Supplement to:

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A. Derivation of Strategic Choice Probabilities

The derivation of equilibrium choice probabilities is based on the strategic random utility model shown in Figure 1 of the article. The attacker’s utilities for the outcomes are assumed to be

\[ U^*_a(SQ) = U_a(SQ) + \pi_{a1} \]
\[ U^*_a(Cap) = U_a(Cap) + \pi_{a3} \]
\[ U^*_a(War) = U_a(War) + \pi_{a4} \]

where \( U^*_a(\cdot) \) is the true utility, \( U_a(\cdot) \) is the observable component (to the analyst and defender), and \( \pi_{aj} \) is a random component that is private information to the attacker. Similarly, the defender’s utilities are

\[ U^*_d(Cap) = U_d(Cap) + \pi_{d3} \]
\[ U^*_d(War) = U_d(War) + \pi_{d4} \]

where \( U_d(\cdot) \) is observable by the attacker and analyst, but \( \pi_{dj} \) is a random component that is private to the defender.

Assume now that the \( \pi_{ij} \) are i.i.d. \( N(0, \sigma^2) \) and that the attacker and defender are utility maximizers. The defender will defend if \( U^*_d(D) > U^*_d(D) \), and will back down otherwise. Hence,

\[ p_d = \Pr[D] = \Pr[U^*_d(D) > U^*_d(D)] = \Pr[U^*_d(War) > U^*_d(Cap)] = \Pr[U_d(War) + \pi_{d3} > U_d(Cap) + \pi_{d4}] = \Pr[\pi_{d4} - \pi_{d3} < U_d(War) - U_d(Cap)] = \Phi \left[ \frac{U_d(War) - U_d(Cap)}{\sqrt{2\sigma^2}} \right] \]

The attacker’s equilibrium choice probability is derived in exactly the same way. The only difference is that, because the attacker is uncertain as to whether the defender will
defend, the attacker’s utility for attacking will be an expected utility. Let \( p_\tau = 1 - p_d \). Then the probability the attacker attacks is

\[
 p_a = \Pr[A] = \Pr[U_a^*(A) > U_a^*(\overline{A})] \\
= \Pr[p_d U_a^*(D) + p_\tau U_a^*(\overline{D}) > U_a^*(\overline{A})] \\
= \Pr[p_d (U_a(War) + \pi_{a4}) + p_\tau (U_a(Cap) + \pi_{a3}) > U_a(SQ) + \pi_{a1}] \\
= \Pr[\pi_{a1} - p_d \pi_{a4} - p_\tau \pi_{a3} < p_d U_a(War) + p_\tau U_a(Cap) - U_a(SQ)] \\
= \Phi \left[ \frac{p_d U_a(War) + p_\tau U_a(Cap) - U_a(SQ)}{\sqrt{\sigma^2(p_d^2 + p_\tau^2 + 1)}} \right]
\]

**B. Probability of Deterrence Success and of War for Other Variables**

*Military Alliances*

Recall from Table 1 of the article that a military alliance between the defender and protege is associated with an increase in the attacker’s as well as the defender’s utility for war. Although it is difficult to determine this just from Table 3 of the article, the effect of a military alliance overall is to decrease the probability of deterrence success. It does so because a military alliance is associated with an increase in 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 (in the article) 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.

*Stalemate, Democratic Defender*

In Table 1 of the article 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 of the article shows, these variables have a very similar effect to each other. 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 “minimal” and “low” cases in Table 3 (in the article), 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 defender in this position is unlikely to defend the protege, so war occurs with probability only .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 enough other deterrents that outweigh the effects of these variables, and we see that there is essentially no change in the probabilities.

Long-Term Balance of Forces

On the surface, the result in Table 1 of the article for the long-term balance of forces is not as intuitive as those for the immediate and short-term balances. The estimated model suggests that an increasing defender-protege advantage in the long-term balance actually increases the attacker’s utility for war. As discussed earlier, one possible explanation for this might be based on a forward-looking attacker being concerned about an opponent’s future military power. Alternatively, it could be due to a selection effect.

The estimates in Table 1 of the article and the graphs in Figure 3 (of the article) and Figure 1 (here) indicate that the long-term balance does not have as great an effect as the immediate and short-term balance. In Figure 1(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
Figure 1: Effect of Long-Term Balance of Forces, Arms Transfers, and Trade.
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 1(b) displays the effect of the long-term balance on the likelihood of war. In the “minimal” scenario, the defender will not defend the protege, the attacker will attack, and so capitulation results. In the “low” situation, the attacker is again not deterred. However, the defender will defend the protege in this case, resulting in almost certain war. In the “moderate” case, the defender will come to the protege’s defense. Moreover, there are generally enough other deterrents that the probability of deterrence success is fairly high for low values of the long-term balance. However, as the long-term balance increasingly favors the defender-protege, the attacker has an increasing incentive to attack, resulting in an increasing probability of war.

Military Arms Transfers

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 1994a), and because of that, we would expect them to have the same general effect on the probability of deterrence success and of war. However, as Table 1 of the article shows, this turns out not to be the case.

Recall from Table 1 of the article 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. Because of the former effect, the probability of successful deterrence increases as the defender’s share of the protege’s arms imports increases. Figure 1(c) shows that for the “minimal” and “low” scenarios, military arms transfers have no real impact on the probability of deterrence success — other deterrents are sufficiently lacking that the attacker attacks no matter what. However, the probability of war decreases as defender-protege arms transfers increase, because the defender is less likely to defend (Figure 1(d)). In the “moderate” case, on the other hand, increased military arms transfers increase the likelihood that the attacker will be deterred (Figure 1(c)). Because of this and because the defender is less likely to defend, the probability of war decreases (Figure 1(d)).
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 of the article 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 1(e) 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 no matter what the value of foreign trade. When the overall situation favors the defender and protege, as in the “moderate” case, increased foreign trade is associated with a higher probability of deterrence success because the defender is more likely to defend, and the potential attacker can anticipate this.

