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# Is high-intensity conflict escalation inevitable in the future? A two-level game analysis on the causes of US-Iran risky rivalry

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**Abstract**

In recent years, there appears to be a growing consensus among policymakers in both the East and the West, that the decades of global peace after the Cold War has now come to an end, and that the world is facing mounting security risks to the future of humanity. Among those challenges, the ongoing U.S.-Iran conflict poses particularly significant risks to regional and global security, and is closely related to many other contemporary international crises involving European states and their allies, particularly the Russo-Ukrainian War, the nuclear proliferation in Europe, and the military disputes between the Iran-backed Houthis and EU forces. But why has the U.S.-Iran relationship deteriorated so dramatically over the past years, and what are the future risks its presents to the international community? While extensive scholarly works have been conducted to examine the ideological, historical, and geopolitical variables that fuel this observed escalating antagonism, no study to date has formal-modelled the complex interactions between Tehran and Washington into a two-level game. Utilizing an infinitely-repeated game theory approach, this research presents a comprehensive analytical framework that explains how interrelated political factors at both the international and the domestic level jointly shape the dynamic of this bilateral relationship. We contend that the domestic rally effect created by risk-oriented diplomacy, incompatible ideological stances and political values, the increasing polarization within U.S. Congress, and the mounting rivalry between Israel and the Iran-led Axis of Resistance convince policymakers from both sides that their utilities can be maximized in a non-cooperative game. Based on our models, it can be forecasted that there is hardly any chance Washington and Tehran will concede to the other's security demands in the foreseeable future. Thus, the risks of high-intensity conflict escalation due to miscalculation will continue to upsurge in the future.

**Keywords** Future studies, Risk analysis, Forecasting, Global challenges, Formal modelling, U.S.-Iran relations, Two-level game, Strategic bargaining

## Introduction

Nearly five decades after the Islamic Revolution in 1979, the U.S.-Iran relationship is as adversarial and risky as it has ever been [12]. Despite during the Obama presidency there was a small window of opportunities of easing elevated risks and tensions, and normalizing diplomatic relations through tacitly collaborating in the nuclear deal and the combat against the global peace threat posed by the Islamic State of Iraq and the Levant (ISIL), the two states have undergone an increasingly risky confrontation since the outset of

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the Trump administration. In May 2018, former U.S. President Donald Trump opted for tougher Iran diplomacy by imposing new comprehensive sanctions and withdrawing from the multilateral nuclear deal which the U.S. and its European allies (most notably Germany, France and the UK) had agreed on in 2015. In response, Tehran resumed its nuclear development program, suspending its engagement in the Additional Protocol of the Austria-based International Atomic Energy Agency (IAEA). In January 2020, Washington authorized targeted killing of Iranian major general Qasem Soleimani at Baghdad International Airport, which plunged the Middle East into the brink of war. In April 2024, amidst the ongoing Israel-Palestinian war in Gaza, Iran launched an unprecedentedly wide-ranging drone and missile strike against America's arguably closest ally, Israel, in retaliation for its attack on the Iranian consulate in Syria a few days ago. Concurrently, Iran's supreme leader Ayatollah Ali Khamenei warns of further retaliations toward Israel and its Western allies, most prominently, the United States. As such, notwithstanding U.S. President Joe Biden and his European counterparts have pledged to revive the Joint Comprehensive Plan of Action (JCPOA) as a major objective of their contemporary and future Iran policy, the process of re-engaging with Iran to bring it back to the negotiation table has been slow and the hope is fading, if hasn't vanished completely.

What are the driving factors behind this persistent mutual antagonism, and how will it evolve in the future? To date, the majority of existing scholarly works on the animosity between the U.S. as a global hegemony and Iran as a regional power have conventionally focused on the state level, explaining how national narratives, admonitions on terrorism, mutual distrust, misrepresentation and misrecognition, and the traditional power politics have exacerbated rivalry and impeded strategic negotiations between Tehran and Washington [1, 9, 11, 42]. More recently, a smaller but growing body of literature looks below the nation-state level and postulates that domestic politics, such as public opinion changes, the American electoral cycle, political structures of the U.S. Congress and the Iranian Majlis have also contributed to escalating tensions [4, 19]. Theoretically, while all such scholarly arguments provide valuable insights, these analytical frameworks nonetheless treat structural dynamics and domestic bargaining as separate variations and therefore have yet to present an explanation which integrates "the second image" and "the third image" into one theoretically model. This caveat is counterproductive. Because in reality international and domestic politics often interact with each other to jointly influence foreign policy decisions, any model that doesn't account for these important correlated dynamics could be questioned and criticized for over-simplifying real-world international affairs.

To engage with such research gap, this article presents an infinitely-repeated two-level game theory model to analyse the contemporary and future dynamics of U.S.-Iran relations. We develop an actor-specific theory by accounting for domestic political and decision-making factors in both states, along with their strategic bargaining at the international level. Our analysis indicates that the domestic rally effect generated by aggressive foreign policy, incompatible political beliefs and ideologies, the increasing polarization in U.S. Congress, and Iran's growing hostility with U.S. allies in the Middle East are the four major causes of this increasingly dangerous rivalry. First, a risk-oriented Iran diplomacy could generate rally'round the flag effect among domestic audiences, enabling American foreign policymakers to take advantage of the rally effect to boost approval rating at home. In Tehran, a tough stance against the U.S. and its allies is also popular among the general public, and therefore could benefit policymakers through domestic political gains. Second, there is a sharp divergence in political ideology between the Iranians and the Americans on key political issues such as terrorism, Western-style liberal democracy, and the opposition between Zionism/Islam. These incompatible values incentivize foreign policymakers to take a confrontational standpoint towards the other side. Third, an increasingly divided Congress urges U.S. President to pursue short-term gain over long-term gain. Last, the escalating conflict between Israel and the Iran-led *Axis of Resistance* simultaneously decrease the costs for Washington and Tehran to engage in conflict than peace. To forecast, a plethora of inter-related domestic and international factors will likely lead to conflict escalation in the future.

