A Game Theoretic Analysis for Ladakh Standoff, 2020

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A game theoretic analysis for Ladakh standoff is presented in this article. Starting with Prisoner's Dilemma (PD) game, a more flexible game, known as De-escalation game,[1] is derived by incorporating the concepts of retaliation and non-escalation probabilities in the PD game. It is shown that by including these concepts, many new possibilities open up for India, which permit it to impose penalty on the aggressor. The intensity of retaliatory actions may be tailored according to the perceived threat; and this strategy allows India to dissuade the aggressor without risking a war or accepting defeat. Finally, options available to India in the light of game theoretic analysis are presented in the article.

Keywords: *India–China disputes, Game theory, De-escalation game, Co-operative Nash equilibrium*

Introduction

The Chinese incursion into Ladakh in spring/summer of 2020 and the killing of 20 Indian soldiers was a rude shock to the conscience of the nation. During the last one and a half years, a large number of articles and research notes have analysed the Chinese intentions and the way forward for India after the incursion.

In order to understand this unprovoked Chinese aggression from India's perspective, it has been proposed that Chinese action was meant to distract the local populace from internal troubles arising from the pandemic, along with its wish to show strength in view of international

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criticism for Wuhan virus, and also to warn India against taking advantage of the situation created by the pandemic.[2] It has also been proposed that China has not been able to liberate itself from medieval mindset of the Middle Kingdom, which has led to crass insensitivity and disregard for rules-based international order.[3]

Chinese strategic goals vis-à-vis India have been propounded as: (i) to make India understand that it is not in the same league as China by using periodic localised assaults to drive home the lesson; (ii) to warn India not to oppose Chinese designs in Indo-Pacific region by aligning with the United States (US)/Quadrilateral Security Dialogue (Quad; involving the US, Japan, Australia and India); (iii) to keep India preoccupied within the South Asian region to prevent it from acting as an alternative pole in Asia; and (iv) to support Pakistan economically and militarily for this purpose.[4] Chinese hardliners argue that there is no possibility of a negotiated settlement of the boundary dispute in the near future. India, they believe, is already a quasi-ally of the US and opportunities for cooperation at the global level are diminishing, hence periodic violent clashes will be the new normal now. They further suggest to take all opportunities to crack down on India and hit it hard whenever possible, along with weakening India internally by leveraging its social and political differences, and completing its strategic encirclement by instigating anti-India activities in the neighbourhood.[5]

Strategic analysts and scholars from India have also suggested measures for countering China's unilateral aggression.[6] It has also been noted that a visible demonstration of Indian good faith towards 'one-China policy' and respect for China's core sensitivities has not helped; and in spite of Delhi's appeasement policy, China has continued to support Pakistan in relation to terrorism, as also undermine India in international forums. India needs to objectively comprehend the nature of the China challenge for India that has continued for the last six decades (since 1962).[7] Indeed, a plan is seen to: (i) secure India's acquiescence as China's junior; (ii) humiliate Indian leaders; and (iii) subvert our civil society. Another part of this is to damage our economy through predatory trade practices, thereby causing destruction of parts of our industry. To counter this, in addition to energising Quad for acting as a balance against China and assuming the responsibility for regional security, a short-term lend-lease programme with the US for Indian armed forces has been suggested.[8] Regarding the Quad grouping, it has been noted that the resurrection of this grouping is a function of China's assertiveness and a deepening

suspicion of its intentions. Despite China's attempts to discredit the idea of Quad, there is a growing consensus that a free and open Indo-Pacific remains the only viable basis for engendering regional peace and stability.[9]

Since the early 1990s, India has been a moderate power, with the disinclination to use force or to intervene in its neighbourhood.[10] The current government has continued the trend, except for responding to serious border threats from China and Pakistan. In contrast, China has developed a more belligerent nationalism, accompanied by a proclivity for coercive action against its neighbours. Since the late 1980s, China has also shown a tendency to use varying degrees of force against its adversaries. This behaviour was seen in 2017, at Doklam, and in 2020, at Ladakh. China, driven by a deep sense of internal fragility, is ruled by elites who seek to build national solidarity and regime strength through adversarial relationships with other states. In addition, by adopting a 'salami slicing' approach in the Ladakh confrontation, China aims at improving its bargaining power, which must be anticipated and countered by India.

