

Hedging Between Blocs: India's dual membership in QUAD and SCO as a Coalition Formation Game

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ABSTRACT

This paper applies cooperative and non-cooperative game theory to analyse India's simultaneous membership in two structurally opposed multilateral frameworks: the Quadrilateral Security Dialogue (QUAD) and the Shanghai Cooperation Organisation (SCO). Three nested models are developed. First, representing each grouping as a characteristic function game, this paper computes India's Shapley value across both coalitions and demonstrates, in what we term the Pivot Theorem, that India's marginal contribution to each bloc is uniquely irreplaceable, making full alignment with either coalition strictly suboptimal. Second, India's simultaneous commitment signals are modelled as a two-audience cheap-talk game following Crawford and Sobel (1982); we show that India's consistent abstentions on Ukraine-related UN General Assembly resolutions constitute a canonical semi-separating equilibrium signal, and identify the conditions under which rising signalling costs cause this equilibrium to collapse. Third, applying the Folk Theorem, we derive critical discount factor thresholds above which dual membership is a self-enforcing subgame perfect Nash equilibrium, and identify three structural shocks capable of destabilising it. The central finding is that India's 'strategic autonomy' doctrine is not a fixed foreign policy preference but an equilibrium condition, one sustained by India's pivot value and fragile to well-defined exogenous shocks.

Keywords: coalition formation; Shapley value; signalling games; strategic autonomy; QUAD; SCO; hedging; repeated games

INTRODUCTION

In October 2024, the Indian Navy hosted all four QUAD partners, the United States, Japan, and Australia, for the twenty-eighth edition of Exercise MALABAR off the coast of Visakhapatnam, conducting carrier strike group operations, anti-submarine warfare drills, and maritime interdiction exercises across the Bay of Bengal.¹ Six weeks prior, at the twenty-fourth Shanghai Cooperation Organisation (SCO) Council of Heads of State in Astana, Prime Minister Narendra Modi held bilateral meetings with both President Xi Jinping and President Vladimir Putin within the same diplomatic framework, reaffirming India's participation in an organisation whose membership now spans China,

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Russia, and Pakistan.² No other major power in the contemporary international order simultaneously occupies both tables.

This structural anomaly, India as a full participant in both the primary security coalition directed at containing Chinese maritime expansion and the principal Eurasian platform co-led by China and Russia, has attracted extensive descriptive commentary. Scholarly and policy accounts have variously labelled it 'non-alignment 2.0', 'multi-vector engagement', or 'strategic autonomy'.³ These frameworks share a common limitation: they identify what India does without providing a rigorous account of why the strategy is sustainable or under what conditions it breaks down.

While this paper proposes an alternative view of the issue of India's membership in these organizations, it defines the specific condition under which India is irreplaceable in these organizations, and the various external shocks that could potentially lead to its exit from these organizations. These definitions are made within three models for maximum clarity on the topic.

In Section 4, we treat QUAD and SCO as characteristic function games following Shapley (1953)⁴ and Aumann and Dreze (1974)⁵, computing India's marginal contributions across all possible coalition orderings. We demonstrate, in what we call the Pivot Theorem, that India's Shapley value across the combined player set is strictly greater than that of any other member, and that this maximal leverage is derived precisely from refusing to commit fully to either bloc. In Section 5, we model India's commitment signals as a two-audience cheap-talk game following Crawford and Sobel (1982)⁶, showing that India's systematic abstentions on Ukraine-related UN General Assembly resolutions are a textbook semi-separating equilibrium signal. We identify the threshold at which rising cross-signal inconsistency costs driven by the iCET/TRUST technology initiative tip this equilibrium toward a pooling outcome that erodes India's leverage. In Section 6, applying the Folk Theorem as formalised by Friedman (1971)⁷, we derive critical discount factor thresholds for each bilateral relationship and identify three structural shocks capable of destabilising the equilibrium.

The paper makes three contributions. Methodologically, it is the first paper to apply the Shapley value to India's dual multilateral alignment and the first to use Crawford-Sobel signalling theory to model the credibility of India's simultaneous commitments to opposing blocs. Empirically, it integrates bilateral trade statistics, SIPRI defence expenditure data, and UN voting records into a unified game-theoretic framework. Normatively, it clarifies the conditions under which India's strategic autonomy doctrine remains tenable, an analysis with direct implications for Indian foreign policy and for US, Chinese, and Russian strategy toward India.

LITERATURE REVIEW

Cooperative Game Theory and Coalition Formation

The foundational framework for this paper is the cooperative game with transferable utility, introduced in its modern form by Shapley (1953). A cooperative game (N, v) pairs a finite player set N with a characteristic function $v: 2^N \rightarrow \mathbb{R}$ mapping every coalition $S \subseteq N$ to its worth $v(S)$, representing the total payoff that coalition S can guarantee for itself. The Shapley value $\phi_i(v)$ is the unique allocation satisfying four axioms, efficiency, symmetry, null player, and additivity, and equals each player's expected marginal contribution across all possible coalition orderings.

Aumann and Dreze (1974) extended this framework to environments with an exogenously given coalition structure, demonstrating that players in such environments receive their within-coalition rather than grand-coalition Shapley value. For the present application, the key insight is that a player whose marginal contribution is indispensable across multiple competing coalitions simultaneously possesses maximal bargaining leverage, a result formalised as the Pivot Theorem in Section 4.

