

Revisiting India's Nuclear Doctrine: A Game Theoretic Approach¹

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1 Introduction

India is a nuclear state which is committed to a policy of no-first-use (NFU) of nuclear weapons against any country including Pakistan. India is admittedly superior to Pakistan militarily and in terms of conventional weapons. India has second-strike nuclear capability, i.e., capability to survive a nuclear attack and launch a counter nuclear attack on the attacking country. This means India has a minimal nuclear deterrence, because not having a second-strike capability together with a NFU policy would effectively amount to not having a nuclear deterrence at all. India has three types of neighboring countries:

(a) **China**

Like India, China is a nuclear state which is committed to NFU policy. However, China's commitment to NFU is viewed with suspicion by some countries. China also has second-strike nuclear capability. China is superior to India militarily and in terms of conventional weapons. China has boundary dispute with India including her claims over Arunachal Pradesh.

(b) **Bangladesh**

Bangladesh is neither a nuclear state nor a militarily stronger country. Bangladesh has no significant boundary dispute with India.

(c) **Pakistan**

Pakistan is a nuclear state. But, unlike India, Pakistan has not committed to NFU policy. On the contrary, Pakistan has publicly announced many times that it will use nuclear weapons early on in any major conflict with India, especially if Pakistan is on the verge of losing a conventional war to India. Pakistan has a

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festering boundary dispute with India including its claim over Jammu & Kashmir and India's counter claim over Pakistan occupied Kashmir (POK).

Threat of launching a nuclear attack against India has been repeatedly used by Pakistan to rile up international support over Kashmir. In view of such a threat it is imperative to discuss whether India ought to reconsider her NFU policy.

The question can be answered by using an intuitive application of game theory. I argue below that a better policy for India is to adopt NFU policy *only* against those neighboring countries that either have a NFU policy against India or that do not possess nuclear weapons. Such a change in India's policy can induce Pakistan to reciprocate with a NFU policy against India and, thereby reduce, if not eliminate, possibility of a nuclear war between India and Pakistan.

2 A game formulation of the situation

The game has two players, labelled country 1: India and country 2: Pak. Each country has two strategies NFU and FU (first-use). A strategy profile is a choice of a strategy by each country. The numbers inside each box in Figure 1 below represent the payoffs of countries 1 and 2 for each possible choice of strategies by them. For example, if country 1 chooses NFU and country 2 chooses FU, then the strategy profile is (NFU, FU) and the payoff of country 1 is -9 and that of country 2 is $+1$. As will be clear, the absolute values of the payoffs assumed in the game in Figure 1 do not matter in that the analysis below is independent of the absolute values of the payoffs. Only the relative values of the payoffs matter. For the time being, the two countries are treated symmetrically. I later discuss in section 3.1 how the analysis may be affected because of an important asymmetry between the two countries.

		Country 2: Pak	
		NFU	FU
Country 1: India	NFU	0,0	-9,+1
	FU	+1,-9	-8,-8

Fig. 1

- The payoffs of both countries are negative for the strategy profile (FU,FU), because both of them then have to live under the fear of a nuclear attack by the other country.
- The payoff of country 2 is +1 for the strategy profile (NFU,FU), because country 2 then controls not only its own “nuclear button”, but effectively also controls the nuclear button of country 1; Country 2 does not have to fear a nuclear attack, unless it first launches a nuclear attack against country 1, assuming that country 1 has second-strike nuclear capability.
- The payoff of country 1 is −9 (less than −8) for the strategy profile (NFU,FU) because country 1 still has to live under the fear of a nuclear attack by country 2, same as under the strategy profile (FU,FU), but has fewer choices than under the strategy profile (FU,FU): If Country 1 sees country 2 preparing for a nuclear attack or is threatened by country 2 with a nuclear attack, country 1 must do nothing because of its commitment to NFU, but wait for an actual nuclear attack to occur and actually suffer a nuclear attack before it can launch a counter nuclear attack on country 2, assuming country 1 has second-strike nuclear capability.
- The game in Figure 1 has a unique Nash equilibrium, namely, the strategy profile (FU,FU).³

It can be argued, as indeed is claimed sometimes, that the strategy profile (NFU,FU) reduces the chance of a nuclear war breaking out between countries 1 and 2 because it assures country 2 of not being attacked with nuclear weapons by country 1, unless it first launches a nuclear attack against country 1. Therefore, country 2 may not launch a pre-emptive nuclear attack against country 1, as that and only that will provoke a nuclear attack against country 2. But this is a misleading argument for two reasons:

First, the chance of a nuclear war between countries 1 and 2 is reduced not because of assurance by country 1 that it will not be the first to launch a nuclear attack on country 2, but because of the second-strike nuclear capability of country 1. Second, if we accept the argument that the strategy profile (NFU,FU) indeed reduces the chance of a nuclear war between countries 1 and 2, then by the same reasoning so should the alternative strategy profile (FU,NFU).

³ Nash equilibrium is the most widely used solution concept in game theory. In the present context, the strategy profile (FU,FU) is a Nash equilibrium because neither country can obtain a higher payoff by choosing an alternative strategy, taking as given the strategy of the other country.