In China's strategic calculation, India's position is that of a rising power. China's rapid growth in recent decades and its superior military capabilities make for an inherently unequal relationship, with China unwilling to accommodate India, such as on permanent membership of United Nations Security Council (UNSC) and the membership of Nuclear Suppliers Group (NSG).[11] China's territorial incursion into Ladakh and its equally perplexing withdrawal (though partial) remain a matter for deep reflection for Indian policymakers. It is believed that India's swift military response, backed by firm political resolve, came as an unpleasant surprise to China and forced it to withdraw. Unfortunately, India also continues to pay a heavy price for having neglected to negotiate the conversion of 3,500 kilometre (km) disputed Sino-Indian boundary into an international border for the last 59 years. The existence of an undefined, un-demarcated Line of Actual Control (LAC) has provided an instrumentality for China to periodically intimidate and distract India and damage its image internationally.[12]

In an extensive study—based on views of Indian and Chinese scholars—on the present and future of India–China relations in the aftermath of Ladakh standoff,[13] the casualties in Galwan have been termed as an 'inflection point' in India–China relationship. The reason for the deterioration in the relationship lies in their perceptions and expectations of each other in the larger context of global relations. India

had made sincere efforts to reduce the salience of the boundary question through a joint process of clarifying the LAC and by creating a new political-level special representatives' mechanism to find a fair, reasonable and mutually acceptable solution. However, it was felt that China is not sensitive to India's core concerns. Indeed, by certain actions, such as reclassifying Arunachal Pradesh as South Tibet, blocking of multilateral lending for development projects in Arunachal, introducing stapled visas for residents of Jammu and Kashmir, blocking the listing of terrorists in UNSC and opposing India's membership of NSG, China has shown a high degree of insensitivity on matters of great concern to India's security and integrity. India's reaction has been to push back against China on matters of its core interests, like the Belt and Road Initiative or the South China Sea. Further, India's active participation in resuscitation of Quad has added to China's feeling that India is a part of the US containment initiative.

The purpose of this article is to present a game theoretic analysis for the recent India–China standoff. Game theory, also termed as the 'science of strategy', is the study of strategic decision making. It is useful for making choices in situations among competing players, and also helps them in reaching optimal decision making when confronted by independent and competing actors in a strategic setting. Recently, game theory has been applied for analysing India–China relationship in a number of publications,[14] focusing on Doklam and Ladakh standoffs. Most of these works present either a descriptive or a preliminary account of Prisoner's Dilemma (PD) with pure strategy approach, which is restrictive as far as the response of the affected player is concerned. Here, I present a more inclusive approach, using mixed strategy approach with PD game,[15] which appropriately models the current India–China standoff, offering a range of options for India's response to unilateral action of China.

A recent Chinese publication on game theoretic analysis of Sino-Indian border dispute is worth mentioning.[16] The work appears to be a part of Chinese propaganda in the garb of scientific analysis. The sole purpose of the said work seems to be to blame India for the deterioration in bilateral relations. Also, it frequently accuses India as the attacker in all the incidents, right from 1962 war to recent minor skirmishes at the border. Apart from this inaccurate depiction of history, there are some technical issues with the work. The game has been stated as Stag Hunt, but the subsequent matrices in the paper with numerical values indicate

that the game is, in fact, standard PD. The qualitative difference between PD and Stag Hunt is evident in the following. In two-player PD, the party who defects or betrays the other partner (who is still cooperating) receives or anticipates to receive a higher payoff than that received by cooperation with the other player; thus, the temptation to defect comes from this greed of higher payoff. In Stag Hunt,[17] the player who defects or betrays cannot hope to get a higher payoff than that received from cooperation; and this realisation dissuades the concerned player from defection/betrayal.

