of coefficients to be estimated, its observed utility for the defender’s capitulation is estimated as a constant $\beta_{130}$, and its observed utility for war is a linear function $X_{14}\beta_{14}$ of explanatory variables. In this manner, we are able to differentiate the attacker’s utility for war from his utility for capitulation, and his utility for attacking from his utility for not attacking.
(i.e., the status quo).\textsuperscript{7} The defender’s utility for capitulation is normalized to zero and we treat her utility for war as a function $X_2\beta_2$ of explanatory variables.\textsuperscript{8}

The estimation method we employ is detailed in Signorino (2000). The equilibrium outcome probabilities in Equations 3–5 are used as the basis of maximum likelihood estimation. Let $y_{sq,i} = 1$ if the crisis in observation $i$ results in a status quo outcome, and zero otherwise. Let $y_{cap,i} = 1$ if the crisis results in capitulation by the defender, and zero otherwise. Let $y_{war,i} = 1$ if the crisis results in war between the attacker and the defender, and zero otherwise. Then, the log-likelihood to be maximized (with respect to the $\beta$’s) is

$$\ln L = \sum_{i=1}^{N} \left[ y_{sq,i} \ln p_{sq,i} + y_{cap,i} \ln p_{cap,i} + y_{war,i} \ln p_{war,i} \right]$$  \hspace{1cm} (6)

One generally cannot estimate the effects parameters (i.e., the $\beta$’s) and the variance parameter $\sigma$ individually. As with most other discrete choice models, they are not all individually identified. As in standard (i.e., nonstrategic) probit estimation, we normalize $\sigma^2$ to one. Parameter estimates are therefore actually estimates of the $\beta$’s and $\sigma$ to scale.

### 3.1 Variables and Data

We are fortunate in that data is available both on the outcomes of our model and on many substantively interesting variables often hypothesized to affect extended immediate deterrence. The bulk of the data used here is from the previous studies of Huth (1988) and Huth and Russett (1988), which examine fifty-eight extended immediate deterrence crises from 1885 to 1983.

The dependent variable in this study codes which of the outcomes \{SQ, Cap, War\} occurred in each of the fifty-eight crises. In the context of our model, the dependent variable examined in Huth (1988) codes whether the attacker attacked or not, $A$ vs $\overline{A}$, respectively. Huth and Russett (1988) followed Huth (1988) with an analysis of the defender’s actions (defend or not defend) in those twenty-four cases in which the attacker attacked. In the context of our model, Huth and Russett (1988) provide data on whether the defender defended or not, $D$ versus $\overline{D}$, given that the attacker used force against the protege. The sequence of actions coded in these two studies match the actions in our deterrence model and, therefore, provide all the information we need to code the outcome for each observation.

Most of our explanatory variables are drawn from Huth (1988). Rather that repeat their operationalizations, we refer the reader to Huth (1988) for the complete details. In general, they can be grouped under the following headings:

\textsuperscript{7}If we included the same variable in all three utilities, the model would be unidentified.

\textsuperscript{8}The defender’s utility for the status quo does not affect the equilibrium choice probabilities $p_d$ and $p_a$, which is why we do not provide a specification for it.
Balance of Forces: Whether the defender possessed nuclear weapons ($\text{NUCLEAR}=1$ if the defender possessed nuclear weapons, 0 otherwise). The immediate balance of forces ($\text{IBF}$) as a ratio of the defender-protege’s forces to the attacker’s — i.e., $\text{IBF}>1$ implies a stronger defender-protege, and $\text{IBF}<1$ implies a stronger attacker. The short-term balance of forces ($\text{SBF}$). The long-term balance of forces ($\text{LBF}$).9

Defender’s Interests at Stake: Whether the defender and protege had a military alliance ($\text{MILALL}=1$ if yes, 0 otherwise). The percentage of the protege’s arms imports that come from the defender ($\text{MILARM}$), scaled from 1–10. The protege’s share of the defender’s total merchandise imports and exports ($\text{FORTRADE}$), scaled from 0–10.

Defender’s Reputation from its Last Extended Immediate Deterrence Crisis: Whether the defender successfully deterred an opponent in its last crisis ($\text{PASTDET}=1$ if yes, 0 otherwise). Whether the defender came to its protege’s aid in its last crisis, if the opponent was not deterred ($\text{ARMED}$). Whether the defender capitulated in its last crisis, if the opponent was not deterred ($\text{CAPITU}$). All three of these variables equal zero when the defender has never been in an extended immediate deterrence crisis before.

Defender’s Reputation from its Last Crisis, if any, with the Current Attacker: Whether the defender adopted a bullying strategy or forced the attacker to make critical concessions in order to avoid armed conflict, or both ($\text{PUTDOWN}$). Whether the defender and attacker avoided a military confrontation, but failed to resolve the underlying issues of the dispute ($\text{STALEMATE}$). Whether the defender retreated under diplomatic and/or military pressure from the attacker in order to avoid armed conflict ($\text{DIPLO}$). All three of these variables equal zero if the attacker and defender have never been in a crisis before.

Defender’s Bargaining Behavior in the Current Crisis: Whether the defender has adopted a “firm-but-flexible,” rather than bullying or conciliatory, strategy in diplomatic negotiations until now ($\text{FIRMFLEX}$). Whether the defender has responded proportionally to, rather than overmatched or undermatched, the military preparations of the attacker until now ($\text{TFT}$).

---

9IBF is measured as the ratio of the defender-protege ground troops to the potential attacker’s ground troops, including only those troops that are at forward positions and that can be deployed to the scene of the battle immediately. $\text{SBF}$ includes each side’s standing ground and air forces and first class of trained reserves; it measures each side’s ability to reinforce the troops that are deployed at or near the scene of the battle, as measured by IBF. Huth (1988, 61-2) defines $\text{LBF}$ as “the capacity of the defender and protege and the potential attacker to build up their existing armed forces (army, air, and naval manpower) and to maintain an increased level of fighting strength by mobilizing the economy and civilian population for war . . . Each state’s existing military capabilities (percentage share of world military personnel and military expenditures) were multiplied by the sum of that state’s industrial and demographic resources (percentage share of world steel production, industrial fuel consumption, urban, and total population). The ratio of defender’s and protege’s capabilities to potential attacker’s capabilities was then calculated.”
Others: Whether the attacker and defender are territorially contiguous (CONTIGAD). Whether the attacker and protege are contiguous (CONTIGAP). Whether the defender and protege are contiguous (CONTIGDP). Whether or not the defender was a democracy (DEMDEF). Whether or not the attacker was a democracy (DEMATT). We also include a variable (SYEAR) that controls for trends over time. It simply indexes the date of the crisis in the data set. SYEAR is coded as the calendar year of the crisis minus 1885, which is the earliest calendar year in the data.

3.2 Strategic Probit Analysis

Based on the strategic deterrence model and using the preceding regressors, a total of four strategic probit regressions were conducted, representing different theoretical perspectives — e.g., a “realist” balance of forces model, a model based on the defender’s interests at stake, a reputation and bargaining model, and a final model that combined all three.

Perhaps not surprisingly, the combined model far outperformed the other three, and we report in Table 1 the maximum likelihood estimates for only that model. The four columns in Table 1 are not four different models, but estimates of the four utility functions shown in Figure 3. For example, column 3 displays the estimates associated with the variables entering into the attacker’s utility for the status quo — i.e., they are the \( \hat{\beta}_{11} \) from \( U_a(SQ) = X_{11} \beta_{11} \). Similarly, column 4 shows the estimate for the attacker’s utility for the defender’s capitulation (\( \hat{\beta}_{130} \)), column 2 shows the estimates for the attacker’s utility for war (\( \hat{\beta}_{14} \)), and column 1 shows the estimates for the defender’s utility for war (\( \hat{\beta}_{24} \)). Standard errors are shown below the estimates. Estimates with one asterisk are statistically significant at \( p < .08 \) (two-tailed) and estimates with two asterisks are significant at \( p < .02 \). Finally, the mean log-likelihood, the percentage of outcomes (war, status quo, or capitulation) correctly predicted (actually, postdicted), and the percentage of the attacker’s actions (attack or not attack) correctly predicted are displayed at the bottom to provide a sense of how well the model fares.

