Joshua Phillip Walcott*

Oil, Power, and Strategy: A Game Theory Analysis of Geopolitical Interactions in the Guiana Region

Introduction

Northeastern South America is known as the Guiana region and is geographically located between the Orinoco River in the northwest and the Amazon River in the south. Recently, the region has become a focal point of international interest due to the discovery of significant oil and gas reserves. The country of Guyana presents a notable case, with estimated recoverable oil reserves of over 11 billion barrels (U.S. Energy Information Administration, 2023).

The discovery of these reserves has significantly boosted Guyana's economic prospects, with an average GDP growth of almost 40% since 2019 (Macrotrends, no data). On the other hand, the discovery has intensified a long-standing territorial dispute with Venezuela over the Essequibo region (Pruitt and Carnevale, 1993, pp. 112–121; Geneva Agreement, 1966) and has witnessed a geopolitical game involving Guyana, Venezuela, Brazil, and the United States of America (USA). Each actor involved has specific interests, ranging from territorial integrity, territorial conquest, and regional stability to access to extractable oil reserves – all of which the paper will elucidate.

*   Lazarski University in Warsaw, e-mail: joshuapwalcott@gmail.com.

Map 1.

Guyana's disputed region

Venezuela

Colombia

Ecuador

Peru

Guyana

Suriname French Guiana

Brazil

Essequibo River

Guyana's exclusive economic zone

Oil field (8 billion barrels)

The paper will address the following:

1. How do the strategic interactions between the key players (Guyana, Venezuela, Brazil, and the United States) shape the geopolitical landscape of the Guiana region?
2. What role do oil and gas resources play in this context?

The analysis will explore the payoffs and incentives for each of the named players as they contend with dynamics that include territorial disputes, resource control, and external intervention. The changing nature of the studied environment necessitates a framework for understanding behaviours and possible outcomes. In order to ascertain these shifting dynamics, the paper forwards game theory as the methodological framework.

Game theory 'provides a structured framework for analysing decision-making processes in such contexts, offering insights into the strategies that actors may adopt to maximize their payoffs in terms of security, economic gain, and political stability' (Ordeshook, 1986, pp. 203–242). By modelling the interaction between Guyana, Venezuela, Brazil, and the USA, the paper identifies the strategic choices available to the named players and explores hypothesised equilibria. The equilibria that may emerge from the game can be cooperative or non-cooperative.

Game theory is chosen as the methodology in this context because it allows for an examination and modelling of the zero-sum aspects of the Guyana–Venezuela territorial dispute and the potential for cooperative outcomes (Ordeshook, 1986, pp. 203–242). In

this zero-sum game, one country's gain is another country's loss; however, energy-sharing agreements can benefit all involved players. The involvement of the USA adds complexity to the game, as the country's strategic interests lie in diversifying oil sources away from OPEC and limiting China's growing influence in South America. Conversely, Brazil, as the preeminent power in the region, models itself as a regional stabiliser, 'this indicates Brazil's strategic efforts to maintain regional peace and stability, often independently of direct economic interests' (Hakim, 2000, pp. 42–55). This research is important for articulating newly relevant dynamics in the Guiana region, as well as their broader implications for global energy markets and geopolitical stability. As such, there is increasing importance placed on alternative oil and gas sources in the global economy, particularly in a context where Russia's invasion of Ukraine and the mutual hostility between Iran and Israel are central features. In this light, Guyana's concentration of oil reserves in a region claimed by Venezuela – which is itself facing internal challenges – means that the choices made by the countries involved will have consequences for the wider world.

The research is organised following a review of similar literature and an elaboration of the applied methodology in the section titled 'Game Theory Framework', where the players in the game, their strategies, and payoffs are defined. Next is 'The analysis of the Guyana game', with specific simulations, namely the Guyana–Venezuela territorial dispute and Brazil's mediation efforts, both studied through the lens of game theory.

This is followed by a section titled: 'The implications for policy', where one makes recommendations for game strategies that focus on how each country may navigate the landscape to maximise payoffs. In the end, the conclusion brings together the findings and presents a future-oriented perspective on how the dynamics of Guyana's oil and gas futures may evolve.

Literature review

Game theory is a cornerstone in the study of international relations, especially in ascertaining decision-making in potential conflicts and the competition over resources. Thomas Schelling's work on bargaining (1960, pp. 101–121) and Robert Jervis' work on the security dilemma (1978, pp. 65–87) are central to the application of game theory in international relations. The prisoner's dilemma and stag hunt concepts are applicable to this research, as they aid in explaining how a country 'navigates cooperation and conflict, with each actor aiming to maximise their payoffs while considering the strategies of others' (Schelling, 1960, pp. 101–121; Jervis, 1978, pp. 68–87). In a game like the one forwarded in this paper where oil resources are contested, Game Theory offers a mechanism to ascertain the behaviour of the countries involved. In contrast, Turocy and von Stengel's research highlights 'how states often pursue short-term gains in non-cooperative scenarios,

which can lead to suboptimal outcomes for all involved, particularly when trust between actors is low' (2001, pp. 56–78). What Turocy highlights is the need for Game theory mechanisms to examine the competition over oil rich regions.