## The domestic-international bargaining *nexus* and the dynamic of U.S.-Iran strategic rivalry

A large and vibrant body of literature in the political science domain has demonstrated that domestic bargaining plays a key role in shaping international relations [13, 20, 26, 33]. Sean Ehrlich finds that domestic institutional changes which shift different interest groups' delegation access to the President cause U.S. trade policy to vary [10]. Souva and Rohde find that cleavages in party elites' opinions render higher level partisanship in congressional foreign policy voting, based on an analysis of foreign policy voting in Congress between 1975 and 1996, hence "foreign policy is also subject to an electoral connection" [39], p. 122).

With increasing scholarly attention to the domestic-international entanglements, the game theory approach,

especially the two-level game modelling, is ideally situated to sort out such sophisticated tangles and to integrate levels of analysis. In fact, a growing body of research has utilized two-level game theoretic models to explain state behaviour (see [21, 29, 41]). In his landmark work which probes the reciprocal causation between domestic and international affairs, Putnam famously notes: "The politics of many international negotiations can usefully be conceived as a two-level game" [31], p. 434).

In the same vein, it is important for contextual research of U.S.-Iran escalation to account for domestic interactions within Iran and the U.S., along with the strategic bargaining process between Washington and Tehran in the international arena. In this article, we use a two-level game theoretic model to capture these dynamics. Here, it shall be pointed out that there are some significant similarities between neoclassical realism (NCR) and our proposed two-level game theoretic model. Specifically, NCR is a school of realism which highlights the importance of the relations between the state and society and of the internal factors, and therefore it differs dramatically from the structural realism which holds a rigid presumption of systemic determinacy and treats states as unitary actors [32]. Notably, while the first generation of NCR still focuses on systemic pressures and uses domestic variables to elaborate the differences between states' behaviours, the second and third generations of NCR have relaxed the core structural realism assumption regarding the clarity of systemic pressures [34, 38]. In fact, more recent developments in NCR now aim to explain international politics rather than merely the foreign policy-making processes of nation-states [38]. Hence, both NCR and two-level game theoretic models propose multi-level analysis approaches to explain the political drivers behind international relations by effectively integrating systemic variables and domestic factors, particularly leader perceptions, cultural elements, domestic political institutions, and state-society relations [34]. In this sense, our two-level game theoretic model can usefully be considered as a mathematical framework that borrows insights and builds on the theoretical "ground" of NCR. Utilizing mathematical approaches, our model attempts to weigh and quantitatively operationalize both the intermediate variables at the national level and systemic incentives and threats to construct a coherent theory.

As such, we choose to construct a two-level game theoretic model to analyse the important political factors that shape the escalating U.S.-Iran risky rivalry. Our model theoretically indicates that there are four major reasons to explain why Iranian and American stakeholders have engaged in an increasingly risk-oriented confrontation, which presents significant risks to contemporary and future global peace and security.

First, employing aggressive foreign policy generates rally'round the flag effects—a substantial upsurge in the incumbent leader's job approval rating which often occurs shortly after dramatic international events involving his country [3, 7, 17, 30]. Such political gain may provide both American and Iranian leaders with strong incentives to engage in international crises as a strategy of portraying strong leadership to their home crowds. Psychologically, significant external risks places the leader in the centre of public attention, symbolizing national strength in the time of crises. As Schubert et al. point out, "mass anxiety responses appear to have been accompanied by a surge in in-group solidarity, patriotism, national cohesion, and support for political institution" [37], p. 560). Ever since the founding of the Islamic Republic in 1979, Western states have imposed comprehensive economic sanctions on Iran in response to the hostage crisis, the Iranian nuclear development programme, and its sponsorship to regional allies which the West generally designates as transnational terrorist organizations [43]. These coercive strategies contributed to deteriorating socio-economic conditions which in turn instigated numerous social unrests, most notably the 2009 Iranian presidential election protests, the 2011–2012 protests started on "The Day of Rage", the 2018 Iranian general strikes, and the more recent nationwide uprising sparked by the death of Mahsa Amini. Inconspicuously, this political turmoil has been eroding the Iranian government's legitimacy and presents a critical threat to its regime survival. Similarly, on the U.S. side, the recent administrations face increasing domestic governance challenges which arguably have placed the American democracy at a dangerous inflection point. Rising inflation, partisan antipathy, public health crises caused by the COVID-19 pandemic, the involvement in strategic competitions with Russia and China, and the declining congressional effectiveness present a plethora of problems to U.S. policymakers. Since the top priority of political regimes would be on maintaining their survival, political elites from both sides could benefit from taking a risk-oriented foreign policy stance towards each other inasmuch as this approach may help create a rally effect to enhance the legitimacy of their political establishment among domestic audiences, even though such risk-seeking strategy may lead to unintended high-intensity global conflicts in the future [35], p. 142).