If we believe that the strategy profile (NFU,FU) or (FU,NFU) reduces the chance of a nuclear war between countries 1 and 2, then the payoffs of the two countries should be modified as follows:

		Country 2: Pak	
		NFU	FU
Country 1:India	NFU	0,0	-7,+1
	FU	+1,-7	-8,-8

Fig. 2

The payoff of country 1 for the strategy profile (NFU,FU) is only -7 , rather than -9 , because the strategy profile (NFU,FU), by assumption, reduces the chance of nuclear war between countries 1 and 2. Analogously, the payoff for country 2 is -7 rather than -9 for the strategy profile (FU,NFU), as the strategy profile (FU,NFU) must similarly reduce the chance of a nuclear war between countries 1 and 2. The game in Figure 2, unlike the game in Figure 1, has two Nash equilibriums (FU,NFU) and (NFU,FU). Of these two Nash equilibriums, the equilibrium (NFU,FU), which represents the current strategy choices of India and Pakistan, is the worst for country 1, i.e. India. Clearly, India will be better-off if the equilibrium is instead (FU, NFU).

If we reject the claim that the strategy profile (NFU,FU) or (FU,NFU) reduces the chance of a nuclear war, then the applicable game is as in Figure 1, which, unlike the game in Figure 2, has a unique Nash equilibrium, namely, the strategy profile (FU,FU). The strategy profile (NFU, FU) or (FU,NFU) is not a Nash equilibrium of the game in Figure 1. However, the Nash equilibrium payoffs for the game in Figure 1 are strictly lower for both the countries compared to their payoffs for the socially optimal desirable profile (NFU, NFU). But if we accept the claim that the strategy profile (NFU,FU) or (FU,NFU) reduces the chance of a nuclear war, then the game is as in Figure 2 which has two Nash equilibriums: (NFU,FU) and (FU,NFU). Then, also it is desirable, at least from the point of view of India, to somehow

induce the equilibrium (FU, NFU) rather than (NFU, FU). Since India has already chosen the strategy NFU, the question from the point of view of India is the same irrespective of whether we accept or reject the claim that the current strategy profile (NFU, FU) reduces the chance of a nuclear war between India and Pakistan: How to induce Pakistan to adopt the strategy NFU and thereby reduce, if not eliminate, the chance of a nuclear war between India and Pakistan?

3 Inducing the strategy profile (NFU, NFU)

It will not be easy to induce Pakistan to switch to NFU policy against India so that the resulting strategy profile is (NFU, NFU), because Pakistan is strictly better-off under the prevailing strategy profile (NFU, FU). However, the game between India and Pakistan is an infinitely repeated game in the sense that the game in Figure 1 or 2 is played by the two countries in every period. This implies choice of a richer set of strategies for the two countries. In particular, each country can now play the strategy that is known as the “Tit for Tat” strategy, i.e., the strategy: “play NFU if the other country played NFU in the preceding period and play FU if the other country played FU in the preceding period”. If a country adopts the Tit-for-Tat strategy, then it is optimal for the other country also to adopt the Tit-for-Tat strategy. There is both theoretical and experimental evidence that shows that if the countries do not highly discount their future payoffs, then in the repeated play of the game in Figure 1 or 2 the optimal choice of both players is to play NFU in each period, resulting in the socially desired outcome (NFU,NFU).

3.1 An Asymmetry

Both games above treat the two countries symmetrically. But in reality they are not symmetrical, as India is superior to Pakistan militarily and in terms of conventional weapons. This asymmetry has been cited by Pakistan to justify possessing nuclear weapons and her FU policy against India. Pakistan has often announced that it will not hesitate to use nuclear weapons against India if it is on the verge of losing a conventional war to India and possessing nuclear weapons and her FU strategy are a deterrence to militarily superior India. To alleviate such fears and encourage Pakistan to choose NFU instead of FU, India, in addition to adopting the Tit-for-Tat strategy, may propose an agreement with Pakistan which, in brief, states that India will not launch a full-scale conventional war against Pakistan,

provided Pakistan stops all terrorist activities against India and credibly commits to resolve all its disputes with India, including that of POK, only through bilateral talks. Adoption of the strategy “play NFU if a neighboring country played NFU in the preceding period and play FU if a neighboring country played FU in the preceding period” by India and an agreement with Pakistan along the lines indicated above can induce Pakistan to choose NFU against India and thereby reduce, if not eliminate, the possibility of a nuclear or conventional war between India and Pakistan.

To conclude, India’s current nuclear policy favors Pakistan at India’s cost. India would be better-off if India adopts instead the Tit-for-Tat strategy, i.e., “play NFU if a neighboring country played NFU in the preceding period and play FU if a neighboring country played FU in the preceding period”.⁴ Adoption of the Tit-for-Tat strategy by India can induce Pakistan also to adopt the Tit-for-Tat strategy and lead to the socially desirable outcome (NFU, NFU), as is the case between India and China. In any case, given the long history of Pakistan not honoring its agreements with India, India must continue to develop a credible second-strike nuclear capability.

⁴ Such a policy is fair and not aggressive. It is unlikely to raise any geopolitical concerns.