It is indeed India's firm resolve and swift deployment of forces in adequate number (both at Doklam and Ladakh), in addition to activation of Quad, that converted the game into Stag Hunt by imposing penalties on China's expected payoff, as shown in the next section.

Game Theoretic Formulation of China–India Standoff

Prisoner's Dilemma (PD)

For ease in understanding of underlying concepts, I will discuss, first, the standard PD game as a model for describing the conflicting situation between India and China. The outcome matrix may be described as in Table 1.

Table 1 Standard PD Game between India and China

		Column (China)	
		Cooperate (C)	*Betray (B)*
Row (India)	Cooperate (C)	(3, 3) Compromise	(1, 4) China wins
	Betray (B)	(4, 1) India wins	(2, 2) Trap–conflict/ war

Source: Brams and Kilgour, *Game Theory and National Security*.[18]

The payoffs vary from 1 (worst) to 4 (best) in the above-described game. It is noted that although the original PD game is a simultaneous move game, the proposed De-escalation game (described next) is a sequential game.[19] The game may be explained in the following steps:

1. India has cooperative policy and expects the same from all neighbours.
2. China betrayed by moving its army into Ladakh and capturing land, expecting to obtain the highest payoff 4.

3. India will lose (that is, it will get the lowest payoff 1) if it does not retaliate.
4. Direct retaliation, that is, attacking the Chinese Army, will lead to war, with payoff 2. This will be costly in terms of undesirable expenditure and loss of military personnel, especially during pandemic when our economy is already under stress.
5. India wants to force China to come back to 'Compromise', with payoff 3, and wants to avoid war, with payoff 2. For this, India has to take steps (that is, to impose penalty) such that China's payoff reduces to value less than or equal to 3.

Nash Equilibrium

A Nash equilibrium is an outcome from which no player would have an incentive to depart or deviate unilaterally because he would do immediately worse, or at least not better, if he did. In the standard PD game, shown in Table 1, the outcome corresponding to betray-betray (BB) with payoff (2, 2) is the Nash equilibrium. It is seen that the outcome corresponding to cooperate-cooperate (CC) with payoff (3, 3) is beneficial to both. However, this outcome is not stable, as Column (China) has the incentive to maximise its payoff to 4 by moving to 'CB', that is, an outcome when India is cooperating but China betrays. (Theoretically, India also has freedom to betray when China cooperates with payoff 4, 1; though it is infeasible as India has a well-known policy of not attacking any country who is cooperating with it.)

Next, we consider how by addition of suitable structures, we can develop a new game, in which India has the option to retaliate suitably to force China to abandon its ill-conceived strategy of betrayal and come back to cooperative strategy.

De-escalation Game

This nomenclature comes from Brams and Kilgour, who proposed mixed strategy game based on incorporation of additional structures (such as escalation or retaliation probabilities) in the standard PD game, resulting in a new game with more flexibility.[20] This enables to add shades of gray to black and white of earlier PD game, resulting in a more flexible game, namely, De-escalation game. Thus, instead of the dichotomous options of cooperation and non-cooperation, each player is allowed to select continuous levels of cooperation. Each player is also allowed for the possibility of retaliation at any level if the initial choice

of an opponent is regarded as non-cooperative. Thus, in the present context, by incorporating a probability of retaliation by the affected party (that is, India, which has been cooperating so far), it opens a lot of possibilities in terms of strategic choices for India. Depending upon the level of hostility or betrayal by China, India has the freedom to choose or decide its level of retaliation in the new De-escalation game, instead of either tolerating China's betrayal (that is, accepting defeat) or outright counter-attacking which may lead to full-scale war between two nuclear-powered adversaries. In the following paragraphs, the game is described with minimal use of mathematics.

For convenience, the outcome matrix of China–India game is rewritten, replacing ordinal values by cardinal ones (presuming they exist; however, the final results are not affected by the numerical values, hence exact determination of cardinal or numerical values is not necessary), as shown in Table 2.