Formal Alliance Theory in International Relations

Morrow's (1991) landmark paper proposed that alliances be understood as autonomy-security trade-offs rather than simple capability aggregation. In Morrow's model, a weaker power trades autonomy concessions, basing rights, policy coordination, foreign policy alignment, for security guarantees from a stronger partner, distinguishing symmetric alliances (mutual security exchange) from asymmetric alliances (security-autonomy trade-off).⁸

India's dual membership presents a configuration that Morrow's bilateral model cannot directly address: a single pivotal player facing simultaneous and structurally incompatible demands from two competing alliance structures. Neither QUAD's security framework nor SCO's Eurasian connectivity agenda represents a simple autonomy-security trade; both require India to make credible but inherently contradictory signals of commitment.

Another framework that is complementary to the framework proposed by Snyder (1984) is the alliance security dilemma.⁹ This theory posits that nations in an alliance must balance between the threats of abandonment by the stronger nation within that relationship and the threat of entrapment of the weaker nation into conflicts that it did not wish to engage in. As China is a member of both QUAD and SCO, India faces the possibility of abandonment from both of these organizations as well as the threat of entrapment from them in conflicts that it does not wish to engage in.

Hedging in Asymmetric International Orders

Both Medeiros (2005) and Goh (2007) have developed the concept of hedging as a separate concept from both the use of balancing and bandwagoning strategies.¹⁰ Hedging involves the maintenance of positive relationships and the extraction of benefits from each of the great powers with which a middle power maintains such relationships, without provoking retaliatory actions from either of those powers. Although Goh's study of Southeast Asian nations during the Sino-American rivalry is the closest to the description of India's geopolitical situation, the Southeast Asian nations that Goh studied have considerably fewer resources and intrinsic value to form geopolitical alliances with either of the competing great powers compared to India.

The majority of existing literature on the hedging strategy is descriptive in nature. Such literature describes the actions of hedging actors, but does not provide explanations for why the use of such a strategy is individually rational within the game-theoretic model of international relations, or under what conditions such hedging can become unsustainable. Thus, the purpose of this paper is to contribute to the existing knowledge on the topic of hedging through the use of game theory models of the Shapley value and signalling theory.

CONCEPTUAL FRAMEWORK

Players, Strategies, and Payoffs

The players in the relevant international order are modelled as a strategic environment with player set: $N = \{I, U, J, A, C, R, P, K\}$ where I = India, U = United States, J = Japan, A = Australia, C = China, R = Russia, P = Pakistan and K represents the Central Asian contingent (Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan) treated as a composite actor for analytical tractability.

For each player $i \in N$, he/she is trying to maximize his/her payoff function π_i which is defined in terms of four components:

$$\pi_i = \alpha_i S_i + \beta_i E_i + \gamma_i D_i + \delta_i L_i$$

This is where S_i represents security rent (reduction of expected loss from military threats), E_i represents economic access rent (preferential trade, investment and technology transfer), D_i represents diplomatic leverage (foreign policy posturing capacity to shape multilateral agenda-setting), and L_i represents domestic legitimacy (electoral and nationalist premium from

foreign policy posture). Each country has its own weights $\alpha_i, \beta_i, \gamma_i, \delta_i \geq 0$, such that $\alpha_i + \beta_i + \gamma_i + \delta_i = 1$.

In India, each is a substantive empirical element. Bilateral trade with QUAD members is \$177bn in FY 2024-25 with the United States (\$131.8bn), Japan (\$25.15bn) and Australia (around \$20bn) as key partners. Trade with the core markets of SCO's Eurasia, China (\$127.71bn¹³) and Russia (\$69bn¹⁴) comes to around \$197bn. The dual membership thus offers maximum access rent to the economy that no single-bloc commitment can match. See Figure 1: India is now in a real "two front" security scenario, after clashes at the Galwan Valley in 2020 with China and the persistent threat of Pakistan-sponsored terrorism, which to date has been handled through the SCO's Regional Anti-Terrorist Structure (RATS). The world's most populous democracy and a leading voice of the G77 nations, India's Global South identity is maintained exactly because it hasn't been formally aligned with either power bloc: D_i : India's Global South identity. L_i : India's political consensus on strategic autonomy is rooted deeply in Nehruvian traditions and enjoys a cross-party consensus which comes at non-trivial cost to any government that formally gives it up.

Figure 1: India's Bilateral Trade with QUAD and SCO Members
FY 2024-25 (USD billion)