Second, Washington and Tehran are also separated by a significant divergence in political ideologies and beliefs – that is, incompatible visions for political and religious issues such as transnational terrorism, Western-style liberal democracy and democratization, and the opposition between Zionism/Islam. Critically, America's diplomatic strategy for engaging in the Middle East is guided by

Western-centred liberal ideologies. The domestic governance and foreign policy of the Islamic Republic, on the contrary, are rooted in Shiite Islamist ideology which the Iranian government has been actively spreading to other countries since the 1979 revolution [6]. Indeed, one cannot make sense of the U.S.-Iran rivalry without referring to their clashes in the ideological dimension. For example, Washington has long been accusing and sanctioning Tehran for proving support to Western-perceived transnational terrorist groups, namely, Hamas, Hezbollah, and the Palestinian Islamic Jihad (PIJ), along with others [40]. However, as viewed by Iran itself and many other countries in the international community, these organizations are essentially freedom fighters and thereby cannot be designated as terrorists. Hence, their connections to the Iranian government are principally not state-sponsored terrorism. More broadly, the irreconcilable differences between the American and the Iranian culture have engendered deep concerns in the Iranian society, particularly among religious Muslim communities, who typically consider their religious and political values as threatened by America's expansionary cultural outreach. As noted by Asadzade, "pious Muslims perceive the secular aspects of American culture, such as gender egalitarianism, individualism, and liberty sexual mores, in contrast to their religious lifestyle" [2], pp. 547–548). As such, anti-Americanist sentiment is widespread and prevalent among Iranian Muslim populations due to the perceived cultural invasion, generating significant popular grievances against the West. Such objections strongly motivate the leadership to express hostility to the U.S. in its foreign policy rhetoric and decisions. For example, Iranian leaders have repeatedly framed the U.S. as "the Great Satan" and have warned American cultural invasion as very dangerous in public speeches [2], p. 546).

Third, accounting for the growing polarization in Congress is important to understand U.S. President's foreign policy preferences. The polarization between Democratic and Republican legislators has risen dramatically since the mid-1970s and has peaked at an unprecedented level in recent years [24]. The substantially increasing partisan animosity not only makes it more arduous for legislators to work across the aisles to form bipartisan coalitions, but also pushes the President to confront a more consolidated opposition party [5, 28]. While the President can benefit from leading a more unified and homogeneous fellow party in Congress, stronger cross-party resistance has detrimental effect on the Presidential leadership [28], pp. 271–272). Facing the mounting pressure from opposition party members, the President urgently needs to strengthen his power by gaining higher approval rating [22]. Driven by such urgency, the President purses short-term approval rating boost in his foreign policymaking process. Thus, in the context of U.S. diplomacy towards Iran, the President should increasingly seek to create rally effects through containing Iran using aggressive measures instead of forging a long-term peaceful relationship.

Fourth, the swelling hostility between *the Axis of Resistance* and U.S. allies in the Middle East (i.e., Israel, and previously also Saudi Arabia) in recent years decreases the costs for politicians from both sides to engage in escalating interstate conflict. Historically, the Islamic Republic and Israel have long viewed each other as an adversary for a laundry list of reasons, most prominently the rejection of Zionism/Islam and the competition for regional geopolitical influence. Such outright rivalry has drastically exacerbated over the past decade and has presently reached its peak in consequence of the ongoing Israeli-Palestinian war in Gaza. While rarely directly engaged in large-scale military disputes, Iran resumes its nuclear development program and continues to endorse its allies in Palestine, Lebanon, Yemen, Syria, and Iraq to retaliate against the Jewish state while the Israeli government openly opposes the JCPOA and attacks Iranian-related targets across the Middle East [15, 18, 44]. As such, intensifying tensions between U.S. allies and *the Axis of Resistance* provide rational incentives for Iranian and American politicians to construct a hostile environment.

## The model

### *The game at the international level*

The international stage game between the U.S. and Iran is designed as an infinitely-repeated simultaneous-move matrix game. We assume both the U.S. and Iran choose their strategies independently. They do not passively observe the other player's tactic and respond accordingly. Therefore, we believe it is reasonable to construct the game in an infinitely repeated simultaneous-move setting.

The player set is $I=\{U.S., Iran\}$. Each player has a pure action space $A_i=\{positive, negative\}$. We utilize $p$ and $n$ to denote positive and negative diplomatic strategies and subscripts 1 and 2 to label the U.S. and Iran, respectively. The space of action profile is $A = X_{i\in I}A_i$. We define players' strategies in a single stage game as $s_i$, and the resulting strategy profile is $a$. Each player has a von Neumann-Morgenstein utility function defined over the function of $G, g_i : A \rightarrow R$. $g$ is the players' stage game payoff function. $g = X_{i\in I}g_i$ so that $g(a) = \big(g_1(a), g_2(a)\big)$.

To construct payoffs for both players, we consider the benefits in the economic and military dimensions, which are the players' core state interests. The payoffs, however, are not limited to results of conflicts or trade/nuclear deals between the U.S. and Iran. For example, when conflict occurs, Iran should logically seek to build a stronger military for security purposes. The extra resources

devoted to military building is a unilateral decision made by Iran, and thereby should be counted into its military gain. As long as the gains are generated by the international bargaining process, they are counted as a portion of the payoffs in our game.