Oil and gas politics in South America

Terry Lynn Karl has conducted extensive research on the 'resource curse and shows how countries like Venezuela, with abundant oil reserves, often face heightened internal and external conflict' (Karl, 1997, pp. 20–45). There is a certain inherent volatility in managing oil and gas resources which has led to both political instability and economic prosperity.

As Harold Trinkunas notes, 'Venezuela has historically used its oil wealth to assert dominance in regional disputes, including its ongoing claim over the Essequibo region' (2005, pp. 45–62). On the other hand, Guyana's oil discovery is historically novel for the country, which in turn has transformed its geopolitical relevance overnight. Anthony Bryan observed that 'the discovery has attracted substantial foreign investment and increased the stakes in its territorial dispute with Venezuela' (2004, pp. 103–122). The discovery of oil and the simultaneous growth, coupled with external tensions seen in similar cases, is also reflective of Guyana's emergence as a new oil producer.

Territorial disputes and resource conflicts

International relations is replete with examples of territorial disputes exacerbated by the discovery of oil reserves. The Guyana–Venezuela dispute is another example of a dormant territorial conflict coming to the fore after the discovery of oil. As Paul Collier and Anke Hoeffler show in their research, 'disputes over resource-rich territories are more likely to escalate, particularly when one or both parties view the territory as vital to their economic survival' (2004, pp. 90–112). In the case of Venezuela, its claim to the Essequibo region of Guyana can be analysed as an attempt to shore up domestic support and rejuvenate its economy, while Guyana seeks to increase and maintain investments. Beth Simmons articulates the difficulty in resolving such conflicts through an overview of historical examples. What she highlights is that political and economic factors often outweigh legal rulings, leading to prolonged conflicts, as seen in the ongoing ICJ case over the Essequibo region' (2009, pp. 247–268).

External powers and regional stability

South America is increasingly a geopolitical battleground for external powers, primarily the USA and China, as they aim to ensure energy security for themselves and expand or limit geopolitical influence.

As Robert D. Kaplan forwards, 'U.S. foreign policy is heavily influenced by the need to secure reliable sources of energy, particularly in regions like South America, where oil and gas reserves are abundant' (2012, pp. 203–217). The above observation perfectly fits the emerging relationship between Guyana and the USA. On the other hand, David Shambaugh underlines 'China's growing involvement in South America's energy markets. This competition between major powers further complicates the regional dynamics, as countries like Guyana must navigate relationships with multiple powerful actors' (2013, pp. 167–180). In the end, Brazil's regional power status is articulated through its desire to be a stabilising force in the region. Peter Hakim's research on Brazil's diplomatic influence shows that 'the country plays a crucial role in mediating disputes in South America, promoting regional peace while protecting its own interests, particularly in maintaining stable oil markets' (2000, pp. 42–55).

Methodology

The paper applies game theory as the methodological framework in order to study the strategic interactions between Guyana, Venezuela, the USA and Brazil in the context of the Guyana region's oil resources. Game theory is 'concerned with situations in which the ability of one participant to gain his ends is dependent on the choices or decisions that the other participant will make' (Schelling, 1960, pp. 1–35). Game theory allows for the modelling of the outcomes and choices for each country and thus serves as a mechanism for predicting both competitive and cooperative dynamics.

Why game theory?

The territorial dispute between Guyana and Venezuela over the Essequibo region is a classical zero-sum game: 'one player's gain in territory and resources is the other player's loss' (Axelrod, 1984, pp. 20–35). In the game constructed in this paper, the presence of the USA and Brazil creates opportunities for mediation or cooperation, making the game and its outcomes more complex. This is modelled using cooperative and iterative game theory approaches. The need to maintain stability and the desire for resource control are conflicting incentives accounted for in game theory.

In this paper, game theory breaks down complex interactions into a model that allows for the 'examination of likely equilibria, including both cooperative and non--cooperative outcomes' (Keohane, 1984, pp. 90–118).

Game theory models

Three game theory models are applied in this paper:
1. Zero-sum games: The Essequibo region is the area of conflict between Venezuela and Guyana. Here, the gain in territory by one country is a direct loss for the other. The Zero-Sum model elucidates the challenge, as Guyana seeks to maintain sovereignty over a rich oil-producing region, while Venezuela seeks to 'reclaim' its hold for political and economic reasons (Turocy and von Stengel, 2003, pp. 45–67).
2. Stag hunt game: The USA's interactions with Guyana are best modelled through the utilisation of the stag hunt game. In this model, both stand to gain by cooperating—the USA by securing access to alternative oil resources, and Guyana by receiving diplomatic and economic support. In this scenario, if either of the countries avoids cooperation, both will lose. Coordination and trust are paramount for maximising gain, and the model highlights this importance (Skyrms, 2004, pp. 23–50).
3. Iterative games: Brazil's involvement in the game is articulated through the iterative game theory model. The country's role, primarily as a force for stability on the continent, depends on the conflict not becoming active. As such, ensuring long-term stability is its main goal. Brazil's neutral stance theoretically allows it to maintain a leadership role and protect its energy interests (Axelrod, 1984, pp. 110–140).