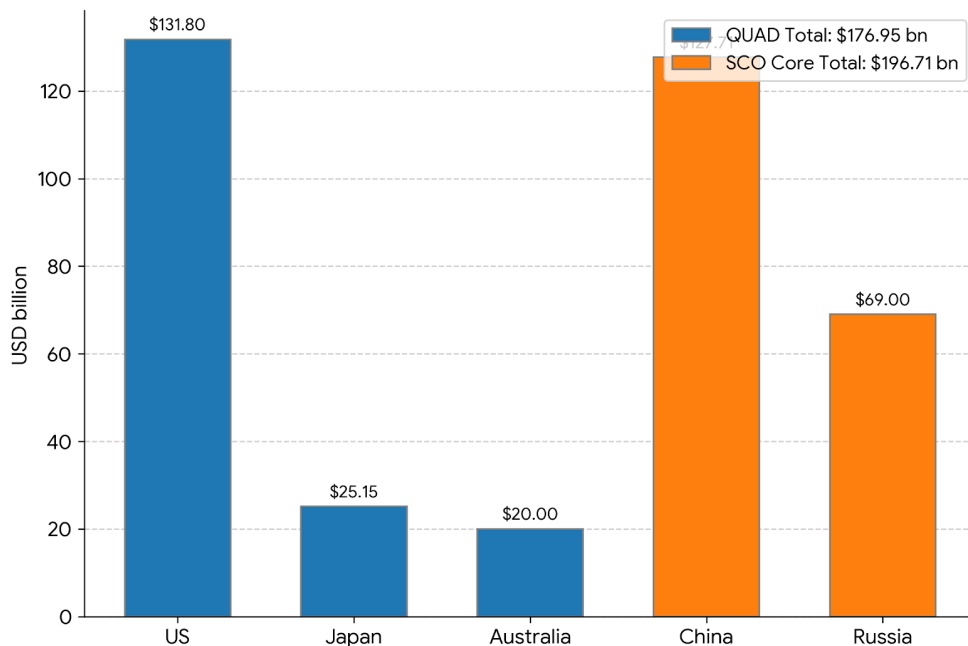


Figure 1: India's Bilateral Trade with QUAD and SCO Members, FY 2024-25 (USD billion)

Three Nested Models

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In Model 1 (Section 4), QUAD and SCO are considered characteristic function games, and the pivot position of India as a result of Shapley value is considered as the structural foundation of the leverage of India. The equilibrium communication strategy of India is modelled in Model 2 (Section 5) as a cheap-talk signalling game by depicting the nature of Indian alliance signals. Model 3 (Section 6) represents India's ties with each bloc in an infinitely repeated game, and uses the Folk Theorem to obtain stability conditions.

Key Assumptions

There are three assumptions underlying the analysis. We assume first that coalition formation has positive-sum effects, i.e., that $v(S \cup T) \geq v(S) + v(T)$ for all $S, T \subseteq N$ and disjoint. The first assumption is superadditivity: $v(S \cup T) \geq v(S) + v(T)$ for all disjoint $S, T \subseteq N$. Second, there are no formal exclusivity clauses in the QUAD Summit Joint Statement of 2021 or SCO Charter. Third, the pressure for exclusivity is modelled as a continuous variable and assumed to be monotonically increasing in the time period 2022-2026.

MODEL 1: INDIA'S PIVOT POSITION

Formal Setup

Definition 1 (Cooperative Game). A cooperative game is a pair (N, v) where N is a finite set of players and $v: 2^N \rightarrow \mathbb{R}$ is a characteristic function satisfying $v(\emptyset) = 0$. A coalition is any subset $S \subseteq N$.

The two principal coalitions in our model are $QUAD = \{I, U, J, A\}$ and $SCO = \{I, C, R, P, K\}$. We assume no exclusivity constraint, so the strategically relevant player set is effectively $N = \{I\} \cup QUAD \cup SCO$.

Definition 2 (Shapley Value). For a cooperative game (N, v) , the Shapley value assigns to each player $i \in N$ the payoff:

$$\phi_i(v) = \sum_{S \subseteq N \setminus \{i\}} \left[\frac{|S|! \cdot (|N| - |S| - 1)!}{|N|!} \right] \times [v(S \cup \{i\}) - v(S)]$$

The term $[v(S \cup \{i\}) - v(S)]$ is player i 's marginal contribution to coalition S , the additional value generated when i joins S . The coefficient $|S|!(|N| - |S| - 1)!/|N|!$ is the probability of the coalition ordering in which S has already formed before i arrives under a uniform distribution over all orderings. The Shapley value is the unique allocation satisfying efficiency ($\sum_i \phi_i(v) = v(N)$), symmetry, the null player property, and additivity.¹⁵

India's Marginal Contributions

We operationalise India's marginal contributions qualitatively, using observable proxies for the strategic value increments $v(S \cup \{I\}) - v(S)$.

India's marginal contribution to QUAD. Define $QUAD-I = \{U, J, A\}$. The marginal contribution $v(QUAD) - v(QUAD-I)$ has three dimensions.

Geographic indispensability. India's coastline spans approximately 7,500 kilometres, providing the only major-power presence along the western Indian Ocean littoral, the theatre through which approximately 80 per cent of global seaborne oil trade transits and an estimated \$5 trillion in annual commercial shipping passes. Without India, QUAD is a Pacific coalition; with India, it acquires continuous deterrence coverage across the Indo-Pacific. No substitution among $\{U, J, A\}$ can replicate this geographic contribution.

Military capability. India's defence expenditure reached \$86.1 billion in 2024, fifth globally, accounting for 3.2 per cent of world military spending, a 42 per cent increase since 2015.¹⁶ India's 1.4 million active personnel, its indigenous ballistic missile programme, and its two operational aircraft carriers (INS Vikrant and INS Vikramaditya) augment QUAD's deterrent posture in ways the Australia-Japan-United States triumvirate cannot self-supply. Japan's defence expenditure, though rising sharply to \$55.3 billion in 2024, the largest annual increase since 1952, remains constitutionally constrained in its expeditionary reach.¹⁷ [See Figure 2.]