Table 2 Standard PD Game with Cardinal Payoffs

		Column (China)	
		t	$1 - t$
Row (India)	s	(r_3, c_3)	(r_1, c_4)
	$1 - s$	(r_4, c_1)	(r_2, c_2)

where r_i: payoff to row; c_i: payoff to column; and $0 = r_1 < r_2 < r_3 < r_4 = 1$; $0 = c_1 < c_2 < c_3 < c_4 = 1$.

Source: Brams and Kilgour, *Game Theory and National Security*, p. 5.[21]

The essential ideas are as follows:

1. Players do not choose between cooperation and betrayal (as in PD game). Instead, they choose 'non-escalation' probabilities: s for Row and t for Column; correspondingly, 'escalation' probabilities are $1 - s$ for Row and $1 - t$ for Column. (These correspond to cooperation and betrayal moves in PD game.)
2. Each player also chooses 'retaliatory actions', which determine his conditional retaliation probability. These arise when one player is cooperative and the other is betraying. Let non-retaliation probability for Column be p and that for Row be q, then the retaliation probabilities are $1 - p$ for Column and $1 - q$ for Row respectively.
3. If both players' initial choices are the same, namely, cooperate-cooperate or betray-betray, the game ends at that point (as no

action is required if both players are cooperating or betraying each other). However, if one player is cooperating and the other is betraying, the first player's conditional retaliation probability comes into play.

4. We will see how by proper utilisation of retaliation probabilities, that is, by taking carefully chosen actions, it is possible to dissuade the betraying partner by convincing him that by taking inimical actions, he is in fact lowering his own payoff.

To elaborate this, suppose China initiates actions which are perceived as inimical by India, it expects to gain its maximum possible payoff, c_4, by resorting to betrayal (while India is still cooperating). To be sure, India will immediately take retaliatory actions, namely, reduce its non-retaliation probability q, and accordingly increase its retaliation probability $1 - q$. Then, the payoff in the right corner box becomes $q(r_1, c_4) + (1 - q)(r_2, c_2)$. By this action, India reduces the expected payoff of China from c_4 (as expected by China) to $qc_4 + (1 - q)c_2$; and increases its own payoff from r_1 to $qr_1 + (1 - q)r_2$.

Similarly, in the hypothetical case of India initiating the hostility, China will also increase its retaliation probability, $1 - p$, by initiating counter actions. The outcome matrix is shown in Table 3.

Table 3 De-escalation Game between India and China

		Column (China)	
		t	$1 - t$
Row (India)	s	(r_3, c_3)	$q(r_1, c_4) + (1 - q)(r_2, c_2)$
	$1 - s$	$p(r_4, c_1) + (1 - p)(r_2, c_2)$	(r_2, c_2)

Source: Brams and Kilgour, *Game Theory and National Security*.[22]

Ladakh Standoff (2020)

Let us consider the case of Ladakh standoff, when initial provocation came from China when it made the move to change the status of the LAC unilaterally by mobilising its army to move into the Indian side of LAC. This was clearly a case of betrayal when India had been cooperating (non-attacking).

In response to China's unilateral action, India was forced to initiate actions, which may be seen as increasing its retaliation probability $1 - q$ (and accordingly decrease non-retaliation probability q). India quickly deployed its troops at the border and made arrangements for their long

stay, including in harsh winter. India also expressed its firm resolve not to withdraw its troops till China restores the status quo as existed prior to China's entry into the Indian side of the LAC. In addition, India took several economic measures, such as banning of Chinese apps, and took steps to reduce China's participation in economic activities. Further, India enhanced its activity in Quad. The net effect of these steps was to convince China regarding the effective reduction in its payoff.