Players, strategies, and payoffs

- Guyana: A new global energy producer. Its strategy in the game is to maintain sovereignty over the country's main oil-producing area, the Essequibo region. For Guyana, the payoffs are political stability, foreign investment, and economic growth – all of which are predicated on resolving its dispute with Venezuela on favourable terms. Guyana's strategy involves strengthening its alliance with the USA, engaging in diplomacy, and appealing to the International Court of Justice.
- Venezuela: For Venezuela, the main tactic involves 'reclaiming its historical ownership of the Essequibo region' and its desire for revitalising its economy (Sharma, 2020). Access to new extractable oil reserves is the country's main payoff and thus the country is faced with the choice of militarising its claim and risking conflict or pursuing a diplomatic resolution. Its strategy includes diplomatic posturing, legal challenges, and the use of economic or military pressure.

- USA: Guyana is a new energy supplier on the global market and is geographically distant from unstable global regions (Kaplan, 2012, pp. 203–217). Thus, the USA sees Guyana's oil reserves as strategically significant. For the USA, the payoffs are containment of rival powers such as China, energy security, and geopolitical influence. The USA's strategy includes countering external influences that may destabilise the region, providing diplomatic support for Guyana in its territorial dispute, and investing economically in Guyana's oil sector.
- Brazil: The main goal for Brazil is stability, and its strategy involves acting as a mediator between the two conflicting parties (Hakim, 2000, pp. 42–55). For Brazil, the payoffs are enhanced diplomatic influence and long-term regional stability.

Brazil's strategy includes promoting cooperative agreements on resource-sharing, mediation through international organisations, and regional diplomacy.

Limitations of game theory

A key limitation of game theory is the assumption that the named players will act rationally and are motivated to maximise the stated payoffs. However, a country may often act according to ideological forces, domestic political pressure, or as a result of miscalculation. In the end, not all actors behave rationally. Nevertheless, game theory remains the most effective method for breaking down these complex interactions into a model that allows for examination and policy recommendations.

TIMELINE AND BACKGROUND

Table 1.

Time	Event
1840s	Venezuela claims the Essequibo River as its natural border with British Guiana, asserting ownership of land west of the river based on Spanish colonial maps.
1899	The Paris Arbitral Award grants the Essequibo region to British Guiana. Venezuela argues the decision was unfair and lacked Venezuelan representation.
1962	Venezuela officially rejects the 1899 ruling, reviving its claim over the Essequibo, citing historical Spanish ownership.
1966	The Geneva Agreement is signed by Guyana, Venezuela, and Britain, seeking a peaceful resolution through the UN. Venezuela's claim remains active.
2015	The discovery of major offshore oil reserves in the Essequibo escalates tensions. Venezuela reasserts its claim to the oil-rich region.
2018	Guyana takes the dispute to the International Court of Justice for a ruling on the 1899 award. Venezuela disputes the court's jurisdiction.
2020	The ICJ rules it has jurisdiction to hear the case.
September 2023	Venezuela holds a referendum to incorporate Essequibo as a new state, Guayana Esequiba, violating the Geneva Agreement.
October 2023	Venezuela begins a military build-up near the Guyana border and creates a special administrative zone for the disputed area.
December 2023	The ICJ orders Venezuela to refrain from altering the situation, but President Maduro continues pushing for the creation of Guayana Esequiba, with increased military presence.

Source: Authors' own elaboration.

GAME THEORY FRAMEWORK

The players and the payoffs

Regarding Guyana and the context in the region, the players include Guyana, Venezuela, Brazil, and the United States of America. These players have particular strategies and interests tied to the exploitation of oil and gas reserves, with conflicts potentially arising over regional influence, energy access, and territory.

- Guyana is a large but sparsely populated oil producer. Guyana's most recent estimate of recoverable oil is 11 billion oil-equivalent barrels. 'The country's

primary objective is to secure and efficiently extract these reserves to bolster its economic development' (World Bank, 2023), rebuffing territorial claims from Venezuela in the Essequibo region. The payoffs for Guyana depend on a stable investment flow, oil production, and strategic partnerships.

- Venezuela has historical claims to the Essequibo region of Guyana (Humphreys, 1951), and thus significant economic and political stakes in the game. Given the current political and economic stability of the country in question, jurisdiction over the Essequibo region represents a significant economic and political opportunity. The assertion of jurisdiction may rally domestic support and enhance its regional standing.

- The United States of America has long treated the Americas through the prism of the 1823 Monroe Doctrine (Monroe, 1823; Walker, 1985; Smith, 2012). Its interests lie in Guyana remaining a stable oil and gas producer. By supporting Guyana diplomatically, militarily, and economically, the USA reinforces the Monroe Doctrine principles, secures alternative oil supplies, and counters its global rivals. The payoffs involve maintaining geopolitical influence, securing energy resources, and containing Venezuela as a destabilising force in the region.

- Brazil is the most significant regional power and is part of the greater Guiana region. Brazil's main concern is the maintenance of stability in the Guianas and it models itself as a stabilising force (Hakim, 2000, pp. 42–55), ensuring that conflicts in the region do not escalate, thereby protecting its own energy interests. Brazil's payoffs lie in its mediating role, increased influence, and control over regional dynamics.