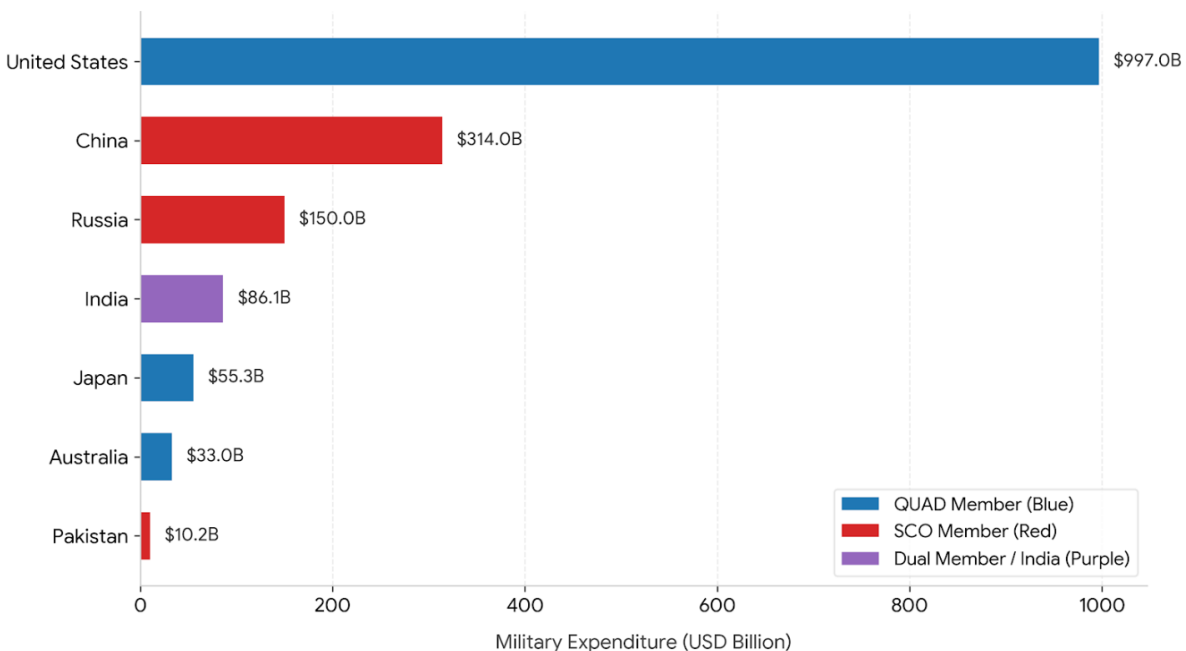


Figure 2: Defence Expenditure of QUAD and SCO Members, 2024 (USD billion, SIPRI)

Global South legitimacy. India's identity as the world's most populous democracy gives QUAD claims to universalism that a narrowly Anglo-Pacific membership cannot assert. India's abstentions on Ukraine-related UNGA resolutions have consistently attracted the co-abstention of several dozen developing economies, demonstrating that India's diplomatic positioning mediates a broader coalition of Global South states.

India's marginal contribution to SCO. Define $SCO-I = \{C, R, P, K\}$. The marginal contribution $v(SCO) - v(SCO-I)$ has two principal dimensions.

Democratic legitimacy and Western hedging. The SCO without India is an overtly Sino-Russian-led bloc whose normative appeal to Western-adjacent states is constrained by authoritarian co-leadership. India's presence allows the SCO to credibly claim multilateral diversity, a crucial source of legitimacy for the organisation's Eurasian governance aspirations. India's nominal GDP of approximately \$3.9 trillion (2024) also materially expands SCO's aggregate economic weight.

India is the only actor through which SCO can plausibly project influence into South Asia, the world's most densely populated subregion and a critical theatre for Chinese strategic competition. Without India, SCO's self-described status as an organisation covering forty per cent of the global population¹⁸ is geographically incomplete and strategically hollow regarding the Indian subcontinent.

Proposition 1: The Pivot Theorem

Proposition 1 (Pivot Theorem). Under superadditivity and the marginal contributions characterised in Section 4.2, India's Shapley value is strictly greater than that of any other player in N :

$$\varphi_I(v) > \varphi_j(v) \text{ for all } j \in N \setminus \{I\}$$

Informal proof. The Shapley value is a probability-weighted average of marginal contributions. India's marginal contribution is strictly positive and indispensable in both QUAD and SCO: no single alternative player can substitute for India's geographic coverage of the western Indian Ocean in QUAD, nor for its South Asian access in SCO. Since India's marginal contributions dominate those of all other players across all coalition orderings in which it appears, the weighted average, the Shapley value, is uniquely maximal. $\square$

The Strategic Implication: Non-Commitment as the Dominant Strategy

The Pivot Theorem implies something counterintuitive that changes the rules of alliance behaviour. If India joined QUAD, it would lead to full alignment of India with QUAD and India's Shapley value would go down by $v(SCO) - v(SCO-I)$. If India joined QUAD, it would fatally undermine the entire concept of the QUAD in a balanced way. The rent-maximising policy is to maintain both marginal contributions.

Let $\phi_I(\text{dual})$ denote India's Shapley value under dual membership, $\phi_I(\text{QUAD-only})$ its value under exclusive QUAD alignment, and $\phi_I(\text{SCO-only})$ its value under exclusive SCO alignment. Under our assumptions:

$$\phi_I(\text{dual}) > \phi_I(\text{QUAD-only}) > \phi_I(\text{SCO-only})$$

The strict ranking $\phi_I(\text{QUAD-only}) > \phi_I(\text{SCO-only})$ reflects the differential security and technology rents available through QUAD's TRUST/iCET framework relative to SCO's primarily connectivity-focused benefits for India's specific preference weights. Crucially, however, both are strictly dominated by $\phi_I(\text{dual})$: India's individually rational strategy is to maintain dual membership for as long as the structural conditions sustaining its pivot value persist.