To put it more clearly, the sole temptation for China's unilateral attempt to change the LAC was to maximise its payoff, c_4, with respect to the cooperative payoff, c_3 ($c_3 < c_4$, as noted earlier). The actual payoff for China in this case might be a complex combination of strategic, diplomatic and economic factors, such as: to restrain India (whom China considers competitor in Asia) from perceived challenging actions, like participation in Quad; to belittle India in international view—at the same time, wishing to make India more dependent on it in respect of imports; and China's old habit of salami slicing (that is, grabbing foreign lands in small pieces). However, India's firm resolve, along with its appropriate diplomatic moves, reduced this payoff by increase in retaliation probability. That is, India wanted to ensure that:

$$qc_4 + (1 - q)\, c_2 < c_3 \qquad ...(1)$$

which implies a reduction in non-retaliation probability;

$$q < \frac{c_3 - c_2}{1 - c_2} \qquad ...(2)$$

and accordingly, an increase in retaliation probability:

$$1 - q < \frac{1 - c_3}{1 - c_2} \qquad ...(3)$$

Hence, an appropriate strategy for India is 'no escalation, but assured retaliation', as has been stated by the present Indian defence minister: 'India will not provoke, but definitely and surely retaliate if provoked'.[23] The same may be expressed in terms of game theory as:

$$s = 1;\ q < \frac{c_3 - c_2}{1 - c_2} \qquad ...(4)$$

Nash Equilibrium in De-escalation Game

It is interesting to note that the De-escalation game has an additional Nash equilibrium, that is, the cooperation-cooperation outcome with payoff (r_3, c_3) has become a new equilibrium point (and hence a stable point; in other words, the adversary will have no incentive to deviate

from this equilibrium, unlike in the standard PD game). It is to be noted that the original Nash equilibrium with betrayal-betrayal outcome with payoff (r_2, c_2) is still a stable point. Further mathematical details may be seen in the work by Brams and Kilgour.[24] The point here is that if India, by adopting suitable retaliatory actions, is able to convince China regarding the futility of aggression decisively and credibly, then the equilibrium in the bilateral relations with cooperative payoff will be stable, or at least it may be expected to be stable with a high level of certainty.

Stag Hunt versus PD

As mentioned earlier, some Chinese scholars have attempted to model India–China relationship as Stag Hunt game, along with a false narrative to blame India for whatever has gone wrong in their bilateral relations.[25] Here, I wish to put the narrative in the right perspective. Various authors have established, with evidence, that it is China who has betrayed India repeatedly since 1962: Nathu La and Cho La (both in 1967);[26] Sumdorong Chu (1987);[27] and recent incidents at Doklam (2017)[28] and Ladakh (2020). Instead of prolonging this debate (as this has already been discussed by numerous strategic analysts and scholars), let us look at the classification of the game: originally, the India–China standoff is a typical example of PD (when China wanted to maximise its payoff by betraying India). India's response utilising mixed strategy (Inequality (1)) imposes costs (or penalty) on China's expected payoff, as explained in Table 3. To simplify further, let us rewrite the outcome matrix of Table 3 (given in Table 4).

Table 4 Stag Hunt Game between India and China

		Column (China)	
		t	$1 - t$
Row (India)	s	(R_3, C_3)	(R_1, C_4)
	$1 - s$	(R_4, C_1)	(R_2, C_2)

where R_i: payoff to Row; C_i: payoff to Column.

Source: 'Stag Hunt'.[29]

The payoffs in the matrix shown in Table 4 are related to those in the De-escalation game (Table 3) as follows:

$(R_3, C_3) = (r_3, c_3)$; $(R_2, C_2) = (r_2, c_2)$; $(R_1, C_4) = q(r_1, c_4) + (1-q)(r_2, c_2)$; and $(R_4, C_1) = p(r_4, c_1) + (1-p)(r_2, c_2)$.

From Inequality (1), it is clearly seen that:

$$C_4 < C_3 \quad \ldots(5)$$

which simply means that India's policy of assured retaliation will not allow China to maximise it payoff. (A similar result also holds in the hypothetical case of India betraying China.)

It may be noted here that (5) makes the game in Table 4 as Stag Hunt.[30]

Qualitative Analysis and Options for India

In this concluding section, an attempt is made to interpret the results of the game theoretic analysis in non-mathematical terms, and finally indicate the steps India may consider for deterring China against such blatant aggressive acts in future.