To briefly summarize the results, contrary to Huth (1988), the results suggest that nuclear weapons, the long-term balance of forces, alliances, military arms transfers, and foreign trade all

---

10 We use strict land contiguity. Thus, for instance, we don’t consider Turkey and Cyprus to be contiguous.
11 To determine this, we use the POLITY III data set, which contains information on the regime characteristics for all of the states in the international system for the time period 1800-1994 (Jaggers and Gurr 1996). We use the commonly used method (see, for instance, Rousseau, Gelpi, Reiter, and Huth 1996; Schultz 1999) of subtracting the eleven-point autocracy score from the eleven-point democracy score, to create a measure ranging from -10 (entirely autocratic) to 10 (entirely democratic). If the difference is at least 5, the state is coded as a democracy (the results are identical if we use a threshold of 6 or 7 instead).
12 Using the raw calendar year causes numerical problems in the estimation, because the magnitude of the calendar year is much larger than that of the other explanatory variables.
13 The results of the other three models are available upon request from the authors.
<table>
<thead>
<tr>
<th></th>
<th>( U_d(\text{War}) )</th>
<th>( U_d(\text{War}) )</th>
<th>( U_d(\text{SQ}) )</th>
<th>( U_d(\text{Cap}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>(-10.98^*)</td>
<td>(-5.04^*)</td>
<td>13.46</td>
<td>12.74</td>
</tr>
<tr>
<td>Nuclear</td>
<td>(6.65^{**})</td>
<td>(-9.18^*)</td>
<td>2.39</td>
<td>5.24</td>
</tr>
<tr>
<td>Immediate Balance</td>
<td>(5.49^*)</td>
<td>(-12.57^{**})</td>
<td>3.28</td>
<td>5.29</td>
</tr>
<tr>
<td>Short-term Balance</td>
<td>(4.17^*)</td>
<td>(-6.23^*)</td>
<td>2.38</td>
<td>3.28</td>
</tr>
<tr>
<td>Long-term Balance</td>
<td>(3.37^*)</td>
<td></td>
<td>1.57</td>
<td></td>
</tr>
<tr>
<td>Military Alliance</td>
<td>(13.46^*)</td>
<td>(12.68^{**})</td>
<td>7.68</td>
<td>5.26</td>
</tr>
<tr>
<td>Armes Transfers</td>
<td>(-1.76^*)</td>
<td>(-.86^*)</td>
<td>.87</td>
<td>.49</td>
</tr>
<tr>
<td>Foreign Trade</td>
<td>(4.86^*)</td>
<td></td>
<td>2.58</td>
<td></td>
</tr>
<tr>
<td>Tit-for-Tat</td>
<td>(17.33^{**})</td>
<td></td>
<td>7.26</td>
<td></td>
</tr>
<tr>
<td>FirmFlex</td>
<td>(6.61^*)</td>
<td></td>
<td>3.27</td>
<td></td>
</tr>
<tr>
<td>Stalemate</td>
<td>(8.43^*)</td>
<td></td>
<td>4.24</td>
<td></td>
</tr>
<tr>
<td>Democratic Defender</td>
<td>(5.94^*)</td>
<td></td>
<td>2.89</td>
<td></td>
</tr>
<tr>
<td>Democratic Attacker</td>
<td>(15.82^*)</td>
<td></td>
<td>8.64</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>(-.35^*)</td>
<td></td>
<td>(.18)</td>
<td></td>
</tr>
<tr>
<td>Mean lnL</td>
<td>(-.214)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCP Outcomes</td>
<td>93.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCP Deter</td>
<td>96.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standard errors are shown below parameter estimates.

\(N=58\). **\(p < .02\). *\(p < .08\). (two-tailed)

Table 1: Strategic Probit Regression. *The table displays the results of the strategic probit regression based on the model in Figure 3. The four columns report the maximum likelihood estimates of the coefficients associated with the variables entering into the defender’s utility for war (\(\hat{\beta}_{24}\)), the attacker’s utility for war (\(\hat{\beta}_{14}\)), the attacker’s utility for the status quo (\(\hat{\beta}_{11}\)), and the attacker’s utility for the defender’s capitulation (\(\hat{\beta}_{130}\)), respectively.*
affect deterrence success. In contrast to Huth and Russett (1988), the results suggest that the latter three variables, as well as the immediate balance of forces, influence the defender’s decision to defend its protege. We find that democratic defenders are more likely to fight to defend their proteges, a finding that is consistent with Fearon’s (1994b) argument that leaders who face high domestic audience costs are less likely to back down in public crises. The model correctly predicts over 96% of the attacker’s actions and over 93% of the outcomes. We now discuss the results in more detail.

3.3 The Defender’s Utility for War

The first column of Table 1 shows that the defender’s utility for war increases, and hence it is more likely to fight to defend its protege, when (1) the defender possesses nuclear weapons, (2) the immediate and short-term balance of forces increasingly favor the defender-protege, (3) there is a military alliance between the defender and protege, (4) the defender is increasingly reliant on the protege for its foreign trade, and (5) there was a past crisis between the defender and attacker that ended without the use of force but without the underlying issues of the dispute being resolved. All of these results are quite intuitive. Of particular note is that in contrast to Huth and Russett (1988), we find that nuclear-armed defenders are more likely to defend their proteges than are non-nuclear defenders.

Interestingly, we also find that democratic states are more likely to go to war to defend their proteges than are non-democratic states. Two different explanations exist for this. A norms-based explanation is that democracies are simply more loyal to proteges than are authoritarian regimes. An alternative explanation is Fearon’s (1994b) audience-cost model of crisis bargaining. Democratic leaders who publicly escalate a crisis involving the defense of a protege will face larger audience costs (e.g., electoral costs) if they back down than would an authoritarian regime. The data analyzed here consists of cases of immediate deterrence, in which threats and counterthreats have already been made, and hence potential audience costs have been generated. If democratic leaders tend to face greater domestic audience costs than their authoritarian counterparts for backing down in public crises, then they should be more likely to fight to defend their proteges after potential audience costs have been raised, other things equal. Indeed, this is what we find.

Somewhat surprisingly, we find that the more heavily the protege relies on the defender for its arms imports, the less likely the defender is to go to war to protect the protege. This suggests that in many cases, a defender sends a lot of arms to its protege precisely when it does not expect to defend the protege if the protege is attacked. In a similar vein, Fearon (1994a, 260) notes a negative simple bivariate correlation between arms transfers and the defender’s decision to defend and suggests that the defender may use high arms transfers as a low-cost substitute for a more
serious commitment to defend the protege, precisely when it does not actually plan to defend. An implication of this is that neither a potential aggressor nor a protege should take high levels of defender-protege arms transfers as a credible indicator that the defender will fight to defend the protege.

### 3.4 The Attacker’s Utilities

Now consider the attacker’s utility for war. The second column of Table 1 shows that potential attackers value war less when the defender has a nuclear capability, when the immediate and short-term balance of forces favor the defender-protege, and the greater the arms transfers between the defender and protege. On that last note, although a defender may use arms transfers as a surrogate for defending the protege, all else being equal, the attacker would prefer the protege be less well armed. All of these results are fairly intuitive.

Not so intuitive, however, is the finding that a higher defender-protege advantage in the long-term balance of forces actually *increases* the attacker’s utility for war. Recall that the long-term balance of forces \((LBF)\) consists of the standing armed forces as well as demographic and industrial factors. It reflects each side’s ability to mobilize for and sustain a protracted armed conflict — or, alternatively, resources that may be converted to military ends at some point in the future. Higher values of \(LBF\) indicate therefore that the defender-protege may be a more formidable foe in the future, and that it may be better to fight the defender-protege now rather than wait until they have converted their untapped military potential into actual military might.\(^{14}\) For instance, in the years leading up to World War I, many German officials were concerned that Russia’s potential was such that she would soon be much more powerful, and if war was inevitable anyway, it was better to fight her now rather than later (Taylor 1954, 511, 515, 522, 527-28; Rich 1992, 435-6).