If both players choose $p$, they will end up with a relatively peaceful relationship. On the contrary, if both players choose $n$, they will end up with a more hostile relationship in the future. Suppose that one player chooses $p$ while the other plays $n$, they would end up with an exploitable relationship. Economic interests as a consequence of the game are denoted by $\alpha$, and these economic benefits states attain from either a positive or a negative relationship are denoted by $\alpha^p$ and $\alpha^n$, respectively. Military gain is defined as $\beta$ and the respective interests from the two types of relationships are $\beta^p$ and $\beta^n$. Thus, the payoff of the U.S. in a positive relationship is $\alpha_1^p + \beta_1^p$. It turns out to be $\alpha_1^n + \beta_1^n$ under a negative relationship. In an exploitable relationship, the player choosing negative strategy thereby gets $\mu$ and the positive state loses the same amount and gets $-\mu$.

In addition to economic and military interests, there certainly exist a number of other critical factors influencing the U.S. and Iran's foreign policymaking process. To capture those important dynamics, we construct a constant term to represent what both countries gain or lose from their interactions. If both players choose $p$, both of them acquire a payoff defined as $\varepsilon$; if both players choose $n$, they will both get $\theta$ in the future. The game is illustrated in Table 1.

#### *The game at the Iranian domestic level*

The domestic game of Iran consists of two players – Iranian elites and the general public. The domestic interplay between political elites and the public impacts Iran's choice of strategy in the international game. Considering the dominant role of Iranian political elites in the Islamic Republic's foreign policymaking process, the public's influence on the international game manifests itself only through the action of elites. Thus, the future payoff Iran receives from the international game will be the same as the payoff for Iranian elites in the domestic game. Nonetheless, while Iran's political elites may be the final decisionmaker of diplomatic strategies, they will always take the public's preferences into consideration when choosing strategies.

Inasmuch as the Iranian public holds strong adversity against the U.S. due to ideological and religious disparities, in cases where the elites employ negative strategy toward the U.S, it naturally caters to the public's preferences. In this scenario, Iranian elites will receive a bonus in its payoff. Furthermore, given the current political tensions between Iran and the U.S. over economic sanctions and nuclear issues, choosing negative strategies may create a domestic rally effect among the home crowds. Consequently, Iranian elites will receive an additional increase in their payoff for choosing negative strategy in the future.

We use $\omega$ to capture the two-fold bonus in payoffs received by Iranian elites from playing negative. The international game between the U.S, and Iran after accounting for Iran's domestic game is presented in Table 2.

#### *The game at the U.S. domestic level*

Similarly, the U.S. domestic game is essentially an extension of its international game. The player set $I'$ is {President, Congress}. The President and Congress make moves sequentially because only after the President negotiates a treaty with or imposes sanctions on a foreign state can Congress review the strategy and reflect on it. Iran chooses between positive and negative. The President chooses from action set $A'_{pr} = \{positive,\ negative\}$ while Congress chooses from action set $A'_{co} = \{approve,\ disapprove\}$. We use $A$ and $D$ to denote the approval and disapproval strategy of Congress, respectively. The strategy chosen by the President in the international game must be the same strategy he proposes to Congress, and Congress will always be able to correctly infer the President's future strategy.

Since both the President and Congresspersons are self-interest players, their payoffs are defined as the fluctuations in domestic public support. The approval rating for the President is a function involving two independent variables. First, benefits from the international game. America's diplomacy towards Iran has a non-trivial effect on its military and, to a less extent, economic conditions. If the U.S. and Iran forges a more peaceful relationship and bring their comparative advantages into full play, they will end up with more security and economic benefits in the future. On the contrary, if they maintain an increasingly conflictual relationship, comprehensive

**Table 1** International bargain between the U.S. and Iran

| | | Iran | |
|---|---|---|---|
| | | **Positive** | **Negative** |
| U.S | Positive | $\alpha_1^p + \beta_1^p + \varepsilon, \alpha_2^p + \beta_2^p + \varepsilon$ | $-\mu, \mu$ |
| | Negative | $\mu, -\mu$ | $\alpha_1^n + \beta_1^n + \theta, \alpha_2^n + \beta_2^n + \theta$ |

**Table 2** Updated international bargain between the U.S. and Iran

| | | Iran | |
|---|---|---|---|
| | | **Positive** | **Negative** |
| U.S | Positive | $\alpha_1^p + \beta_1^p + \varepsilon, \alpha_2^p + \beta_2^p + \varepsilon$ | $-\mu, \mu + \omega$ |
| | Negative | $\mu, -\mu$ | $\alpha_1^n + \beta_1^n + \theta, \alpha_2^n + \beta_2^n + \theta + \omega$ |

economic sanctions should continue to incur costs on both the sender and the target state. In the military dimension, if the U.S. and Iran forge a positive relationship, they would logically harbour less incentives to construct their regional military forces as colossal as they would be in a negative future relationship. Second, in terms of the rally effect, if the President emphasizes on the Iran threat as an archenemy of the U.S., he will end up with a rally'round the flag effect at home.

The President's payoff is also contingent on the Congress. If Congress endorses the strategy chosen by the President in the international game, the President's payoff is to be decided by the two factors listed above. The Congress's payoff is only dependent on payoffs for the U.S. from the international game. However, only when Congress chooses approval, the President's strategy can transform into the overall U.S. foreign policy. We assume if the President chooses a strategy and Congress disapproves, then the overall U.S. foreign policy will remain unchanged. In that scenario, payoffs for both the President and Congress would be zero. Yet, inasmuch as the President chooses negative strategy, he would still be able to benefit from the rally effect in the short future.