Strategies

Each of the players named is driven by established goals related to geopolitical influence, territorial integrity, and resource management:

- Guyana's main strategy includes forging alliances with the USA and Brazil, managing the diplomatic and legal processes with regard to its territorial disputes with Venezuela, and perfecting oil production to develop and grow economically.

- Venezuela faces a destabilising domestic environment and thus has two main strategies: escalate further its claims to the Essequibo region, potentially utilising military or diplomatic means, or seek agreement with Guyana to divide the resources in the disputed region. The latter, while economically advantageous, may be politically unrealistic.

- The USA's strategy involves economic, diplomatic, and military support for Guyana, so as to ensure Guyana remains politically stable and its oil production remains viable. The USA also aims to forestall Venezuela's aggression, either diplomatically or through indirect military support, while simultaneously limiting China's influence in the region.
- Brazil's interest lies in stabilising the region, either as a mediating force or by using its diplomatic influence to prevent external actors from destabilising the aforementioned region. Brazil's strategy therefore prioritises long-term stability over short-term actions.

Game types

The interactions among the aforementioned players can be modelled utilising a few types of strategic games:
- Prisoner's dilemma: This model is applicable to the dispute over the Essequibo region between Guyana and Venezuela (Axelrod, 1984, pp. 93–112). In this layout, Venezuela and Guyana could potentially both benefit through a cooperative stance on the region's oil resources. On the other hand, if either side chooses to escalate, both stand to lose. Guyana could lose territory and investments, while Venezuela would risk further isolation and economic losses. Cooperation is a scenario that offers mutual benefit, but mutual distrust can lead either actor to behave unilaterally, resulting in suboptimal outcomes.

Table 2.

	Venezuela Cooperates	Venezuela Defects
Guyana Cooperates	3, 3	0, 5
Guyana Defects	5, 0	1, 1

Source: Authors' own elaboration.

- **(3, 3)**: If both cooperate, both gain equally from resource-sharing and peaceful negotiations.
- **(0, 5)**: If Guyana cooperates and Venezuela defects, Venezuela benefits while Guyana loses.
- **(5, 0)**: If Guyana defects and Venezuela cooperates, Guyana benefits while Venezuela loses.
- **(1, 1)**: If both defect, both suffer losses due to conflict and sanctions.

- Stag hunt game: This model is also useful in considering possible collaboration between Guyana and the USA (Skyrms, 2004, pp. 23–50). If Guyana stabilises its position as an oil exporter with USA support, both stand to benefit. On the other hand, if Guyana defects by allowing instability or corruption to undermine its oil production potential, the USA may withdraw support, leading to a decline in economic and geopolitical benefits. In this game, trust and cooperation between the two are important for maximising payoffs.

Table 3.

	U.S. Cooperates	U.S. Defects
Guyana Cooperates	3, 3	1, 0
Guyana Defects	0, 1	0, 0

Source: Authors' own elaboration.

- **(3, 3)**: If both cooperate, they benefit from stable oil production and shared gains.
- **(1, 0)**: If Guyana cooperates and the USA defects, Guyana gains slightly but the USA gains nothing.
- **(0, 1)**: If Guyana defects and the USA cooperates, the USA gains slightly but Guyana loses.
- **(0, 0)**: If both defect, neither country benefits from cooperation.

- Iterative games: The competition over the Essequibo region can be modelled as an iterative game. As time progresses, the players adjust their strategies based on the opposing player's moves, with the potential for shifting alliances or escalations. For instance, Venezuela may soften its claim to the region of Guyana if confronted with intense pressure from the USA and Brazil, while Guyana may continue to fortify its oil and gas sector through foreign investments, leading to a more stable long term equilibrium.

Table 4.

Round 1	Round 2 (After Brazil's Mediation)	Round 3 (Outcome)
Guyana Cooperates	Venezuela Cooperates	Stable cooperation (Green)
Guyana Cooperates	Venezuela Defects	Brazil intervenes again
Guyana Defects	Venezuela Cooperates	Brazil pushes for negotiations
Guyana Defects	Venezuela Defects	Increased conflict (Red)

Source: Authors' own elaboration.

This decision tree visually captures how repeated interactions influenced by Brazil can either:

- Lead to cooperation, where both parties benefit from oil revenues and peace.
- Escalate into conflict, where defection leads to sanctions or military build-up.

Solution concepts

On the other hand, the Nash equilibrium 'offers a solution concept where each player's strategy is optimal given the strategies of others, providing a framework to analyse stability within strategic interactions' (Fudenberg and Tirole, 1991, pp. 239–260). In this context, a Nash equilibrium might occur if Guyana continues oil production without provoking Venezuela, while Venezuela maintains its territorial claim without resorting to military action. Brazil's role as a stabiliser and the USA's diplomatic fortification of Guyana may help to ensure the equilibrium remains stable.

Another solution concept is Symmetric Meta-Rationality, where 'players with medium term foresight recognise that cooperation' (Fudenberg and Tirole, 1991, pp. 239–260), such as a regional agreement on oil production, yields better outcomes than unilateral actions. For example, Brazil could act as a mediator of such an agreement, ensuring that Guyana, Venezuela, and external actors work together to ensure regional stability while maximising oil production benefits for all involved parties.