Somewhat surprisingly, a defender-protege alliance actually increases the attacker’s utility for war. We suspect this is due to the decisions by potential attackers prior to the immediate deterrence game. Recall that a defender-protege alliance makes it more likely that the defender will fight to defend the protege. If a forward-looking potential attacker can anticipate this, it will only initiate a crisis when there is a defender-protege alliance if it is in fact quite ready to go to war with the defender. That is, in the sample of immediate deterrence crises in which there is a defender-protege alliance, the attacker must be quite willing to go to war with the defender, because the defender is very likely to defend the protege. Hence, in this sample of immediate deterrence crises, a defender-protege military alliance appears to be highly correlated with the attacker’s eagerness to go to war with the defender.

Consider now the attacker’s utility for the status quo (the third column of Table 1). The

---

\(^{14}\)Our thanks to Robert Walker for suggesting this interpretation.
variables included here reflect the extent to which the potential attacker values the status quo relative to attacking the protege and possibly entering into a war with the defender. The variables do not differentiate between capitulation and war — only between attacking and not attacking.

Table 1 shows that tit-for-tat responses by the defender in the current crisis increases the attacker’s utility for the status quo, as does firm-but-flexible diplomatic bargaining by the defender. These results are consistent with Huth (1988), who argues that tit-for-tat escalation indicates that the defender is resolved to defend its protege, but does not provoke the attacker by putting its reputation and credibility on the line, as a more aggressive/bullying bargaining strategy by the defender might. In other words, tit-for-tat allows the attacker to back down without losing face.

The results also indicate that democratic states (as potential attackers) prefer the status quo more than authoritarian states in the same situation. This finding would seem to contradict the audience-cost hypothesis that democratic states are less likely to back down in public crises. An alternative hypothesis is that democratic audiences differentiate between their state attacking versus defending. Once a democracy or its protege is attacked, audience costs are likely to be very large. However, democratic citizens generally do not like being perceived as aggressors. In some sense that could create audience costs in the opposite direction — against attacking — resulting in an observed preference by democracies for the status quo.

Finally, note that the effect of the “year” variable, which represents otherwise unexplained trends over time, is negative — i.e., as time progresses in our data, the potential attacker is more likely to attack. It could be the case that potential attackers have increasingly entered into crises with the intention of attacking. However, without further historical investigation and a more complicated dynamic model, it is difficult to explain why this would be the case.

### 3.5 The Probability of Deterrence Success and of War

As in other discrete choice models (such as multinomial or ordered probit), interpreting the relationship between the dependent and independent variables simply by examining the regression results is difficult. A better means for assessing those relationships is by determining how predicted probabilities of outcomes change as the values of the explanatory variables change. One advantage of our strategic probit analysis is that we can assess the impact of the explanatory variables not only on the probability of deterrence success (to which Huth 1988 is limited), but also to any of the other actions or outcomes of the model. In addition to examining the effects of the explanatory variables on the probability of deterrence success ($p_{sq}$), we will also analyze their impact on the probability of war between the attacker and the defender ($p_{war}$). For both of these, we use the equilibrium probabilities in Equations 1–5 and the estimates reported in Table 1.
Table 2: Minimal, Low, Moderate, and Mean Values of Explanatory Variables. The minimal, low, and moderate columns show three sets of values (in ascending order) at which the explanatory variables are held constant, in order to examine the impact of the individual explanatory variables on the probability of deterrence success and of war. The mean column reports the mean values of the continuous explanatory variables, and the median values of the binary ones.

![Table 2](image)

*The median is shown for the binary variables and for Year.*

It is typical in analyses of fitted values or first differences to hold “all other variables” (i.e., other than the one being varied) constant at some values, usually their means. However, seven of the explanatory variables in Table 1 are binary, and their means are values we would never observe in the data. Moreover, although it is not commonly done, it might be substantively interesting to examine the impact of the explanatory variables in situations other than that represented by their means. Therefore, to provide a more nuanced picture of the explanatory variables’ effects on deterrence success and on war, we calculate predicted probabilities holding all other variables constant at what we call their “minimal,” “low,” and “moderate” values. These values are displayed in Table 2. In addition, Table 2 also displays the mean values of the continuous explanatory variables and the median values of the binary ones.

Of course, no crisis in the data perfectly matches the combination of values expressed by any of the three cases. They are simply references or ideal types for the analysis. We have chosen relatively low values for the variables because of the generally cumulative nature of deterrents. If a defending state possesses nuclear weapons and has a large advantage in both immediate and
short-term balance of forces, it is highly unlikely that another state will attack it. Not surprisingly, in our analysis when these (and other) variables are set to relatively large values, often a single variable will have no effect on relevant probabilities (e.g., of war or of deterrence success), since enough other deterrents already exist (by definition of the values at which they are set). We have therefore set the variables at relatively low values to better assess the effects of individual variables.

For example, the “Minimal” case is one where the defender does not possess nuclear weapons, where the attacker has twice as many forces (of all types) versus the defender and protege, where no military alliance exists between the defender and protege, where military arms transfers and foreign trade between the defender and protege are very low, where a firm-but-flexible diplomatic and a tit-for-tat military bargaining strategy were not used by the defender, where the last encounter between the attacker and defender did not end in a stalemate, and where neither the attacker nor the defender are democracies. The “Minimal” case is one where we would not usually expect the attacker to be deterred. For precisely that reason, it is interesting to ask, whether possession of nuclear weapons, stationing more forces along the front, or military alliances would be enough to deter potential attackers. Of course, these same questions could also be asked from the attacker’s perspective. Finally, the “Low” case is similar to the “Minimal” case, with the exception that the defender and protege forces are only three-fourths of the attackers. The “Moderate” case shifts the balance of forces slightly in favor of the attacker and protege, and increases their arms transfers and foreign trade.

Before proceeding, we should note that in the context of our deterrence model, relevant variables can affect the attacker’s behavior in two ways: directly through its utilities for the various outcomes and indirectly through its belief $p_d$ about whether the defender will defend. The attacker attacks if and only if its true expected utility for attacking is greater than its true utility for the status quo, i.e., if and only if $p_d U^*_a(War) + p_d U^*_a(Cap) > U^*_a(SQ)$. $p_d$ is a function of the explanatory variables in the defender’s utility for war, $X_{24}$ (Equation 1). Hence, those variables affect not only the defender’s decision to defend, but also the attacker’s decision to attack, albeit indirectly, through $p_d$. In other words, variables that are statistically significant in the defender’s utility for war but not in the attacker’s utilities, such as the regime type of the defender, still affect the attacker’s decision to attack or not, because they affect his estimation of whether or not the defender will defend (they thus affect the attacker’s expected utility for attacking). Variables that are statistically significant in both the attacker’s and the defender’s utilities, such as the immediate balance of forces, have a direct as well as an indirect effect on the attacker’s decision to attack or not.

We address the effect of each variable in turn, starting with Table 3 for the effects of the binary variables. Table 3 displays the probability of deterrence success (labeled “Deter”) and the
### Holding all other variables at

<table>
<thead>
<tr>
<th></th>
<th>Minimal</th>
<th></th>
<th>Low</th>
<th></th>
<th>Moderate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deter</td>
<td>War</td>
<td>Deter</td>
<td>War</td>
<td>Deter</td>
<td>War</td>
</tr>
<tr>
<td><strong>Baseline:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binary Variables = 0</td>
<td>0 .02</td>
<td>0 .96</td>
<td>.76</td>
<td>.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual Variable = 1</td>
<td>Nuclear</td>
<td>.99</td>
<td>.24</td>
<td>.76</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Military Alliance</td>
<td>0 .99</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Tit-for-Tat</td>
<td>0 .02</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>FirmFlex</td>
<td>0 .02</td>
<td>0</td>
<td>.96</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Stalemate</td>
<td>0 .99</td>
<td>0</td>
<td>1</td>
<td>.76</td>
<td>.24</td>
</tr>
<tr>
<td></td>
<td>Dem. Defender</td>
<td>0 .98</td>
<td>0</td>
<td>1</td>
<td>.76</td>
<td>.24</td>
</tr>
<tr>
<td></td>
<td>Dem. Attacker</td>
<td>0 .02</td>
<td>.99</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3: Effects of Binary Variables. The first row in the table shows the probabilities of deterrence success and of war, calculated for each of the “baseline” cases: where each of the variables are set at the “minimal,” “low,” and “moderate” values. Note that the binary variables are all set to zero in each of these baseline cases. The lower rows display the probabilities when the row variable is set to one, and all other variables held at the column values. The effect of a row variable is therefore simply the difference between the row probability and the baseline probability.