To map the international game's results into the U.S. domestic game, we use notations $\gamma_{s_2}$ and$\omega_{s_2}$. $\gamma_{s_2}$ denotes U.S.'s payoff under the circumstance where the President chooses positive strategy in the international game and $s_2$ represents Iran's corresponding strategy. The realization of $\gamma_{s_2}$ is either $g_1((\mathrm{p}, \mathrm{p}))$ or$g_1((\mathrm{p}, \mathrm{n}))$. The first entry represents U.S. strategy, and the second is the Iranian elite's strategy. $\omega_{s_2}$ represents payoff for the U.S. in the international game where the President chooses negative strategy. The exact outcome for the international game would be (n, p) or (n, n). Moreover, the notation for rally effect is φ. The President should benefit from rally effects so long as he plays negative in the international game. The U.S. domestic game is illustrated in Table 3.

**Table 3** Domestic bargain between the president and congress

| | | Congress | |
|---|---|---|---|
| | | **Approval** | **Disapproval** |
| President | Positive | $\gamma_{s_2}\gamma_{s_2}$ | 0, 0 |
| | Negative | $\omega_{s_2} + \varphi, \omega_{s_2}$ | φ, 0 |

Key:

$$\gamma_{s_2} = \begin{cases} \alpha_1^p + \beta_1^p + \varepsilon & s_2 = p \\ -\mu & s_2 = n \end{cases}$$

$$\omega_{s_2} = \begin{cases} \mu & s_2 = p \\ \alpha_1^n + \beta_1^n + \theta & s_2 = n \end{cases}$$

φ is a constant.

After incorporating the Iranian elites' moves into the U.S. domestic game, we draw the game tree as the following (Fig. 1).

#### *Relations between variables*

From a rational choice perspective, both the U.S. and Iran harbour strategic incentives to deviate from the outcome (p, p) in the future, which is the Pareto-superior result, to exploit the other side. Paradoxically, suppose they simultaneously choose negative strategy out of egoism, they would only end up with a mutual-disadvantageous outcome. As such, even though it may be the Pareto-superior for the United States and Iran to develop a mutual-beneficial relationship to alleviate security concerns and facilitate trade exchange, this relationship is sometimes unstable. In order to satisfy the prisoner's dilemma setting, the relationship between variables involved in the game is set as the following:

$$\varepsilon > 0 > \theta \tag{1}$$

In accordance with the classic prisoner's dilemma setting, if both parties choose to de-escalate tensions by adopting peaceful strategies, they will gain future benefits from cooperation. On the contrary, if both states choose negative strategy and exploit each other, they will suffer from an antagonistic environment and bear the cost of losing potential cooperative opportunities.

$$\alpha^p > \alpha^n, \beta^p < \beta^n \tag{2}$$

In the economic dimension, both the U.S. and Iran benefit from a positive relationship. On the contrary,

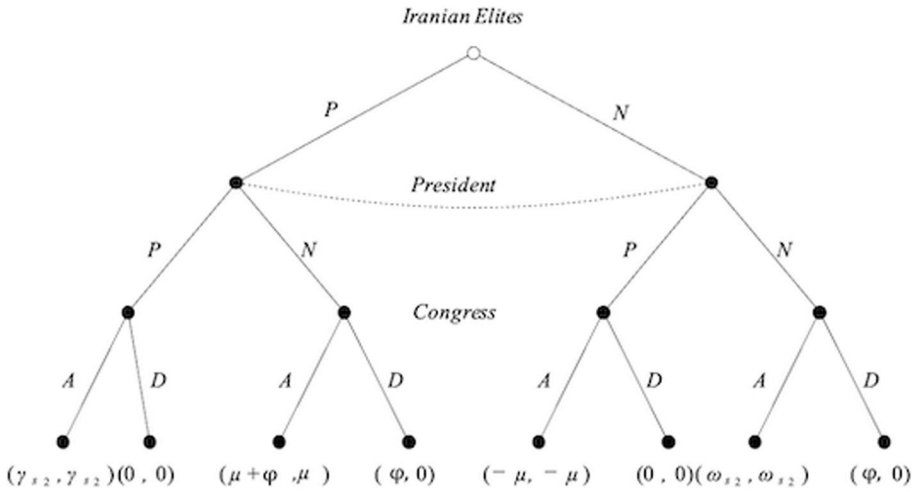


**Fig. 1** Updated International Game with Domestic Components. Note, $\gamma_{s_2=p} = \alpha_1^p + \beta_1^p + \varepsilon$; $\omega_{s_2=n} = \alpha_1^n + \beta_1^n + \theta$. As Figure 1 illustrates, the `›Iranian elites move first. Being unaware of Iran's strategy, the U.S. President makes foreign policy decisions, and then Congress chooses to either endorse or oppose the Presidents' decision. The payoffs listed at the bottom of the figure are payoffs for the President and the Congress, respectively

a negative relationship has detrimental welfare effects. Nevertheless, in a hostile and competitive atmosphere, both countries face self-perceived security threats and thereby have strong incentive to build stronger military forces in the region. Military forces in both countries thus benefit from a negative relationship between the U.S. and Iran.

$$0 < \alpha_1^p + \beta_1^p + \varepsilon, \alpha_2^p + \beta_2^p + \varepsilon < \mu \tag{3}$$

$$-\mu < \alpha_1^n + \beta_1^n + \theta, \alpha_2^n + \beta_2^n + \theta < \mu \tag{4}$$