ANALYSIS OF THE GUYANA GAME

The Guyana–Venezuela territorial dispute: A prisoner's dilemma

A prisoner's dilemma concept succinctly describes the conflict over the Essequibo region between Venezuela and Guyana (Axelrod, 1984, pp. 93–112). In a mutual gain

scenario, the incentives are present in relation to exploitable oil reserves. If Venezuela and Guyana cooperate, they would benefit from sharing resources, a reduction in tensions, and peaceful negotiations. Notwithstanding these payoffs, there exists an environment of distrust that more often than not leads to defection in the game, as either side may fear the other will seek unilateral control of the disputed Essequibo region (Humphreys, 1951, pp. 178–202).

Venezuela's strategy in the prisoner's dilemma:

- ▪ Cooperate: Accept a joint venture to extract oil reserves with Guyana, or pursue a mutually acceptable settlement, which leads to an improvement in international relations and economic recovery.
- ▪ Defect: Forward its claim over the disputed region by way of military intervention and/or diplomatic means, thereby isolating Guyana and force the country to acknowledge its loss of sovereignty.

Guyana's strategy in the prisoner's dilemma:

- ▪ Cooperate: Pursue a diplomatic solution that may include a joint venture and shared benefits from the extractable oil in the disputed region, and continue international arbitration through the International Court of Justice.
- ▪ Defect: Strengthen its diplomatic and military posture and therefore deterrence from Venezuela's claims and/or increase the rate of oil extraction and investment in the Essequibo region.

The payoff matrix for the above is presented below:

Table 5.

	Venezuela Co-operates (negotiates)	**Venezuela Defects (claims entire Essequibo)**
Guyana Co-operates	Both benefit moderately (shared resources, peace)	Guyana loses territory and investments; Venezuela gains economically
Guyana Defects	Guyana wins short-term (increased oil production); Venezuela loses	Both lose (conflict, sanctions, and economic damage)

Source: Authors' own elaboration.

Analysis: The above matrix leads to mutual defection and the Nash equilibrium in this prisoner's dilemma is the same. Though one can argue that in the event of cooperation the payoffs in the long term would lead to beneficial outcomes, i.e., regional stability and resource-sharing.

However, the fear by both parties that the other would defect leads to a suboptimal outcome. This suboptimal outcome leads to military confrontation, international sanctions, and long term instability.

Building trust is the observable challenge in the game. To this effect, the International Court of Justice may act as the mechanism guiding the countries towards cooperation. However, without ironclad guarantees, there is no obligation for the countries to uphold arbitration by the International Court of Justice, and as such, the dispute persists. Escalation threatens territory, further economic isolation for Venezuela, and the deterrence of foreign direct investments in Guyana's oil reserves.

USA–Guyana relations: A stag hunt game

The stag hunt game is appropriate for modelling the relationship between the USA and Guyana. The stag hunt game is appropriate because both nations would gain from cooperating, though trust is necessary to avoid defection by either party (Skyrms, 2004, pp. 23–50). What one needs to keep in mind is that the USA has considerable interests in securing access to the oil resources in the disputed region (CBS News, 2023). In Guyana's case, the support of the USA ensures continued foreign direct investment, diplomatic backing, and continued economic growth.

The USA's strategy:
- Cooperate: Fortify Guyana's new status as a global oil producer, provide security assistance, and continue diplomatic backing.
- Defect: Withdraw support and reduce financial investments if Guyana's politics deteriorate or if China actively challenges the USA's interests in the region on behalf of Venezuela.

Guyana's strategy:
- Cooperate: Ensure the USA's support and direct investment by maintaining transparent, stable politics internally.
- Defect: Allow political maladministration, corruption, and instability to risk the USA's withdrawal of diplomatic/military support.

The payoff matrix for the above is presented in Table 6:

Table 6.

	USA supports Guyana (cooperation)	USA withdraws support (defection)
Guyana cooperates	Both benefit (stable oil production, geopolitical stability)	Guyana loses USA's backing (economic downturn, reduced geopolitical protection)
Guyana defects	USA loses influence (regional instability, risks to oil access)	Both lose (economic and political instability)

Source: Authors' own elaboration.

Analysis

Mutual cooperation by both parties is the Nash equilibrium in the above stag hunt game, as both countries seek to maximise the payoffs that come with collaboration. In this scenario, the USA entrenches a new oil partner on the global scene, diversifies oil resources away from the unstable Middle East, and Guyana continues to grow as a new oil exporter. On the other hand, if either country chooses to defect, i.e. there is Middle East stability or Guyana succumbs to excessive corruption then both nations would lose.

The stag hunt game requires political stability and trust in order to maximise the benefits for the countries. For the USA, continued collaboration with Guyana would prevent outside powers from establishing a foothold. In Guyana's case, continuous oil sector growth is dependent on the country's ability to establish stable governance.

Brazil's role as a mediator: An iterative game

Brazil is a stabilising force on the South American continent and has engaged in diplomatic efforts to lower the temperature between Venezuela and Guyana (The Brazilian Report, 2023). The ongoing play between the countries is analysed through the lens of an iterative game (Axelrod, 1984, pp. 101–130). In this game, Brazil's influence grows with each mediation; however, there are risks to Brazil if its role as a mediator fails to prevent conflict.