Before proceeding to the individual variables, we should examine what the baseline cases represent in terms of the model’s predicted probabilities. Take the “minimal” case, where the balance-

---

15Since deterrence success is equivalent to the status quo outcome, the probability that the defender capitulates can be determined at any time by adding the probabilities of deterrence success and of war, and subtracting that from one.
of-forces are decidedly in favor of the attacker. In this situation, the defender has no hope of winning a war, so will almost certainly capitulate. The attacker knows (or believes) this and will therefore attack. The model’s resulting probability of deterrence success is \( \Pr(\text{Deter}) \approx 0 \) and the probability of war is \( \Pr(\text{War}) = .02 \). This, of course, implies that the probability that the defender capitulates is \( \Pr(\text{Cap}) = .98 \). Given the lack of deterrents in this situation, an obvious question to ask in the subsequent analysis is whether any individual factor (e.g., nuclear weapons) would by itself be a sufficient deterrent. Similarly, we will examine whether any individual factor makes the defender more likely to defend the protege.

The interaction in the baseline “low” case is slightly different than in the “minimal” case. In this situation, the defender and protege are still at a disadvantage in terms of the balance of forces, but not nearly as much as in the “minimal” scenario. As Table 3 shows, the attacker is still not deterred (\( \Pr(\text{Deter}) \approx 0 \)). However, the increased balance of forces, along with the increased trade, make it much more likely that the defender will come to the aid of the protege, resulting in war (\( \Pr(\text{War}) = .96 \)). In the “moderate” situation, the balance has shifted in favor of the defender-protege, but not overwhelmingly. In this case, the attacker will be deterred with fairly high probability (\( \Pr(\text{Deter}) = .76 \)), the defender will defend its protege, and war will result with probability .26.

Taking these three cases together, one interesting conclusion is that increasing the balance of forces and trade has a nonmonotonic effect on the likelihood of war — in other words, arming the defender and protege does not always lead to deterrence success. When the defender and protege are severely disadvantaged, arming them may make them more likely to fight without simultaneously deterring the attacker, resulting in war. It is only after the defender and protege are sufficiently well armed that further arming them deters the attacker and decreases the threat of war. Having examined the “baseline” situations, we now examine the effects of each of the individual factors, beginning with nuclear weapons.

**Nuclear Weapons**

Scholars have come to very different conclusions concerning the effect of nuclear weapons on deterrence success — and on international stability more broadly. Some conclude that possessing nuclear weapons increases the likelihood of deterrence success (Alexandroff and Rosencrance 1977; Fearon 1994; Huth 1990; Huth, Gelpi, and Bennett 1993; Waltz 1990; Weber 1990). Others conclude that nuclear weapons have no effect at all (Mueller 1989; Paul 1995; Huth 1988). Finally, Waltz (1981) argues that either no proliferation or a relatively fast proliferation of nuclear weapons increases the chance of war.

The predicted probabilities of deterrence success and of war are presented in the lower section of Table 3 for the situation where the defender possesses nuclear weapons. The general effect of the
defender’s possession of nuclear weapons is to increase monotonically the probability of deterrence success. It does so for two reasons. As we saw in Table 1, possession of nuclear weapons gives the defender a higher utility for war and makes it more likely to fight. In contrast, it decreases the attacker’s utility for war. Because possession of nuclear weapons simultaneously increases the probability that the defender will fight and decreases the attacker’s utility for war, the attacker’s expected utility for attacking decreases, making it more likely that the attacker will be deterred. As Table 3 shows, this holds for all of the cases (minimal, low, and moderate), although the effect in the “minimal” case is extremely small.

The effect of a nuclear capability on the likelihood of war is slightly more complicated. Whereas the effect of nuclear weapons monotonically increases deterrence success, it has a nonmonotonic effect on the likelihood that war will occur, and for essentially the same reason as discussed before. In the “minimal” situation, where the defender does not possess nuclear weapons, the situation so favors the attacker that the defender will capitulate \( \Pr(Cap) = .98 \). The attacker knows (or believes) this, so the attacker is not deterred \( \Pr(Deter) = 0 \). The resulting probability of war is extremely small (.02). However, if in this same situation the defender possessed nuclear weapons, Table 3 indicates that the war would likely ensue. Why? In the “minimal” case, the situation greatly favors the attacker, especially in terms of the immediate and short-term balance of forces. Even if the defender possesses nuclear weapons, the attacker is still not deterred. However, a nuclear capability is enough to tip the defender (quite strongly) towards defending the protege. Since the attacker is not deterred, but the defender is now willing to defend, war ensues with \( \Pr(War) = .99 \).

Suppose now that the attacker and defender face the “low” situation, where the defender-protege’s balance of forces are three-fourths that of that attacker. In this case, Table 3 shows that possession of nuclear weapons decreases the probability of war. When the defender does not possess nuclear weapons, the balance of forces (and other factors) are close enough that the defender will likely defend its protege, but the attacker will still not be deterred. War results with \( \Pr(War) = .96 \). If the defender possesses nuclear weapons, the defender is even more likely to defend its protege. However, now the attacker’s utility for war has decreased, making deterrence success more likely and decreasing the probability of war to \( \Pr(War) = .76 \). The same dynamic is displayed in the “moderate” case, which slightly favors the defender-protege. The main difference in this situation is that the attacker is likely to be deterred even when the defender does not possess nuclear weapons. The effect of a nuclear defender is to decrease the probability of war from .24 to essentially zero.

This analysis suggests, then, that nuclear weapons will (1) generally incline the defender to assisting its protege, (2) generally increase the probability of deterrence success, but (3) depending on the situation, may actually increase the likelihood of war. Indeed, it must be remembered that the “effect” of nuclear weapons has been analyzed with respect to only three situations (minimal,
low, and moderate). It would not be difficult to construct other situations (i.e., values of the variables) where the presence of a nuclear defender had an even larger effect. Likewise, cases could be constructed where nuclear weapons had little or no effect. The effect of nuclear weapons — or of any of the deterrents — therefore greatly depends on the situation (i.e., the values of the other variables).

**Military Alliances**

Recall from Table 1 that a military alliance between the defender and protege increases the attacker’s as well as the defender’s utility for war. Although it is difficult to determine this just from Table 3, the effect of a military alliance overall is to decrease the probability of deterrence success. It does so because a military alliance simultaneously increases the attacker’s utility for war and makes it more likely that the defender will go to war if put in that position. This is exactly what Table 3 displays. The presence of a military alliance increases the probability of war by .97, .04, and .76, in the “minimal,” “low,” and “moderate” scenarios, respectively. Having said that, we should be careful about attributing causation to a protege-defender military alliance. In this case, it is more likely that the “effect” (especially on the attacker’s part) is a reflection of the sample of cases in the immediate deterrence situation. If we were to analyze a larger “game” — e.g., with decisions prior to the attacker’s — it may very well be that a defender-protege military alliance tends to deter potential attackers from entering into immediate deterrence crisis situations in the first place. Because we are only analyzing the immediate deterrence situation, however, we can only report the results for this “subgame.”

**Tit-for-Tat, Firm-but-Flexible**

Table 1 indicated that the defender’s use of a tit-for-tat military preparations strategy, as well as “firm-but-flexible” diplomatic bargaining, increase the attacker’s utility for the status quo. Any factor that increases the attacker’s utility for the status quo must, by definition, increase the probability of deterrence success and decrease the probability of war. Indeed, Table 3 reflects exactly that. Notice, however, that tit-for-tat appears to be the more important factor. Neither have much of an effect in the “minimal” situation. In the “low” case, tit-for-tat escalation has a huge effect, while a firm-but-flexible diplomatic strategy has no effect at all. Of the three scenarios, it is not until the “moderate” situation that we see firm-but-flexible have an effect. In other words, it appears that tit-for-tat military preparations can have a big effect on deterrence success even when the balance favors the attacker. Although still positively related to deterrence success, a firm-but-flexible strategy is effective only when other deterrents are also present. It then “tips the scale” in favor of maintaining the status quo.