MODEL 2: DUAL SIGNALLING AND THE CREDIBILITY CONSTRAINT

Setup: A Two-Audience Cheap-Talk Game

We adapt the canonical signalling framework of Crawford and Sobel (1982)¹⁹ to a two-audience setting. The game has three players: India (the Sender, S) and two Receivers, QUAD (R_1) and SCO (R_2). India has private information about its strategic type $\theta \in \Theta = \{\theta_Q, \theta_N, \theta_S\}$, representing QUAD-leaning, Neutral, and SCO-leaning alignment preferences respectively, drawn from a prior distribution $p(\theta)$ that is common knowledge.

Each Receiver takes an action $a_i \in A$, specifically, the depth of strategic engagement offered to India, that affects India's payoff. India sends observable signals $\{m_Q, m_S\}$ to R_1 and R_2 respectively. Critically, signals sent to QUAD are observable to SCO, and vice versa. This cross-observability creates a two-audience coordination constraint that transforms the standard bilateral signalling game.

Costly Signals and the Cross-Inconsistency Penalty

India's signals carry partial costs: diplomatic capital, economic concessions, and institutional commitments made to one audience that constrain behaviour toward the other. Define:

- $c_Q(m_Q)$: cost to India of sending signal m_Q to QUAD, including defence procurement reorientation and technology access concessions
- $c_S(m_S)$: cost to India of sending signal m_S to SCO, including diplomatic gestures toward Russia and SCO institutional investment

The total cost of dual signalling is:

$$C(m_Q, m_S) = c_Q(m_Q) + c_S(m_S) + \gamma \cdot \text{cross}(m_Q, m_S)$$

where $\text{cross}(m_Q, m_S)$ captures the cross-signal inconsistency penalty, the credibility loss from signals that are jointly difficult to sustain, and $\gamma \geq 0$ is a penalty weight that has increased monotonically since 2022.

Equilibrium Characterisation

Definition 3 (Signalling Equilibria). In a Perfect Bayesian Equilibrium (PBE): (a) a separating equilibrium has different Sender types sending different messages, fully revealing type; (b) a pooling equilibrium has all types sending the same message; (c) a semi-separating equilibrium has signals that are informative but not fully type-revealing; (d) a babbling equilibrium is a pooling equilibrium in which messages are entirely uninformative and the Receiver acts on the prior.²⁰

Proposition 2 (Dual Signalling Constraint). A semi-separating equilibrium is sustainable if and only if:

$$C(m_Q, m_S) \leq \phi_I(\text{dual}) - \max(\phi_I(\text{QUAD-only}), \phi_I(\text{SCO-only}))$$

Proof sketch. The rent premium for dual membership on the right hand side is India's next best unilateral alternative. The cost of dual signals is not an issue for India as long as the incremental rent from keeping both audiences' beliefs positive outweighs the total signalling cost. If $C(m_Q, m_S)$ exceeds this threshold, then pooling is India's preferred option, because it will lead to a pooling equilibrium at which neither party will be able to tell the difference between India's positions.

Empirical Illustration: India's Ukraine Abstentions as Semi-Separating Equilibrium

India has voted against all the UNGA votes on Ukraine since February 2022, including ES-11/1 (March 2022, 141 voted in favour, 35 abstained), ES-11/4 (October 2022, 143 voted in favour, 35 abstained), the first-anniversary ceasefire resolution (February 2023, 141 voted in favour, 32 abstained), and the fourth-anniversary ceasefire resolution (February 2026, 107 voted in favour, 51 abstained).²¹ [See Figure 3].

Resolution name	Date	Result(Total Votes in Favour)	India's Vote
Aggression against Ukraine (ES-11/1)	March 2, 2022	141	Abstain
Territorial integrity of Ukraine (ES-11/4)	October 12, 2022	143	Abstain
Principles of the Charter underlying a comprehensive, just and lasting peace in	February 23, 2023	141	Abstain

Ukraine (ES-11/6)			
Situation of human rights in the temporarily occupied territories of Ukraine	December 19, 2024	78	Abstain
Review of Peace Efforts and Humanitarian Assistance in Ukraine	February 18, 2026	135	Abstain

Figure 3, India's Voting Record on Ukraine UNGA Resolutions, 2022–2026

Source: UN Digital Library (digitallibrary.un.org) and News on Air February 2026 report.

This voting record isn't a mere no-decision vote, it's a finely tuned semi-separating equilibrium signal. The abstention is also believable for the recipients because India did not abstain from voting against resolutions that condemn the Russian territorial aggression, thus maintaining its formal adherence to the rules-based international order promoted by the QUAD democratic members.

India abstained from voting for resolutions calling for unconditional withdrawal by Russia, thus retaining its Special and Privileged Strategic Partnership with Moscow and its right to non-Western identity in the SCO bloc, which is Credible to SCO.

Individually rational for India: Both receivers updated their beliefs about India's type in directions that maintained India's bilateral relationships. This is the semi-separating equilibrium, which can be observed: a signal of medium informativeness, set to not incur the cross-inconsistency penalty and provide rent to both audiences.

The Rising Cross-Inconsistency Penalty, 2022–2025

Since 2022, three developments have significantly raised γ , bringing the supremely binding condition of Proposition 2 closer. The iCET and TRUST programmes.

These commitments involve India to be integrated into the U.S. semiconductor supply chain, co-developing artificial intelligence, and having export control arrangements aligned with the U.S. These are structural economic commitments which have no place in maintaining deep defence technology ties with Russia.