According to the prisoner's dilemma setting, the party acting benignly will be exploited by the other side which chooses a more self-interest strategy. The country which exploits the other side by choosing a negative strategy receives a benefit larger than it would otherwise receive in a mutual-beneficial relationship in this single term. Therefore, the U.S. and Iran will achieve higher payoffs if they choose negative strategies while the other player chooses positive, and they should have no intention to deviate from the only Nash equilibrium strategy set, (n, n), because they cannot be better-off by shifting their own strategies to positive given that the other side would still play negative.

$$\alpha_1^n + \beta_1^n + \theta < \alpha_1^p + \beta_1^p + \varepsilon \tag{5}$$

$$\alpha_2^n + \beta_2^n + \theta < \alpha_2^p + \beta_2^p + \varepsilon \tag{6}$$

The payoffs from the (p, p) outcome is Pareto-superior. On the one hand, the economic gain from a cooperative relationship is far greater than the military loss. On the other hand, the economic loss from a negative relationship is also far greater than the military gain. If the U.S. and Iran could maintain a mutual-beneficial relationship and bring their comparative advantages into full play, they would have more to gain than in a mutual- exploitable relationship.

$$\varphi > 0 \tag{7}$$

The rally effect should naturally be a positive value inasmuch as it is essentially a unifying effect that increase the incumbent leader's approval rating among the general public. In other words, adopting an aggressive foreign policy stance helps the incumbent to consolidate his political power.

$$\omega > 0 \tag{8}$$

## Solving for the game

### *International game*

Suppose the game between the U.S. and Iran happens only once, it is apparent that both parties, anticipating their opponent's behavior, would choose the Nash equilibrium strategy and play *n*.

According to the Folk theorem, the infinitely-repeated two-level game could have an infinite number of subgame perfect Nash equilibrium, depending on how each player values the future [8, 14]. We use a discount factor δ to represent how players weigh their payoffs in the future,$\delta \in (0,1)$. We are primarily interested in two types of equilibriums. First, the grim trigger strategy where the

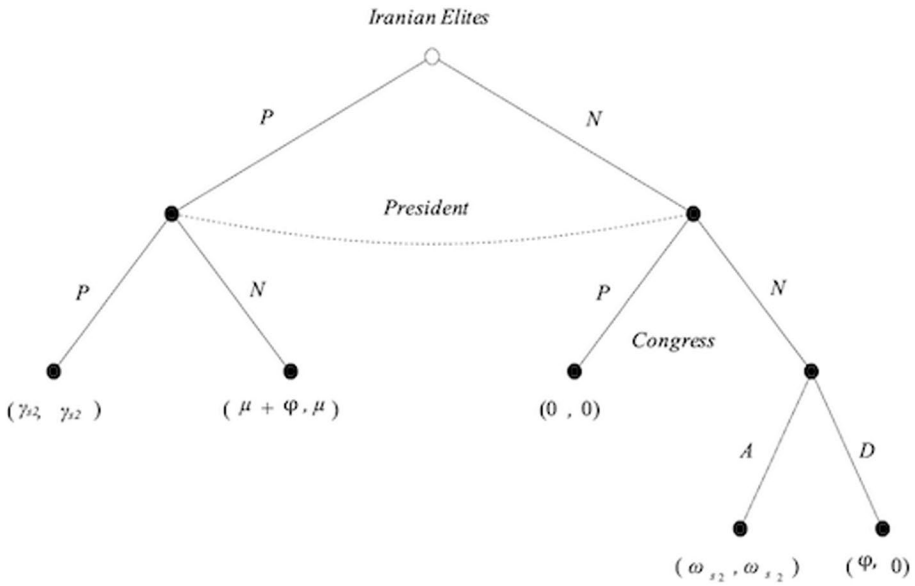


**Fig. 2** Reduced Form of the Domestic Game. Note that $\gamma_{s_2=p} = \alpha_1^p + \beta_1^p + \varepsilon$; $\omega_{s_2=n} = \alpha_1^n + \beta_1^n + \theta$

U.S. and Iran both play *p* until one party deviates. Second, both the U.S. and Iran consistently choose strategy *n*. Importantly, two questions reveal themselves: (1) what factors influence how the U.S. weigh the future and (2) what conditions does δ need to meet in order for both players to choose peace rather than conflict?

*Proposition 1*: If both players are sufficiently patient, action profiles that are not Nash equilibrium of the stage game can be reached. If $\delta_1 \geq \frac{\mu-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu-\left(\alpha_1^n+\beta_1^n+\theta\right)}$, it could be an equilibrium strategy profile that both players keep choosing positive (See Appendix I for proof).

*Proposition 2*: Both players playing negative is the Nash equilibrium of the stage game. It is also a sub-game perfect Nash equilibrium for the U.S. and Iran to play negative for their entire action profiles (See Appendix I for proof).

Based on proposition 1, we can calculate under what circumstances would Tehran and Washington play positive until one player deviates.