**Stalemate, Democratic Defender**
In Table 1 we saw that if the defender and attacker had a previous crisis that ended without armed conflict but left underlying issues unresolved, then in the current crisis the defender is more likely to defend against the attacker. Additionally, if the defending nation is democratic, it is also more likely to defend its protege. As Table 3 shows, these variables have a very similar effect. Because the attacker foresees that a democratic state will be more likely to defend its protege, the attacker’s choice is then weighted towards one between the status quo and war. The effect of these variables (stalemate and democratic defender) on the attacker’s choice therefore depends on the extent to which the values of the other variables lead it to favor war versus the status quo.

In the first two scenarios in Table 3, the effect is towards increasing the probability of war. In the “minimal” case, the situation so favors the attacker that it is likely to attack regardless of whether a stalemate resulted in the last crisis or whether the defender is a democracy. An authoritarian nation in this position is unlikely to defend the protege, so war occurs with only probability .02. War is similarly unlikely when the last crisis did not result in a stalemate. However, when an attacker faces a democratic defender or when a stalemate resulted in the last crisis, the defender is much more likely to fight, resulting in war. Although to a much smaller extent, the same effect is evident in the “low” scenario. In the “moderate” situation, there are again enough other deterrents that outweigh the effects of these variables, and we see that there is essentially no change in the probabilities.

**Democratic Attacker**

Recall from Table 1 that democratic attackers have a higher utility for the status quo than do authoritarian attackers. As seen in Table 3, democratic attackers are less likely to attack the protege than are authoritarian attackers. The probability of war decreases in each case as well, although it is negligible in the “minimal” situation. On that note, Table 3 does not paint an entirely altruistic picture of democracies. Of the three situations, democracy has the greatest effect in the second, when the attacker has a slight advantage in balance of forces versus the defender and protege. The effect appears to be less in the “moderate” case partly because there are enough other deterrents to keep a potential attacker from using force.

If one were to examine these two cases alone, one might conclude that in situations where enough other deterrents do not exist to otherwise deter the attacker, that democracy somehow “fills the gap” and inclines the potential attacker towards the status quo. As Table 3 displays, this would be too generous an interpretation of democratic regimes. We see in the “minimal” scenario that when the attacker has a large advantage in balance of forces, democracy has essentially no effect — the democratic attacker will attack and the defender will capitulate. As we have noted before, however, it is unclear whether democracy has this effect directly in the immediate deterrence subgame, or whether this is an effect due to decisions made prior to the subgame and the resulting
sample selection.

**Immediate and Short-Term Balance of Forces**

We turn now to the continuous variables, the effects of which are displayed in Figures 4–7. The probability of deterrence success and of war are plotted in the figures as a function of each continuous variable, holding all the other variables constant at their “minimal” (dotted lines), “low” (dashed lines), and “moderate” solid lines) values.

We saw in Table 1 that increasing either the immediate balance of forces (\(IBF\)) or short-term balance of forces (\(SBF\)) simultaneously increases the defender’s utility for war, making it more likely to defend the protege, and decreases the attacker’s utility for war, making it less likely to attack. As Figures 4(a) and (c) show, this results in a monotonic effect on the probability of deterrence success: increasing the immediate or short-term balance of forces in favor of the defender-protege always increases the probability of deterrence success. This is obviously an intuitive result: the more soldiers the defender and protege have on the front line and in reserve, the less likely the attacker is to attack. Huth (1988) found the same result for the immediate balance of forces.

Examining Figure 4(a) and (c), two other results emerge. First, the point at which the immediate and short-term balance of forces have the greatest effect — i.e., result in the largest change in the probability — depends on the values at which the other variables are held constant. Consider the “minimal” situation, when most other factors favor the attacker. To deter the attacker, the defender and protege would need to increase the immediate balance of forces to almost twice that of the attacker, or increase the short-term balance of forces to over three times the attacker’s. When the situation is more favorable to the defender and protege, fewer soldiers on the front and in reserves are required. For example, in the “moderate” scenario, the defender-protege require only a little over parity in the immediate balance to deter the attacker, or only 1.5 times the attacker’s short-term forces. With an additional mitigating factor or two, even less of an advantage in the balance would be required.

The second result that jumps out of Figure 4(a) and (c) concerns the relative impact of the immediate and short-term balance. The graphs show that the immediate balance generally has a greater deterrent effect. This is most obvious for the “minimal” and “low” cases: fewer soldiers on the front are required to deter the attacker relative to soldiers in reserve.

Figures 4(b) and (d) display the effect of the immediate and short-term balance of forces on the probability of war between the attacker and the defender. The figures indicate that both variables have a nonmonotonic effect on the probability of war. The intuition is relatively straightforward. Consider the “minimal” situation (the dotted line) in Figure 4(b). When the immediate balance of forces greatly favors the attacker (e.g., when \(IBF < .8\)), the defender will likely capitulate if
Figure 4: Effect of Immediate and Short-term Balance of Forces. Figures (a) and (b) display the effect of the immediate balance of forces (IBF) on the probability of deterrence success and war, respectively, holding all other variables constant at their minimal (dotted line), low (dashed line), and moderate (solid line) values. Figures (c) and (d) show the effect of the short-term balance of forces (SBF).
the protege is attacked. The attacker knows this and therefore attacks. Capitulation results with near certainty, and the probability of war is near zero. Now consider this same situation, but when the immediate balance of forces favor the defender and protege (e.g., $1.25 < IBF < 1.75$). In this case, the defender believes it may be able to win a war against the attacker and is likely to defend the protege if the protege is attacked. The attacker again believes the defender will likely aid its protege. However, the defender and protege are not so strong that, in combination with the other factors, the attacker is deterred. Because the attacker is likely to attack and the defender is likely to defend, war results with fairly high probability. Finally, consider the case when the defender and protege have a generally overwhelming advantage in the balance of forces (e.g., when $IBF > 2$). In this case, not only will the defender almost certainly defend, but the attacker is at such a disadvantage that it is deterred from attacking, resulting in a negligible probability of war. The intuition for the short-term balance of forces (Figure 4(d)) is exactly the same as that just described.

Figures 4(b) and (d) also illustrate a few points already made in discussing deterrence success. First, the presence of other deterrents shifts the graphs to the left (e.g., in going from the “minimal” case to the “low” and then “moderate” cases). In other words, when other deterrents exist, the immediate and short-term balance does not need to favor the defender-protege quite as much (1) in order for the defender to aid its protege and (2) to deter the attacker. Second, comparing immediate versus short-term balance of forces, we see that the immediate balance has the greater effect.

**Long-Term Balance of Forces**

On the surface, the result in Table 1 for the long-term balance of forces is not as intuitive as those for the immediate and short-term balance. The estimated model suggests that an increasing defender-protege advantage in the long-term balance actually increases the attacker’s utility for war. Although we do not explicitly model it here, one explanation for this might be based on a forward-looking attacker concerned about an opponent’s future power.

The estimates in Table 1 and the graphs in Figures 4 and 5 indicate that the long-term balance does not have as great an effect as the immediate and short-term balance. In Figure 5(a), we see that the long-term balance has essentially no effect on deterrence success in the “minimal” and “low” scenarios. In both cases, deterrence is unsuccessful, and increasing the defender-protege long-term advantage only increases the attacker’s utility for attacking. In the “moderate” situation (solid line), other factors loom large enough to have deterrent effects. However, the long-term balance mitigates this: as the long-term balance increasingly favors the defender-protege, the attacker has more incentive to attack in order to prevent conversion of those resources to immediate and short-term capabilities, and an even worse situation in the future.

Figure 5(b) displays the effect of the long-term balance on the likelihood of war. In the “min-
(a) Effect of LBF on Deterrence Success

(b) Effect of LBF on War

Figure 5: Effect of Long-Term Balance of Forces. Figures (a) and (b) display the effect of the long-term balance of forces (LBF) on the probability of deterrence success and war, respectively, holding all other variables constant at their minimal (dotted line), low (dashed line), and moderate (solid line) values.