Russia's declining share in Indian defence procurement. Russia historically constituted approximately 65 per cent of India's defence hardware inventory. This share has declined to an estimated 50–55 per cent by 2025 as India reorients procurement toward domestic production under Atmanirbhar Bharat and Western-origin platforms. Each procurement reorientation raises $c_S(m_S)$ by reducing India's demonstrable strategic dependence on Russian supply chains. [See Figure 4.]

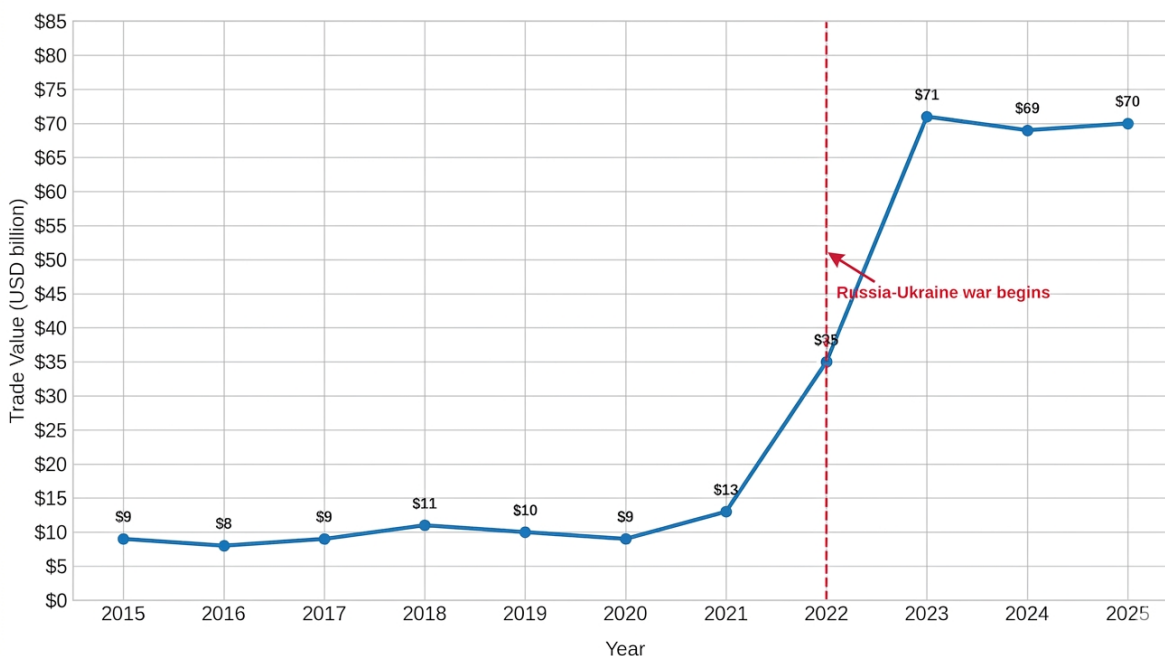


Figure 4: India-Russia Bilateral Trade, 2015–2025 (USD billion)

Pakistan-China military alignment within SCO. Following the India-Pakistan military exchange in May 2025, the SCO framework, which includes Pakistan as a full member, became internally contradictory for India. SIPRI data shows Pakistan's military spending growing 11 per cent to \$11.9 billion in 2025, with new weapons orders placed with China following the exchange.²³ India dispatched a lower-level delegation to the 2025 Tianjin SCO Summit than in preceding years, a revealed-preference signal consistent with a rising c_S penalty.

MODEL 3: REPEATED GAME STABILITY AND THE FOLK THEOREM

Setup

We model India's strategic relationship with each bloc as an infinitely repeated game. In each period $t \in \{0, 1, 2, \dots\}$, India plays a stage game with each bloc and receives per-period payoffs π_Q and π_S from QUAD and SCO respectively. India's intertemporal payoffs are discounted by factor $\delta \in (0, 1)$, representing the weight placed on future relative to current payoffs. A high δ corresponds to a long-horizon strategic perspective; a low δ reflects short-termism induced by electoral cycles or economic crises.

The Folk Theorem Applied

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Theorem 1 (Folk Theorem, Friedman 1971). In an infinitely repeated game, any feasible individually rational payoff profile that Pareto-dominates the stage game Nash equilibrium payoffs can be sustained as a subgame perfect Nash equilibrium for δ sufficiently close to 1.²⁴

Cooperation brings a per-period payoff of $\pi_Q(\text{coop})$ to India's QUAD relationship. If the temptation to defect is too great, exploiting QUAD security guarantees, but with incompatible Russian defence ties, one-period gain $\pi_Q(\text{dev})$. QUAD's punishment is India's long run punishment payoff $\pi_Q(\text{pun})$. The critical discount factor below which QUAD cooperation breaks down is:

$$\delta_Q = [\pi_Q(\text{dev}) - \pi_Q(\text{coop})] / [\pi_Q(\text{dev}) - \pi_Q(\text{pun})]^*$$

An analogous threshold δ^*_S governs SCO cooperation stability.

Proposition 3 (Metastability of Dual Membership). India's dual membership is a subgame perfect Nash equilibrium if and only if:

$$\delta > \delta = \max(\delta_Q, \delta^*_S)^{**}$$

This equilibrium is metastable: self-sustaining over a broad parameter range but susceptible to sudden tipping when shocks raise δ^*_Q , raise δ^*_S , or reduce India's effective δ .