### *Domestic game*

Now we move on to analyze the sub-game perfect Nash equilibrium of the domestic game by incorporating the payoffs from the international game. Since the four sub-games for Congress are all perfect information games, we reduce the games into the two following matrices using backward induction to eliminate irrational actions of Congress [27]. When the strategy set at the international game is (p, p), Congress will choose to approve since, by our assumption, $\alpha_2^p + \beta_2^p + \varepsilon > 0$. By the same reasoning, when the strategy set in the international game is (p, n) and (n, p), Congress will choose "disapproval" and "approval", respectively. However, our assumptions do not specify the optimal strategy for Congress at the (n, n) action profile. It requires discussion by cases. One case is $\alpha_1^n + \beta_1^n + \theta \geq 0$, in which the Congress approves. Nevertheless, if $\alpha_1^n + \beta_1^n + \theta < 0$, the Congress will disapprove. The reduced form of the domestic game is illustrated in Fig. 2.

(a) Case 1.

If $\alpha_1^n + \beta_1^n + \theta \geq 0$, Congress will choose approval when the international game arrives at the (n, n) result. The game can be reduced into Tables 4 and 5. Since we are interested in how the domestic game affects U.S. foreign policy decisions in the international bargaining, we incorporate the domestic interactions between the President and Congress into the international game between the U.S. and Iran.

After taken the domestic game into consideration, the two sub-game perfect Nash equilibriums in the international game still hold, but the conditions which the time coefficient must satisfy in order for the President to choose positive have altered.

*Proposition 3*: When a negative relationship with Iran brings about sufficiently high economic and military benefits to the U.S., Congress may approve the Presi-

**Table 4** International bargain between the U.S. and Iran when congress approves

| | | Iran | |
|---|---|---|---|
| | | **Positive** | **Negative** |
| U.S | Positive | $\alpha_1^p + \beta_1^p + \varepsilon, \alpha_2^p + \beta_2^p + \varepsilon$ | 0, 0 |
| | Negative | $\mu + \varphi, -\mu$ | $\alpha_1^n + \beta_1^n + \theta, \alpha_2^n + \beta_2^n + \theta$ |

**Table 5** International bargain between the U.S. and Iran when congress disapproves

| | | Iran | |
|---|---|---|---|
| | | **Positive** | **Negative** |
| U.S | Positive | $\alpha_1^p + \beta_1^p + \varepsilon, \alpha_2^p + \beta_2^p + \varepsilon$ | 0, 0 |
| | Negative | $\mu + \varphi, -\mu$ | $\varphi$, 0 |

dent's proposal to take a negative strategy towards Iran. Foreseeing that, it becomes more likely for the President to play negative in the international game because he can gain an extra rally effect in the domestic game. The discount factor needs to satisfy a more restrictive condition in order for the President to play positive. $\delta_2 \geq \frac{\mu+\varphi-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu-\left(\alpha_1^n+\beta_1^n+\theta\right)}$ (See Appendix II for proof).

(b)Case 2.

If $\alpha_1^n + \beta_1^n + \theta < 0$, the Congress will choose disapproval when the international game arrives at the (n, n) result. The international game between the U.S. and Iran can be reduced into the following table.

*Proposition 4*: When the cost of further confrontation with Iran is too high, the Congress will disapprove the President's combative Iran diplomacy. Congress's disapproval will sway the decision of the President. The President is now more likely to play positive in line with the Congress's move (See Appendix II for proof).

## Discussion of results

The international game yields two important sub-game perfect Nash equilibriums. According to the classic prisoner dilemma's setting, both countries playing negative is the only Nash equilibrium for a single period. Nevertheless, by extending the horizon of the game to infinity, it is possible for the U.S. and Iran to simultaneously play positive, providing that the time coefficient satisfies a certain condition specified above.

After taken the domestic game into consideration, two major changes take place in the international game. First, the President may choose negative strategy for short-term approval rating increase inasmuch as the rally effect could provide the President with rational incentives to deviate from the positive strategy. Second, in the domestic game, Congress can observe the President's decision and then makes its own move. The sequential nature of the game modifies the President's strategy. Knowing that Congress will move after him, the President may use backward induction and take Congress's strategies into consideration while designing his policy. The domestic game modifies the President's payoff from the international bargaining with Iran.

Since the U.S. has been overwhelmingly taking a combative stance towards Tehran in recent years, we provide a framework to analyse the incentives of the President and Congress to choose negative and approval, respectively. When will the President be willing to cooperate with Iran by choosing positive strategy? Combing the results from both games, we answer this question on a case-by-cases basis. First, when $\alpha_1^n + \beta_1^n + \theta \geq 0$, the time coefficient must satisfy $\delta_2 \geq \frac{\mu+\varphi-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu-\left(\alpha_1^n+\beta_1^n+\theta\right)}$. Second, when $\alpha_1^n + \beta_1^n + \theta < 0$, the time coefficient must satisfy $\delta_3 \geq \frac{\mu+\varphi-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu}$.

Consequently, whether the President chooses to cooperate with Iran depends on how he weighs the future (time coefficient), the benefit from cooperating with Iran ($\alpha_1^p + \beta_1^p + \varepsilon$), the extra gain from exploiting Iran ($\mu$), the cost from competing with Iran ($\alpha_1^n + \beta_1^n + \theta$), and the rally effect ($\varphi$). Here, the time coefficient is the most pivotal variable in our model inasmuch as it determines under what conditions will the U.S. and Iran play positive. If due to some variable changes, the time coefficient needs to satisfy a more restrictive condition in order for the U.S. to choose positive, we explain why the U.S.-Iran relationship moves towards negative.