Figure 1(f) 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. However, the defender does not defend, and hence the probability of war is zero. 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 that the defender defends is now high enough that the attacker is deterred. Therefore, the probability of war decreases.
C. US Deterrence of China over Quemoy-Matsu, 1955

The US and China have periodically rattled sabers over the status of Taiwan. One period of heightened tensions occurred during 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 quite seriously.

Figures 2(a) and (b) display the estimated probabilities of deterrence success and of war, respectively, in the Quemoy-Matsu crisis. As seen in Figure 2(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 2(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.¹ Consider the counterfactual where the

¹Huth (1988, 113) also argues that the US’s threats to use nuclear weapons may have helped deter China
US does not have a nuclear capability. As seen in Figures 2(c) and (d), our model predicts that if the US did not possess nuclear weapons, there would have been virtually no chance of deterring China: with probability $p_{\text{war}} = .01$ the US would have fought to defend the islands, and with probability $p_{\text{cap}} = .99$ would have capitulated to a Chinese invasion. We also see in Figure 2(c) 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 armed forces 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, Figure 2(d) suggests that the lack of a nuclear capability would also have increased the “space” for war.

D. Iraq’s Invasion of Kuwait, 1990–1991

The final case we discuss is the crisis resulting from Iraq’s invasion of Kuwait in 1990. Unlike the previous examples, this case is not contained in Huth’s (1988) data set, which runs up to 1983. In particular, we analyze the failure of the US to get Iraq to voluntarily withdraw from Kuwait.

Iraq invaded Kuwait on August 2nd, 1990, citing oil disputes and territorial claims. It appears that the US did not actively attempt to deter the invasion by giving clear indications of what its response would be (Bin, Hill, and Jones 1998, 20-22). On August 8th, the US announced a deployment of troops to Saudi Arabia for the purpose of preventing an Iraqi attack against that country. The US buildup of forces continued as the goal evolved from preventing an attack on Saudia Arabia to convincing Iraq to withdraw from Kuwait. When Iraq did not, on January 17th, 1991, the US and its coalition began an offensive against Iraq.

We code this as a deterrence failure. In reality, it is probably closer to compellence failure. Lebow and Stein (1990) argue that ten of the cases in Huth’s (1988) data are cases of compellence rather than deterrence, e.g., cases in which the defender tries to get the attacker to undo actions it has already undertaken. Huth and Russett (1990) respond in this case, although nuclear weapons are not statistically significant in his probit analysis.
by acknowledging that some of their cases include elements of compellence in addition to deterrence, and agree with Lebow and Stein’s contention that deterrence and compellence are often attempted in tandem. We agree with this perspective and examine what our estimated results predict about the effects of the balance of forces in the crisis over Kuwait.²

As seen from Figures 3(a) and (b), the model correctly predicts that Iraq would not be compelled to leave Kuwait, and that war would break out. However, the model predicts that if the US had a significantly greater advantage in either the immediate or short-term balance of forces, Iraq would have left Kuwait voluntarily. For example, if the US and its allies had about twice the number of troops on the ground as Iraq had ($IBF \geq 2$), the model predicts that Iraq would have backed down. Alternatively, a 3:1 advantage for the US in its standing forces ($SBF \geq 3$) would have had the same effect. As seen in Figure 3(b), this would have led to the probability of war going down to zero. Interestingly, the model predicts that if the US was relatively weaker in either the immediate or short-term balance of forces (but not both simultaneously), it would have still defended Kuwait, and war would have resulted.³

References


²In fact, the Kuwait case seems to fit rather well with Huth and Russett’s (1990, 475) abstract example of a crisis containing elements of both deterrence and compellence.

³We coded the variables for this case as follows. The US possessed nuclear weapons, there was no military alliance between the US and Kuwait, the US adopted a tit-for-tat military preparation strategy and a firm-but-flexible diplomatic bargaining strategy, there was no previous dispute between the US and Iraq that resulted in an unresolved stalemate, the US was a democracy whereas Iraq was not, Kuwait’s share of the US’s foreign trade was negligible ($FORTRADE = 0$; *International Trade Statistics Yearbook*), and Kuwait imported between 10 and 20% of its arms from the US ($MILARM = 2$; *World Military Expenditures and Arms Transfers*). In terms of the balance of forces, $IBF = 1.07$ (this is calculated based on 575,000 coalition ground troops and 540,000 Iraqi ground troops deployed in and around Kuwait; Bin, Hill, and Jones 1998, 147), $SBF = 1.29$, and $LBF = 5.89$ (these latter two variables are calculated from data taken from EUGene (Bennett and Stam 2000), and take into account Bueno de Mesquita’s 1981 distance correction, as in Huth 1988).


Figure 2: Quemoy-Matsu Crisis (1955). The figures show the estimated probabilities of deterrence success (Figures a and c) and of war (Figures b and d) as a function of the immediate and short-term balance of forces, based on the 1955 data (Figures a and b) and based on the 1955 data but assuming a non-nuclear US (Figures c and d). The dot in each graph denotes the estimated probability.
Figure 3: Iraq-Kuwait Crisis, 1990-1991

(a) Probability of deterrence success

(b) Probability of war