A limitation of our model is highlighted by this result. Consider a situation where the balance of forces or other deterrents favor the defender-protege even more. The defender will almost certainly defend, and for low values of the long-term balance, the attacker will be deterred. However, our current model suggests there must be some (even larger) value of the long-term balance for which the attacker will attack. The logical extension of this is obviously unreasonable. At some point — e.g., when the immediate, short-term, long-term, and other factors provide the defender-protege with an insurmountable advantage — we would expect an increased long-term balance to decrease the attacker’s utility for war. The result given here, therefore, should be interpreted as a first-order or average effect of the long-term balance. Model refinement is an obvious area for future research.

Military Arms Transfers, Foreign Trade

It has been argued elsewhere that military arms transfers and foreign trade are both ex ante indicators of the defender’s level of interest in defending its protege (Fearon 1994), and, because of that, that we should expect them to have the same general effect on the probability of deterrence success and of war. However, as Table 1 shows, this turns out not to be the case.
Recall from Table 1 that both the attacker’s as well as the defender’s utility for war decreases as the defender provides a greater share of the protege’s arms imports. Figure 6(a) shows that for “minimal” and “low” scenarios, military arms transfers have no real impact on the probability of deterrence success. In the “moderate” case, however, increased military arms transfers increases the likelihood that the attacker will be deterred.

Consider now the relationship of arms transfers and war. As Figure 6(b) displays, when the situation greatly favors the attacker, the defender will capitulate if attacked. The attacker knows this and therefore attacks, resulting in a probability of war near zero. In the “low” scenario, the attacker is not deterred, regardless of the level of arms transfers. However, for low levels, the defender is more likely to defend, and for high levels the defender is more likely to capitulate. Hence, the probability of war is very high for low levels of arms transfers, but decreases as the transfers increase. On the surface, the dynamic looks the same for the “moderate” situation in Figure 6, but it is actually very different. In this case, when the balance favors the defender-protege, the defender is likely to aid its protege regardless of the level of arms transfers. However, the attacker is less likely to attack as arms transfers increase. Thus, we see in Figure 6(b) that in the “moderate” situation the likelihood of war decreases as arms transfers increase.

When the other variables are held at their minimal values, other factors favor the attacker, who is thus never deterred. However, the probability of war declines as MILARM increases, because the defender is increasingly less likely to defend the protege. When the other variables are held at their moderate values, other factors favor the defender, and hence the attacker is always deterred, and so the probability of war is always 0.
Figure 7: Effect of Foreign Trade. Figures (a) and (b) display the effect of defender-protege trade on the probability of deterrence success and war, respectively, holding all other variables constant at their minimal (dotted line), low (dashed line), and moderate (solid line) values.

**Foreign Trade**

The foreign trade variable measures the protege’s share of the defender’s total merchandise exports and imports and, thus, how economically valuable the protege is to the defender. The estimates in Table 1 indicate that as the level of trade between the defender and protege rises, the more likely the defender is to defend the protege. Because the attacker expects that increased foreign trade makes the defender more likely to defend its protege, the attacker’s choice is then weighted towards one between the status quo and war. The effect of foreign trade on the attacker’s choice therefore depends on the extent to which the values of the other variables lead it to favor war versus the status quo.

As Figure 7(a) displays, foreign trade has no real effect on deterrence in the “minimal” and “low” cases. The situation favors the attacker enough that it will attack. When the overall situation favors the defender and protege, however, increased foreign trade is associated with a higher probability of deterrence success.

Figure 7(b) shows the effect of defender-protege trade on the probability of war. In the “minimal” and “low” scenarios, increased foreign trade makes the defender more likely to assist its protege. The attacker is not deterred in these situations, leading to a high probability of war. In the “moderate” situation, foreign trade has a nonmonotonic effect on the probability of war. When trade is low, the attacker will likely not be deterred. As trade increases, the probability of war increases, because the defender is increasingly likely to defend the protege and the attacker is at that point not yet deterred. However, once the trade is high enough, the likelihood of deterrence success increases and the probability of war therefore decreases. We should again note that, in
contrast to a deterrent based on power, foreign trade is not likely to actively deter a potential attacker. Rather, we believe it is more likely the case that the sample of observations is such that foreign trade is associated with this dynamic.

3.6 Model Fit

Although the relevance of model fit is a much-debated subject, we believe it provides information that, when not stretched beyond its intended use, can be helpful. Signorino (1999) also suggests that poor model fit may be a sign of a misspecified model, which would cast doubt on the parameter estimates.

In discrete choice models such as logit and probit, a commonly used measure of goodness of model fit is the percentage of the outcomes (i.e., realizations of the dependent variable) correctly predicted. Table 1 provides the percentage of the attacker’s actions (i.e., deterrence success versus failure) correctly predicted and the percentage of the model’s outcomes (status quo, capitulation, or war) correctly predicted. The typical null in this case would be the modal category. In our data, the attacker is deterred in 34 out of 58 cases (or 58.6%). When the attacker was not deterred 10 cases resulted in capitulation by the defender and 14 cases resulted in war. For both the deterrence data and outcomes data then, the modal category is the status quo.

As Table 1 displays, our immediate deterrence model correctly predicts over 93% of the outcomes and over 96% of the attacker’s actions. That level of model fit is impressive for the international relations literature, where it is not uncommon for discrete choice models to barely predict above the modal percentage. As a further comparison, Huth (1988) correctly predicts 84% of the attacker’s actions, and Huth and Russett (1988) correctly predict 83% of the defender’s actions.

The fact that our statistical model is also a theoretical deterrence model, the fact that it is populated by statistically significant and theoretically justified regressors, the fact that most of the regressors have effects that seem reasonable and that can be explained in the context of the model — all of this in combination with the extremely high predictive power provides substantial support for the model as an explanation of extended immediate deterrence. Having said that, the percentage of the outcomes correctly predicted (93%) is not as high as the percentage of the attacker’s actions correctly predicted (96%). There is therefore still room for improvement.

4 Historical Examples

Statistical research is often reported without reference to specific cases in the data. An argument for this is that the purpose is to find trends in the data, rather than to explain any individual event.
While we are sympathetic to that perspective, we would like to further illustrate that our estimated immediate deterrence model “makes sense” in the context of specific historical cases in our data. Furthermore, we illustrate our results with two cases that most would consider “big” crises (the Berlin Blockade and Sino-US tension over Taiwan), as well as with a case that is perhaps less familiar to most American scholars (the Russo-Japanese conflict over Manchukuo). As we proceed through the historical examples, we will also demonstrate that the estimated model can be useful in assessing the effect of particular deterrents in those cases. We will focus on the effects of the immediate and short-term balance of forces, as well as nuclear weapons (when they existed).

4.1 Soviet Crisis with Japan over Manchukuo, 1937–1938

In June 1937, Soviet forces captured islands in a branch of the Amur River marking the border between the Soviet Union and the Japanese puppet state of Manchukuo (formerly Manchuria) in northeast China. Japan moved troops to the area and demanded that the Soviet forces leave the islands. Of significance is the fact that Japan matched the Soviets in terms of forces in that area, sending divisions from Japan’s elite Kwantung Army (Ikuhiko 1976, 137-8). Although the Soviets held an advantage in terms of overall armed forces, they were deterred at that time from their attempt to alter the border, and they subsequently left the islands.

Just one year later (July 1938), the Soviet Union sent troops to occupy Changkufeng, a strategic hill on the disputed Soviet-Korean-Manchukuo border. Japan, with its troops now bogged down in a war against China, was either not willing or able to match the number of troops committed by the USSR to the dispute. It has been argued that Japan deliberately limited the number of troops because it wanted to keep the conflict localized and not lead to a broader war with the USSR, while already engaged in a war against China (Blumenson 1960, 263; Coox 1976, 121; Ikuhiko 1976, 142). Japan subsequently committed 10,000 troops, compared with the Soviets 20,000 (Blumenson 1960, 262; Ikuhiko 1976, 154). In contrast to the events one year before, deterrence failed. The Soviets refused to back down from their demand for a change in the border. The Japanese leadership decided to defend the region, and war ensued.

Interestingly, these two cases nicely form a natural experiment in the data. As it turns out, the values of all of the explanatory variables for the two observations are the same, with the exception of the immediate and short-term balance of forces. In 1937, $IBF = 1$ and $SBF = .43$, whereas in 1938, $IBF = .5$ and $SBF = .36$. Although the short-term balance increased in the Soviet’s favor, what really differed between these events was the immediate balance of forces.