Brazil's strategy:
- Mediates actively: The Guyana and Venezuela dispute is continuously mediated by a neutral Brazil, who pushes the countries to resolve the dispute peacefully.
- Steps back: Brazil withdraws from its mediating role, thus allowing the conflicting parties to resolve the conflict among themselves.

Guyana's and Venezuela's response:
- Cooperate: With Brazil as a mediator, Venezuela and Guyana engage in diplomacy to end the conflict.

- Defect: Brazil's mediation efforts are rebuffed by either Venezuela, Guyana, or both. This leads to an escalation of the dispute and the risk of regional spillover.

The payoff matrix for the above is presented below:

Table 7.

	Venezuela escalates (defection)	**Venezuela cooperates (negotiates)**
Brazil mediates actively	Brazil stabilizes the region (moderate success)	Brazil gains long-term stability and influence
Brazil steps back	Regional conflict escalates, affecting Brazil's interests	Brazil loses influence as Venezuela and Guyana resolve conflict independently

Source: Authors' own elaboration.

Analysis

Brazil's role as a mediator in the iterative game is not fixed, as the game is ongoing in nature. Brazil's diplomatic engagement builds its influence as a stabilising power in the region. On the other hand, Brazil's withdrawal from the conflict could lead to direct escalation, which poses a threat to Brazil's economic interests and the security of its bordering provinces.

The iterative game gives Venezuela and Guyana the option to continuously engage with Brazil, allowing them to adjust their strategies from round to round. Brazil's main challenge is to temper disputes early and thus secure stability. However, if the sides defect frequently, Brazil would lose its controlling influence over the dispute. The Nash equilibrium points to continuous mediation by Brazil, as this would entrench Brazil's geopolitical interests and regional stability while maximising the payoffs for each of the players.

POLICY RECOMMENDATIONS

Strategic recommendations for Guyana

Guyana is a small but significant new entrant to global geopolitics, having become a key contributor to global crude oil supply growth. The country faces several challenges, the foremost being its balancing act between economic growth and securing its territorial holdings. Guyana's likely optimal strategy in the game theory analysis foresees the country escalating its collaboration with the USA and Brazil to secure diplomatic, military, and economic backing.

Guyana should prioritise:

a. Alliance Building: Economic, diplomatic, and military collaboration with the USA provides Guyana with a stability buffer against Venezuela. Furthermore, continued appeal to the ICJ solidifies Guyana's position regarding its territorial integrity.

b. Diversification: It is imperative that Guyana diversify its economy from the oil sector or threat from an external actor (Meierding, 2020, pp. 38–62). Though the USA is immensely important, Guyana needs to diversify its international partners and markets. Diversification reduces the risk associated with over-reliance on any single country that may withdraw support.

c. Governance: Economic benefits from its new oil gains must be maximised quickly. To this end, Guyana must address corruption issues and focus on transparency (Collier, 2007, pp. 145–169). What is more, a clearer regulatory framework is essential for attracting further direct investment, utilising funds to reduce the risk of internal instability, and fostering national development.

The above strategies will enable Guyana to maximise its payoffs and offset the risks associated with Venezuela's claims.

Strategic recommendations for Venezuela

The Essequibo region and its claim will remain a key part of Venezuela's foreign policy strategy. The game theory analysis conducted above suggests a strategy focused on unilateral action that will prompt an immediate response from Guyana's international backers, primarily the USA.

To avoid further isolation, Venezuela must consider:

a. Diplomacy: If Venezuela moderates its territorial claim over the Essequibo region the country would benefit diplomatically (Romero, 2013, pp. 25–47). Venezuela's appeal to regional organisations such as UNASUR or through bilateral talks with Guyana, would demonstrate a moderated position. Furthermore, cooperation may allow Venezuela to benefit from resource-sharing deals without provoking international sanctions.

b. Diversification: Venezuela's economy is severely sanctioned by the USA, which continues to hamper its economic development. The country must build even stronger relations with non-Western countries. While such partnerships may not directly strengthen its claim to the disputed region, they would provide Venezuela with alternative economic and military channels and offer greater diplomatic leverage.

    c.   Domestic reforms: Venezuela's intense internal economic challenges limit its ability to assert influence beyond its borders. The Venezuelan regime must prioritise internal economic and political stability before pursuing external claims. International isolation and economic decline will be exacerbated by further aggression, and without strong domestic support, any such action is likely to worsen internal instability.

For Venezuela to achieve a beneficial outcome regarding its economic situation and territorial claim, it is essential that the country improve its domestic conditions and pursue a cooperative strategy *vis-à-vis* Guyana.

Brazil's role as a regional stabiliser

Brazil's role as a stabilising mechanism in the dispute between the two countries is central to its interests. The maintenance of stability allows the potential for continuous oil extraction in the wider Guiana region. It is not unreasonable to expect spillover from a potential hot conflict into other areas of South America. With this in mind, Brazil's position as mediator is an opportunity for the regional power to assert its interests through the Venezuela–Guyana territorial dispute.