Estimating the Critical Thresholds

Bounding δ_Q .^{*} The fact that India has been continuing with purchases of the Russian S-400 Surface to Air missile system despite threats from the US in terms of the CAATSA act is direct evidence of the temptation pay-off $\pi_Q(\text{dev})$ being non-trivial: India believes it is better to maintain Russian air defence capabilities than to be held to ransom by the United States for non-compliance with CAATSA. But the size of the TRUST initiative commitments (such as a \$500m investment in the Shakti Semiconductor Fab and a cooperation architecture for artificial intelligence) suggests that the costs of being excluded would be high, which means that cooperation in QUAD would not need to be met with extreme patience.

Bounding δ_S .^{*} India has been systematically absent from the SCO statements from endorsing CPEC, and it has been sending lower-level delegations to the forum after India-Pakistan escalation, with a bilateral trade deficit with China of about \$100 billion in FY 2024-25²⁶, indicates that India is already securing the SCO benefits without fulfilling the SCO obligations. This behaviour is suggestive of a relatively high δ^*_S such that for India, the danger of defecting from the priorities of the SCO partners on its border with China is strong and the consequences of defecting are costly and delayed, thereby requiring a patient long run outlook for cooperation to be sustained in the SCO.

Three Destabilising Shocks

The metastability result generates a taxonomy of shocks capable of collapsing the dual membership equilibrium. [See Figure 5.]

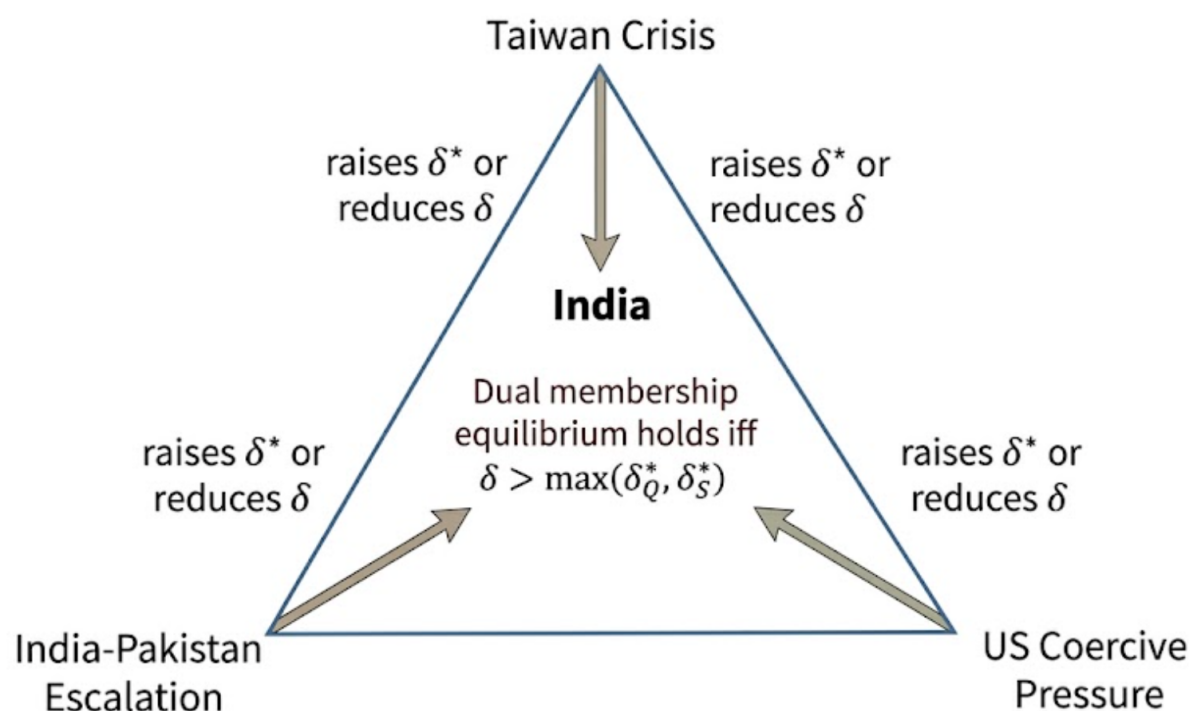


Figure 5: The Metastability Triangle: Three Shocks to Dual Membership Equilibrium

Shock 1: Taiwan crisis. India's bilateral trade reliance on China (\$127.71bn, its biggest trading partner in FY 2024-25²⁷) would also increase the cost of complete QUAD alignment—leading to an impasse in the event of a PLA military move against Taiwan. This is the only shock that poses the highest risk to the stability of dual membership.

Shock 2: India-Pak military escalation. A real stress test for the military exchanges between India and Pakistan was the May 2025 event. If you are an organisation that has Pakistan as a member and consensus as a procedure, then you can't be defending India's security. The lower level Tianjin SCO delegation is consistent with a post conflict period with an effective δ lower than the real one for India.

Shock 3: The pressure of the United States. The bilateral trade rents between India and the United States, $\pi_Q(\text{dev}) > \pi_Q(\text{coop})$, were lowered and India was given increased reasons to defy QUAD commitments under the reciprocal tariff architecture that the Trump administration proposed in April 2025 for India. By creating such a tariff pressure regime on the other hand, the US indirectly undermines the QUAD relationship it claims to be strengthening.

POLICY IMPLICATIONS

The three models come up with similar and surprising ideas about what each main player should do.