Figure 8 plots the predicted probability of deterrence success as a function of the immediate and short-term balance of forces, holding all other variables at their 1937/1938 values. The predicted probabilities using the actual data for those crises are denoted by the two points on the surface and
Figure 8: Soviet Crises with Japan over Manchukuo in 1937 and 1938. The plot shows the predicted probability of deterrence success as a function of the immediate and short-term balance of forces, for two border disputes between the Soviet Union (potential attacker) and Japan (defender) over Manchukuo (protege) in 1937 and 1938. The two points on the probability surface denote the estimated probabilities of deterrence success based on the 1937 and 1938 data.

The year labels next to them. As the figure shows, the model makes strong predictions about the probability of deterrence success in these two situations. For the 1937 crisis, the model correctly predicts that the Soviets would almost certainly be deterred. The exact opposite is predicted for the 1938 crisis. Although not shown here, the model also correctly predicts war in the 1938 crisis with probability .97.

The estimated model also allows us to perform counterfactuals within the context of our model. The dark lines in Figure 8 plot the probability of deterrence success as the immediate and short-term balance of forces are individually changed from the 1937 and 1938 values.\(^\text{16}\) For example,\(^\text{16}\)

\(^{16}\)Of course, we could also assess the effect of changing both variables simultaneously. However, researchers are often most interested in analyzing the effect of individual variables.
consider the 1937 crisis. Figure 8 suggests that if Japan had not matched the Soviets in troops sent to the region, then the Soviets would not have been deterred from attempting to alter the Soviet-Manchukuo border. As the immediate balance changes from parity to a 2:1 advantage for the Soviets (i.e., \( IBF = 0.5 \)), the probability of deterrence success decreases from nearly one to nearly zero. The figure also indicates that the immediate balance was much more important in this case than the short-term balance, since the short-term balance already favored the Soviets, and changes to it in favor of the Soviets only modestly affect the likelihood of deterrence success.

Turning to the 1938 crisis, our model predicts in Figure 8 that if Japan had been willing to match the Soviet commitment of front-line troops as it had in 1937 (i.e., if \( IBF \geq 1 \)), then the Soviets would have likely backed down from their demand to alter the border. In contrast to the 1937 crisis, the model also suggests that the short-term balance could have played a more decisive role in 1938. Although this would have required a tremendous (and unlikely) effort by Japan, Figure 8 shows that increasing its standing reserves (i.e., \( SBF \)) to at least a 3:2 advantage over the Soviets would have deterred them. Interestingly, Blumenson (1960, 250) argues that the Soviets were not prepared for a full-fledged war with Japan, and would have backed down if Japan had been willing to commit more resources to the dispute. Blumenson (1960, 255) further speculates that the Soviets deliberately timed their demand for a border change at a time when Japanese troops were bogged down in the war against China.

4.2 Berlin Blockade, 1948

There has been some dispute concerning the efficacy of nuclear weapons in the 1948 Berlin Blockade crisis. Among the detractors, Betts (1987) argues that the US’s threats to use nuclear weapons against the Soviet Union were vague and ambiguous, and their impact on the final outcome was unclear. More recently, Gaddis (1997, 91, 98) has argued that the US’s threats were vague. For example, he suggests that although B-29 “atomic bombers” — the type that had dropped the atomic bombs on Hiroshima and Nagasaki — were sent to Britain and Germany, these particular ones were not nuclear-capable, and their impact on the outcome was uncertain. In contrast to these claims, our estimated model suggests that nuclear weapons played a very significant role in deterring the Soviet Union from escalating the crisis. Figures 9(a) and (b) display the predicted probabilities of deterrence success and of war, respectively, for this case, as a function of the immediate and short-term balance of forces.

Figures 9(a) and (b) show the estimated probabilities of deterrence success and of war, respectively, in the Berlin crisis. The probabilities are plotted over a range of values for the immediate and short-term balance of forces, with the point marking the actual values of \( IBF \) and \( SBF \) in the crisis. As Figure 9(a) displays, the model correctly predicts deterrence success with probability
The two figures show the estimated probabilities of deterrence success and of war based on the 1948 data (i.e., the US possessed nuclear weapons), but varying immediate and short-term balance of forces. The point in each graph denotes the estimated probability for the actual 1948 data.
Figure 10: Berlin Blockade (1948) with Non-Nuclear US. The figures display the estimated probabilities of deterrence success and of war based on the counterfactual scenario in which the US did not possess nuclear weapons. The point in each graph denotes the estimated probability based on the actual 1948 data, but assuming a non-nuclear US.
\[ p_{sq} \approx 1 \] — i.e., that the Soviets would not seriously challenge the Allied airlift, and would eventually end the ground blockade without further escalating the crisis. In this case, the USSR held a 10:1 advantage in the immediate balance of forces over the US (\( IBF = .1 \)). These forces were in a position to immediately engage in battle in Berlin, which of course lay in the Soviet zone that would eventually become East Germany. Additionally, the Soviet Union held a large advantage in the short-term balance of forces (\( SBF = .34 \)). The US defense budget was quite low at the time, and its conventional forces very weak (Betts 1987, 28; Gaddis 1997, 91; Oneal 1982, 248, 257-9).

Referring again to 9(a), the model predicts that the USSR would have been deterred even if the immediate balance of forces was even more in its favor (i.e., if \( IBF \) was even lower). However, if the number of its standing armed forces was even higher relative to the US (i.e., if \( SBF \) was even lower), the predicted probability that the USSR would have been deterred drops dramatically, despite the fact that the US possessed nuclear weapons. That is to say, the model predicts that if the US’s conventional forces were trivial compared to the USSR’s, the Soviets would not have been deterred, despite the fact that the US possessed nuclear weapons. As seen in Figure 9(b), the predicted probability of war therefore rises, although not as much, because the US would have been less likely to defend Berlin as the short-term balance of forces increasingly favored the USSR.

Provocatively, the model predicts that if the US did not have nuclear weapons, the probability of deterrence success would have dropped to virtually zero, and with probability \( p_{cap} \approx 1 \) the US would have surrendered Berlin. This is seen in Figures 10(a) and (b), which display the predicted probabilities of deterrence success and of war, respectively, in the counterfactual scenario in which the US did not possess nuclear weapons. That is, Figures 10(a) and (b) are generated in exactly the same manner as Figures 9(a) and (b), except that the variable \( NUCLEAR \) is set to 0 (its counterfactual value) rather than 1 (its true value). Gaddis (1997, 92) also speculates that if the US did not possess nuclear weapons, it is possible that it would not have even attempted an airlift in support of Berlin against the Soviets, given the USSR’s great superiority in the conventional balance of forces (see also Betts 1987, 24).

Figure 10(a) indicates that it would have taken a non-nuclear US roughly a little over parity in the immediate balance of forces to deter the USSR, or alternatively just over a 3:2 advantage in the standing armed forces. In other words, if the US did not possess nuclear weapons, it would have taken an enormous increase in the immediate or short-term conventional balance of forces (over their actual values) to deter the USSR from escalating the crisis.

In some ways, the likelihood of war is also greater in this context. Consider Figure 10(b). The predicted probability of war increases as \( IBF \) or \( SBF \) increase over their actual values, because the US would have been more likely to defend Berlin as the balance of forces increased in its favor. Although, the predicted probability of war begins declining once \( IBF \) increases beyond about 1 or
SBF increases beyond about 1.5, there exists a much larger range of values for IBF and SBF for which the probability of war is quite high. Comparing these graphs to those in Figure ?? suggests (1) that nuclear weapons played a critical role in deterring the USSR, and (2) that lack of nuclear weapons leaves more “room” for war.

4.3 US Deterrence of China over Quemoy-Matsu, 1955

Following World War II, another security concern for the US was the rise of a Communist China. Since then, the US and China have periodically rattled sabers concerning the status of Taiwan. One such period of heightened tensions concerned the 1955 crisis over the (Taiwanese) Nationalist-held islands of Quemoy and Matsu. Of particular interest to us is the extent to which the balance of forces and especially the US nuclear capability helped deter China from invading these islands.