Since we focus on explaining the deteriorating relationship between the U.S and Iran over the past years, it is reasonable to assume that the extra gain from exploiting Tehran is not long-lasting and the temporary gain does not provide enough compensation for the U.S. in the long-term. After noticing U.S.'s exploiting strategy in

one term, Iran will immediately retaliate in the next term, which means the extra gain will only last for one term. Nevertheless, the bargain between the U.S. and Iran may continue in the long run. As such, we offer our explanation for why the U.S. has been adopting a negative policy towards Iran in three long-term angles:

First, the President places less weight on the future. If the President is only concerned about his gain in a single term (or in a very limited number of terms), he may be more inclined to choose the Nash equilibrium strategy in a single term, which is the negative strategy in the prisoner dilemma setting. In the international game, only when $\delta_1 \geq \frac{\mu-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu-(\alpha_1^n+\beta_1^n+\theta)}$, the grim trigger strategy is a sub-game perfect Nash equilibrium, i.e., the U.S. and Iran both play positive and harbour no incentive to deviate. There might not exist a clear-cut line between cooperation and competition in reality, but the President's perception of short-term versus long-term future gains obviously has a marginal effect on the design of his Iran diplomacy.

Second, the U.S. benefits less from collaborating with Iran and suffers less by confronting Iran. Consider the equation, $\delta_1 \geq \frac{\mu-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu-(\alpha_1^n+\beta_1^n+\theta)}$, the value of the discount factor depends on how the U.S. benefits from cooperating with Iran or suffers from competing with Iran. On the one hand, if the U.S. benefits less in a positive relationship, the numerator will increase. On the other hand, if the U.S. suffers less in a negative relationship, the denominator will decrease. In either scenario, it is more difficult for the time coefficient to satisfy the necessary conditions for mutual-cooperation, and thereby makes it less likely for the President to act positively.

Third, the rally effect plays an important role in shaping the President's foreign policy decision. If the President predicts that he can benefit from domestic rally effects after choosing a negative strategy, he will have stronger incentives to deviate. If Congress believes that a negative relationship with Iran will yield more benefits than holding onto the status quo, Congress will support the President's decision. In such scenario, the conditions that the time coefficient must satisfy in order for the President to play positive is more restrictive than that in a pure international game, namely $\frac{\mu-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu-(\alpha_1^n+\beta_1^n+\theta)} < \frac{\mu+\varphi-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu-(\alpha_1^n+\beta_1^n+\theta)}$. On the other hand, if Congress does not approve the President's negative strategy and chooses disapproval, it will provide the President with more rational incentives to hold on to a positive strategy. $\frac{\mu+\varphi-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu-(\alpha_1^n+\beta_1^n+\theta)} > \frac{\mu+\varphi-\left(\alpha_1^p+\beta_1^p+\varepsilon\right)}{\mu}$. The time coefficient conditions are easier to satisfy in this case than in the case where Congress approves the President's negative policy.

In addition, it is important to account for the Congress's decisions. Only if Congress chooses approval and the President plays negative will the overall U.S. foreign policy shift towards intensifying confrontation. Importantly, the Congress's choice depends on its perception of whether engaging in a negative relationship with Iran will yield a positive influence on its approval rating, that is, whether $\alpha_1^n + \beta_1^n + \theta$ is larger than 0.

## Conclusion: does US-Iran conflict risk escalation in the future?

According to the World Economic Forum's *Global Risk Report 2024* [45], interstate conflict features among the most severe global risks (others include climate change, social polarization, cost-of-living crisis) [16, 23, 25, 36, 46] facing the world today. Over the past years, it is obvious that U.S.-Iran relations have been shifting towards increasing risks. This poses an important question for scholars and policymakers: what are the fundamental causes of such intensifying antagonism, and how will such conflict evolve in the future?

In this article, utilizing a two-level game theoretic model, we investigate how the observed confrontation is fuelled by interconnected international and domestic bargaining processes. Our analysis suggests that the interactions of the "second image" and the "third image" encourage policymakers to take a non-cooperative strategy. Dynamics at home and at abroad explain why both countries have been acting more risk-seeking towards each other.

Our research begs the question of how bargaining at the two levels will affect the direction of this relationship in future years. What is likely to be the future path of the U.S-Iran relations? It is clear that the future trajectory of the Iran-U.S. relationship will have a profound influence on international security in the Middle East, and more generally, the globe. If both parties strive to soften their foreign policy strategies, the two states will contribute to the region with sustainable economic growth and efficient de-escalation of interstate conflict. Conversely, if Washington and Tehran continue to view each other as threats and act more aggressively, future diplomatic and military frictions are likely to occur.

Unfortunately, our analysis points to a displeasing future inasmuch as it suggests that even though there may exist some vectors that tend to push this relationship towards peaceful settlement, the power of risk-oriented forces overcomes the strength of peace-oriented forces. This implication of our study is particularly worrisome not only because it tends to make a pessimistic prediction but also because it indicates that the

deteriorating tendency of this relationship is deeply rooted in both domestic and international politics. Specifically, U.S. and Iranian policymakers carefully evaluate their utilities in different scenarios, and eventually they find themselves better-off when this bilateral relationship risks escalation. In other words, even though economic and counterterrorism collaborations can increase policymakers' utility, the volume of increased utility simply cannot exceed their gain in a negative game. As a result, it can be predicted that both states will go to great length to confront each other. In this risky process, the possibility of conflict escalation due to miscalculation will likely upsurge in the future.

## Supplementary Information

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Supplementary Material 1.

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## Publisher's Note