For India, the key to success lies in its ability to make valuable contributions to the groups it's a part of. This means India should keep building its military, growing its economy, and being a leader in the Global South. It's like a big team effort, and India needs to be a strong player. The country should keep spending money on its military, about \$86.1 billion, to make sure it's strong and can protect itself. It should also try to grow its economy to \$5-7 trillion by 2030, which is a big goal, but it's doable. And, India should be a good leader in the Global South, which means being diplomatic and making good choices. One thing India should not do is give in to US pressure about the S-400 systems. These systems are important for India's security, and it shouldn't let the US dictate what it can and can't do. As long as there's no other system that's just as good, India should stick with what it has. Also, when it comes to voting on things related to Ukraine, India should be careful. It's like a big balance scale, and if India votes for Western resolutions, it might lose its importance in another group, the SCO. So, India should keep abstaining from voting, at least for now, to make sure it stays valuable to both groups. It's all about finding that balance and being smart about the choices India makes. By doing so, it can stay strong, grow its economy, and be a leader in the world.

When it comes to the United States, a surprising thing is found. If the US tries to force India to fully work with the QUAD group by using tariffs, enforcing CAATSA, or demanding that India only work with them, it actually doesn't make India more committed to the QUAD. This goes against what you might expect to happen. It raises the cross-inconsistency penalty to a point where the semi-separating equilibrium collapses into a pooling outcome in which India's positions lose informativeness to both parties. The result is a less strategically valuable India, one whose positions no longer carry the credibility with Global South states that makes India's QUAD participation uniquely valuable. The United States maximises its QUAD payoff not by demanding exclusivity but by ensuring that India's marginal contribution to QUAD grows faster than its marginal contribution to SCO, through generous technology transfer under TRUST, market access concessions, and active validation of India's global leadership aspirations.

For China. China's SCO strategy of leveraging its dominant position, insisting on CPEC recognition, blocking India-Pakistan dispute resolution, expanding Chinese institutional influence through the Beijing Secretariat, is self-defeating in game-theoretic terms. Marginalising India within SCO reduces India's perceived marginal SCO contribution, lowering India's incentive to sustain SCO membership. China's

payoff-maximising SCO strategy is to actively preserve India's sense of valued participation, by accommodating Indian priorities on connectivity (INSTC over BRI) and counter-terrorism (RATS against Pakistan-linked groups), precisely because India's presence gives SCO the democratic legitimacy that China cannot supply through its own membership alone.

The structural implication for 'strategic autonomy.' The repeated game analysis reveals that India's strategic autonomy doctrine is not a principled ideological commitment, it is a contingent equilibrium condition that holds only when $\delta > \max(\delta^*_Q, \delta^*_S)$. Indian policymakers would be better served by a doctrine that explicitly acknowledges this contingency and institutionalises specific response protocols for the three shock scenarios identified above, rather than presenting strategic autonomy as an unconditional foreign policy principle whose sustainability is independent of external conditions.

CONCLUSION

This paper has applied three complementary game-theoretic frameworks to analyse one of the most consequential structural puzzles in contemporary international relations: India's simultaneous full membership in QUAD and SCO. Characteristic function analysis suggests that India holds the unique position of a pivot player in both coalitions. Such structural circumstances make dual membership individually rational and ensure that alignment with any coalition alone is strictly suboptimal from the point of view of the Shapley value. Application of cheap-talk signalling theory to India's eleven consecutive abstention votes on Ukraine issues at the UN General Assembly suggests that India has managed to maintain a semi-separating equilibrium by producing partially credible signals to two distinct audiences through strategic diplomacy. However, increasing inconsistency costs caused by iCET/TRUST and Russia-India procurement deal realigning are pushing this equilibrium toward its limiting point. According to Folk Theorem analysis, this equilibrium is metastable – self-reinforcing over a wide parameter space but susceptible to a number of structural shocks.

First and foremost, it must be pointed out that India's strategic autonomy as a doctrine is not a foreign policy philosophy proper. Strategic autonomy is rather the Nash equilibrium solution that arises as a result of India's pivot status and can only persist as long as India's contribution to both QUAD and SCO coalitions does not fall below a certain threshold where the blocs could plausibly consider replacing India and India's intertemporal discount factor does not fall below critical levels δ^*_Q and δ^*_S . As long as these requirements persist, dual membership becomes India's dominant strategy. However, changes in either situation will force India to make an explicit foreign-policy decision, which Indian tradition has succeeded in avoiding for almost ten years now.

This paper has three main limitations. First, construction of the characteristic function was purely qualitative; estimation of the Shapley value with quantitative parameters would have required detailed and precise capability data about security outcomes in coalitions which is unavailable in the open source literature to date. Second, the current model assumes unitary rationality; domestic political economy integration into the signalling model could provide for interesting results. Third, the discount factor used

in the Folk Theorem analysis was exogenous; an endogenous δ would have generated additional testable hypotheses.

Notwithstanding these limitations, the paper demonstrates that cooperative and non-cooperative game theory provide uniquely precise analytical leverage on the strategic problems that will define the Asian century. As the international order bifurcates further, between a US-led technology and security architecture and a Sino-Russian Eurasian connectivity framework, how India maintains its pivot position will determine not only Indian foreign policy but the structural character of the emerging multipolar order itself. Game theory does not resolve that question, but it does, as this paper has attempted to show, make it formally tractable.

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¹⁹ Crawford and Sobel (1982), endnote 6. The paper establishes that the number of distinct equilibrium messages in a single-receiver cheap-talk game is bounded by $N^*(b)$, decreasing in b (preference divergence between sender and receiver). In our two-receiver extension, effective divergence is the maximum bilateral divergence, imposing a tighter constraint on informative signalling.

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