Even more so than in the Berlin crisis, nuclear weapons appear to have played an important role. In their attempt to deter the potential Chinese invasion, President Eisenhower and Secretary of State Dulles made a number of public statements suggesting that nuclear weapons would be used to defend the islands. In internal administration discussions about the crisis, Eisenhower, Dulles, and Chairman of the Joint Chiefs of Staff Admiral Arthur Radford all indicated that the use of tactical nuclear weapons would be an important component of the defense of the islands (Betts 1987, 55-59; Chang 1990, chapter 4). Indeed, both Radford and Eisenhower believed that only nuclear weapons could destroy the gun emplacements that China had placed opposite to the islands (Chang 1990, 126), suggesting that a defense of the islands without nuclear weapons would have been extremely difficult if not impossible (also see Betts 1987, 55, 57-58). Chang (1990, 128) argues that Chinese officials took the US’ threats seriously.

Figures 11(a) and (b) display the estimated probabilities deterrence success and of war, respectively, in the Quemoy-Matsu crisis. As seen in Figure 11(a), the model correctly predicts deterrence success with probability \( p_{sq} \approx 1 \). The model indicates that if China’s advantage in the immediate or short-term balance of forces was just a little higher (i.e., if \( IBF \) or \( SBF \) was just a little lower), the probability that it would have been deterred drops dramatically, especially in the case of the short-term balance of forces. As seen in Figure 11(b), this would have therefore given rise to an increased probability of war.

Our model also suggests that the US’s nuclear weapons played just as important a deterrent role (if not more so) than in the Berlin crisis.\(^{17}\) Consider the counterfactual where the US does not have a nuclear capability. As seen in Figures 12(a) and (b), our model indicates that if the US did not possess nuclear weapons, there would have been virtually no chance of deterring China:

\(^{17}\)Huth (1988, 113) also argues that the US’s threats to use nuclear weapons may have helped deter China in this case, although nuclear weapons are not statistically significant in his probit analysis.
Figure 11: Quemoy-Matsu Crisis (1955) with Nuclear US. The two figures show the estimated probabilities of deterrence success and of war based on the 1955 data (i.e., the US possessed nuclear weapons), but varying immediate and short-term balance of forces. The point in each graph denotes the estimated probability for the actual 1955 data.
Figure 12: Quemoy-Matsu Crisis (1955) with Non-Nuclear US. The figures display the estimated probabilities of deterrence success and of war based on the counterfactual scenario in which the US did not possess nuclear weapons. The point in each graph denotes the estimated probability based on the actual 1955 data, but assuming a non-nuclear US.
with probability $p_{\text{war}} = 0.01$ the US would have fought to defend the islands, and with probability $p_{\text{cap}} = 0.99$ would have capitulated to a Chinese invasion. We also see in Figure 12(a) that to deter China, a non-nuclear US would have had to increase its front-line forces to about 1.25 times the Chinese forces, or increase its standing reserves to about twice as many as China’s (or some combination thereof). Again, compared to the actual front-line and standing forces, this would have represented a huge increase. As in the Berlin crisis, 12(b) suggests that the lack of a nuclear capability also increased the “space” for war.

5 Concluding Remarks

We have presented the first unified theory and statistical test of extended immediate deterrence. Our results indicate that the immediate and short-term balance of forces, as well as the defender’s possession of nuclear weapons, all significantly contribute to immediate deterrence success or failure. Contrary to Huth (1988), our analysis suggests that alliances, the long-term balance of forces, nuclear weapons, military arms transfers, and foreign trade also affect deterrence success. In contrast to Huth and Russett (1988), we find that the latter three variables, as well as the immediate balance of forces, influence the defender’s decision to defend its protege. We find that democratic defenders are more likely to fight to defend their proteges, a finding that is consistent with Fearon’s (1994b) argument that leaders who face high domestic audience costs are less likely to back down in public crises. We also find that democratic attackers value the status quo more than nondemocratic attackers. In terms of model fit, our model correctly predicts over 96% of the potential attacker’s actions and over 93% of the crisis outcomes. We also find evidence that the likelihood of deterrence success and of war are not consistent with the typical (monotonic) structural assumptions of previous studies using logit, probit, or binary selection models with monotonic link functions.

Substantively, the results indicate that as the immediate and short-term balance of forces increasingly favor the defender-protege, the attacker is more likely to be deterred. Surprisingly, as the long-term balance of forces increasingly favors the defender-protege, the attacker’s utility for war increases. This suggests that when an attacker faces a defender with substantial untapped military potential, there is an incentive to attack, rather than wait until the foe is more powerful.

The results indicate that the defender’s possession of nuclear weapons can play a significant role in achieving deterrence success. In line with Huth (1988), we find that tit-for-tat military preparations and a firm-but-flexible diplomatic bargaining strategy by the defender indicates to the attacker that the defender will defend its protege, but does not provoke the attacker by putting its reputation and credibility on the line, as a more bullying/aggressive bargaining strategy by the defender might. Tit-for-tat military preparations and firm-but-flexible diplomatic bargaining by
the defender thus help achieve deterrence success.

We find that defenders are more likely to defend proteges with whom they have a formal military alliance. Surprisingly, attackers also have a higher utility for war when there is a defender-protege military alliance. As we argued earlier, this may be due to how attackers select themselves into the current sample. The greater the protege’s share of the defender’s total merchandise exports and imports, the more likely the defender is to fight to defend its (economically valuable) protege. On the other hand, the more heavily reliant the protege is on the defender for its arms imports, the less likely the defender is to come to the protege’s aid. This suggests that a defender will often send a great deal of arms to the protege precisely when it does not expect to fight itself if the protege is attacked — i.e. high arms transfers may act as a low-cost substitute for a more serious military commitment (Fearon 1994a). If there was a previous dispute between the defender and the attacker which did not end in armed conflict but in which the underlying issues were left unresolved, the more likely the defender is to defend against an attack on the protege. Finally, we find that democratic defenders are more likely to go to war to protect their proteges than are authoritarian defenders, a finding that is consistent with the hypothesis that democratic leaders face greater domestic audience costs (Fearon 1994b) and are hence less likely to back down in public crises. On the other hand, democratic attackers are less likely to attack the protege, and we conjecture that this may be due to how attackers select themselves into the current sample — namely, democratic attackers will initiate a crisis only when they face unusually low costs for backing down.

Although our model fares quite well, we believe a number of avenues of research would prove fruitful. First, more data needs to be collected. As we mentioned earlier, we are fortunate as it is to have the Huth (1988) and Huth and Russett (1988) data, which allow us to code the outcomes of our model and provide data on many substantively interesting variables often hypothesized to affect extended immediate deterrence. However, there are only fifty-eight observations, which makes estimation difficult for larger models, both in terms of number of regressors, as well as number of decision nodes, and hence outcomes, in the model. Additional data would not only assist in estimating larger models, but would allow us to assess model fit by testing out-of-sample predictions. Huth and Russett (1988) state that these fifty-eight observations appear to comprise the entire universe of extended immediate deterrence crises in the international system over the time period of 1885 to 1984; if that is true, then additional observations can only come from other time periods.\footnote{Danilovic (2001) has created a new data set of extended immediate deterrence encounters among the major powers from 1895 to 1985. However, it only contains 46 observations.}

Second, we raised the issue of selection bias in the text, but did not attempt to extend the model any further than it is presented here. It is somewhat surprising that our simple deterrence model fares as well as it does, both in terms of theoretical explanation and statistical fit. Nevertheless,
there are a few puzzling estimates that may be due to how states selected themselves into the current sample. The next obvious step would be to incorporate the prior round or two of interaction into the current model (see Fearon 1994a for a theoretical model that does this). The fact that that would add more outcomes is somewhat problematic in the current context, since we would need to specify utilities and possibly additional explanatory variables for those outcomes, placing an even larger burden on the fifty-eight observations available. Fortunately, analyzing a model that incorporates prior rounds of interaction (such as Fearon’s) would expand the potential population of cases beyond simply those of immediate deterrence — general deterrence could be considered as well. That is, additional observations could be obtained from the same temporal domain as the Huth (1988) and Huth and Russett (1988) data. All of this suggests that theoretically-informed statistical analysis of the factors that influence crisis behavior remains a fruitful and exciting avenue for future research.
References