Policy recommendations for Brazil include:

    a.   Mediation: Brazil's diplomatic and mediation efforts through UNASUR and MERCOSUR are important leverage tools it can use to facilitate communication between the two parties. Brazil's role as a neutral country supports its position as a regional actor capable of de-escalating the conflict.

    b.   Regional Agreement: The promotion of a revenue-sharing agreement by Brazil is a position that mitigates the zero-sum nature of the conflict (Hakim, 2005, pp. 88–103). Such an agreement would theoretically maintain peace in the region.

    c.   Regional Stability: Brazil has a direct interest in maintaining peace in north--eastern South America. Its northern states are part of the broader Guiana region, and the prevention of conflict here reduces the risk of spillover and limits intervention by external powers.

Overall, Brazil's efforts are central to managing the conflict, and the country will be interested in achieving a mutually beneficial cooperative agreement that avoids escalation into a hot conflict.

The United States' strategic interests

Guyana and the wider Guiana region represents an important new oil-producing region of strategic interest, especially in light of current tensions with Russia and the Middle East. For the USA, support for Guyana facilitates access to exploitable oil reserves and limits disruptions from other global oil producers.

The USA maximises its payoffs by:

a. Economic Ties: The USA's interests lie in deepening its relationship with Guyana through investments in the country's oil infrastructure (Kaplan, 2012, pp. 203–217). The USA's continued investment secures this partnership and provides considerable geopolitical benefits.

b. Diplomacy: The USA's primary strategy is to prevent an escalation of the conflict, encouraging stability and an uninterrupted flow of oil (Brzezinski, 1997, pp. 100–120). It should be noted that the USA's interests align with Brazil's, and thus their collaboration in reducing an escalation risk is a mutual goal.

c. External Influence: The USA's stance towards Guyana is rooted in its broader geopolitical strategy to limit external-Americas involvement in the region (Walker, 1985, pp. 211–232). The USA's entrenchment in the region limits external footholds and promotes its strategic interests.

Continued American diplomatic and military investment supports its role as a stabilising force, thereby securing its energy interests and reinforcing its geopolitical position in South America, and thus reinforces its Monroe Doctrine.

Global implications and energy markets

The wider Guiana region is thrust into the spotlight as a new focal area of geopolitics through the discovery of substantial oil reserves. The further development of the wider Guiana region's oil reserves will influence global energy prices and the balance of power internationally, and more specifically, in the Americas. The geopolitical payoffs for the USA in securing these resources create a hedge against further global instability. Moreover, Brazil's status as a regional power aids in mitigating the escalation of a conflict that could disrupt the Guiana region's ascent in global geopolitics.

The risk of instability in the region, Venezuela's antagonistic attitude towards the USA, and its closeness to China and Russia present both an opportunity and a risk that policymakers will have to contend with.

Conclusion

The paper applied game theory frameworks to the dispute between Guyana and Venezuela over the Essequibo region, focusing on strategic interactions between the two, along with the USA and Brazil. The analysis aimed to provide a structured approach to examining the involved nations' goals and constraints, and how these influence decision-making processes, through a series of strategic games. The findings of the prisoner's dilemma, iterative games, and the stag hunt theories reveal that due to deep-seated distrust and contradictory national interests, the game leads to competitive strategies that fall short of optimal outcomes – even though cooperation would lead to a higher payoff for all countries. Guyana's establishment of alliances with Brazil and the United States of America provides it with a path to reinforce its control over the Essequibo region and stabilise its nascent oil industry. Guyana's alliances with regional and hemispheric powers allow the country to fortify its defence *vis-à-vis* Venezuela. On the other hand, Guyana's main challenge lies in its ability to secure internal governance, stability, and transparency.

Venezuela faces several significant challenges that constrain its ability to act decisively, namely international sanctions and internal economic issues. As such, its position and ability to aggressively pursue its claims risk further isolation. Economic benefits for Venezuela require a reorganisation of its strategy towards regional agreements and diplomatic channels. To this effect, Brazil's position as South America's pre-eminent power broker underscores the diplomatic avenue available to Venezuela. Brazil, through UNASUR and MERCOSUR, attempts to stabilise or prevent conflicts from escalating and positions itself as a neutral mediating country. The hemispheric power, the United States of America, is involved, and its global energy interests introduce a global dimension to the conflict that significantly complicates the dynamics.

The paper contends that the utilisation of game theory in international politics demonstrates how these game models elucidate the intricacies of oil- and gas-based conflicts. The attempt to model these interactions as a game, one that sees potential for shifting alliances, captures the unpredictable and fluid nature of geopolitical competition.

One notices the importance of trust-building mechanisms such as international arbitration and third-party mediation by Brazil and/or the involvement of the United States of America. The overarching attempt in the paper is to illustrate the implications for policymakers seeking to navigate potential conflict over oil and gas resources, and thus to offer a foundation for promoting stability in contested regions.

To conclude, a more sophisticated application of game theory and the incorporation of empirical data on the economic impact of oil and gas extraction in influencing regional power balances would offer a fuller picture. Furthermore, an examination of

socio-political factors in Venezuela and Guyana would reveal how domestic elements shape the international posturing of each country. Finally, this research contributes to a structured, game-theoretic approach to comprehending geopolitical calculations around resource disputes. The paper offers insights that are relevant to scholars, but more directly to policymakers in the South American and Caribbean region engaged in politics and international relations.