The standard PD game (Table 1), which uses only pure strategies, lacks flexibility as it leaves India with only two possibilities: to acquiesce to China's blatant and hegemonistic behaviour; or to go to war with China. Both are unacceptable to India as it cannot accept entirely the unjustifiable aggression of China, nor can it afford a war, which would be economically and militarily costly, especially when the nation is struggling with an unprecedented pandemic. On the other hand, incorporation of additional structures, such as retaliation and non-escalation probabilities in the PD game, results in De-escalation game, which offers numerous options to India to counter the aggression and force the adversary to change its path of confrontation to that of cooperation and peace. The incorporation of retaliation and non-escalation probabilities opens up a vast pool of possible retaliatory/deterrent actions before India, which have a potential to reduce the gains or payoffs that the aggressor might have expected prior to unilateral action to change the status quo. In other words, PD game is converted into Stag Hunt game by imposing penalty on China, so that aggression does not remain beneficial to the aggressor.

Numerous strategic analysts and scholars have suggested the actions that India needs to take for countering Chinese aggression. For instance, it has been suggested that the Quad should be strengthened, along with seeking American support to meet the challenge.[31] It is also recommended to go in for a short-term American lend-lease programme for Indian Armed Forces for meeting urgent requirements. Rajesh Basrur, in turn, mentions that a modicum of nuclear capability is sufficient to deter an adversary and advises against large nuclear arsenal.[32] Further, he stresses

on the need for a secure and robust command and control system for nuclear weapons, including improved cyber technology to counter cyber threats from China. It has been noted by Vijay Gokhale that China has global ambitions and is engaged in comprehensive rivalry with the US.[33] This is not the case with India and hence, China has more to lose from confrontation with India. Indeed, an unfriendly or antagonistic India might make China's rise more complicated, particularly in the current landscape where China is subject to greater suspicion and resistance. If the two sides cannot reconcile or manage their differing perceptions, both might lose, but China might have much more to lose.

A detailed account of the possible punitive options against China has been given by Brahma Chellaney.[34] He says that if India begins exacting mounting costs that make its territorial gains unbeneficial, only then will China roll back its aggression. It is essential that India imposes on China significant economic and diplomatic costs, coupled with the application of coercive military pressure. Apart from banning Chinese apps and restricting Chinese companies' access to government contracts, India needs to implement informal trade sanctions and leverage its buying power to correct the trade deficit with China. Further, India must launch diplomatic offensive to spotlight Chinese aggression; as a warning, India should rescind its 2006 decision to reopen Chinese consulate in Kolkata. India also needs to review its one-China policy (by raising issues concerning Taiwan or Tibet); and this policy should be predicated on China's adoption of one-India policy.[35]

I wish to add a few points here (in addition to the above-mentioned actions suggested by renowned strategic analysts):

1. *Strengthening of nuclear deterrence*: In contrast to the view expressed by Basrur,[36] I consider nuclear deterrence an essential component of the actions grouped under 'retaliation probability' in the De-escalation game. At the same time, we should not forget China's all-weather friend Pakistan, which will be too eager to fish in troubled water, in addition to the threats of counter-force attacks from our adversary duo.
2. *A robust cyber security arrangement for all military and critical civil installations*: In this regard, technological assistance may be sought from Japan, which is also a member of Quad. Also, cyber security threat is considered 'severe'[37] and calls for a serious consideration by our policymakers.

3. In case of a serious conflict, there is always a distinct possibility of China attempting to encourage disgruntled elements, sleeper cells and internal insurgents to create trouble within India. In fact, this category of hidden adversaries has been termed as the 'half front' in the parlance of 'the two and a half front war'.[38] It is certainly possible for India to neutralise this category of enemies well before a serious confrontation arises at the border.
4. As has been stated by the Prime Minister of India last year, the real solution to Chinese incursion in Ladakh or Doklam lies in self-reliance ('Atma Nirbharta').[39] It is a bitter truth that for many essential items (including raw material for Covid vaccine), we depend on China. Any worthwhile progress on this may well take decades to accomplish. A serious thought on this needs to be given by the government, including wide-ranging consultations with leaders of industry, experts from finance and economic field, social and political thinkers, along with wide public participation. Only a militarily strong, financially stable and self-reliant India will be in a position to tackle the Chinese challenge in a true sense.

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