References

Agreement to resolve the controversy over the frontier between Venezuela and British Guiana (Geneva Agreement) (1966).

Axelrod, R. (1984) *The evolution of cooperation*. New York: Basic Books.

Axelrod, R. (1997) *The complexity of cooperation*. Princeton: Princeton University Press.

Bryan, A.T. (2004) *Oil and geopolitics in Latin America: the Caribbean Basin and regional conflicts*. Miami: University of Miami.

Brzezinski, Z. (1997) *The Grand Chessboard*. New York: Basic Books.

CBS News (2023) 'US announces military drills with Guyana amid dispute over oil--rich region with Venezuela', *CBS News*, 7 December. Available at: https://www.cbsnews.com/news/guyana-venezuela-conflict-essequibo-oil-us-military-flight-drills/ (Accessed: 13 December 2023).

Collier, P. (2007) *The bottom billion. Why the poorest countries are failing and what can be done about it*. Oxford: Oxford University Press.

Collier, P. and Hoeffler, A. (2004) 'Greed and grievance in civil war', *Oxford Economic Papers*, 56(4), pp. 90–112.

Fudenberg, D. and Tirole, J. (1991) *Game theory*. Cambridge, MA: MIT Press.

Hakim, P. (2000) 'Brazil's role in the hemisphere', *Foreign Affairs*, 79(2), pp. 42–55.

Hakim, P. (2005) 'Brazil and regional conflict mitigation', *Foreign Policy*, (143), pp. 88–103.

Humphreys, R.A. (1951) *The Anglo-Venezuelan boundary dispute*. Oxford: Oxford University Press.

Jervis, R. (1978) 'Cooperation under the security dilemma', *World Politics*, 30(2), pp. 167–214.

Kaplan, R.D. (2012) *The revenge of geography: What the map tells us about coming conflicts and the battle against fate*. New York: Random House.

Karl, T.L. (1997) *The paradox of plenty: Oil booms and petro-states*. Berkeley: University of California Press.

Keohane, R.O. (1984) *After hegemony: Cooperation and discord in the world political economy*. Princeton: Princeton University Press.

Macrotrends (no date) *Guyana GDP growth rate*. Available at: https://www.macrotrends. net/countries/GUY/guyana/gdp-growth-rate (Accessed: 14 August 2023).

Meierding, E. (2020) *The oil wars myth: petroleum and the causes of international conflict*. Ithaca: Cornell University Press.

Monroe, J. (1823) *Seventh annual message* (*Monroe Doctrine)*. Washington, D.C.

Ordeshook, P.C. (1986) 'Nonzero-sum games: political economy, public goods, and the prisoners' dilemma', in *Game theory and political theory: An introduction*. Cambridge: Cambridge University Press, pp. 203–242.

Pruitt, D.G. and Carnevale P.J. (1993) *Negotiation in social conflict*. Pacific Grove: Brooks/Cole Publishing Company.

Romero, C.A. (2013) *Venezuela's foreign policy and its neighbors*. New York: Routledge.

Schelling, T.C. (1960) *The strategy of conflict*. Cambridge: Harvard University Press.

Shambaugh, D. (2013) *China goes global: The partial power*. New York: Oxford University Press.

Sharma, G. (2020) 'Venezuela's quest for control over Essequibo region: a regional flashpoint?', *Forbes*. Available at: https://www.forbes.com/sites/gauravsharma/2020/08/14/ venezuela-quest-for-control-over-essequibo-region/?sh=6bdf01de678c (Accessed: 14 August 2023).

Simmons, B.A. (2009) *Mobilizing for human rights: International law in domestic politics*. Cambridge: Cambridge University Press.

Skyrms, B. (2004) *The stag hunt and the evolution of social structure*. Cambridge: Cambridge University Press.

Smith, P.H. (2012) *Talons of the eagle: Latin America, the United States, and the world*. 4th edn. New York: Oxford University Press.

The Brazilian Report (2023) 'Brazil hosts negotiations between Guyana and Venezuela over Essequibo dispute', *The Brazilian Report*. Available at: https://brazilian. report/liveblog/politics-insider/2023/12/15/brazil-negotiations-guyana-venezuela/ (Accessed: 15 December 2023).

Trinkunas, H.A. (2005) *Crafting civilian control of the military in Venezuela: A comparative perspective*. Chapel Hill: University of North Carolina Press.

Turocy, T.L. and von Stengel, B. (2003) 'Game theory', *Encyclopedia of Information Systems*, 2, pp. 403–420.

U.S. Energy Information Administration (2023) *Country analysis brief: Guyana*. Available at: https://www.eia.gov/international/analysis/country/GUY (Accessed: 24 July 2023).

Walker, W.O. (1985) *National security and core periphery relations: U.S. policies in Latin America*. Austin: University of Texas Press.

World Bank (2023) *The World Bank in Guyana*. Available at: https://www.worldbank. org/en/country/guyana/overview (Accessed: 24 June 2023).

Oil, Power, and Strategy: A Game Theory Analysis of Geopolitical Interactions in the Guiana Region

Abstract

This paper analyses the ongoing tensions in the Guiana region of South America between Guyana and Venezuela over the Essequibo region. It utilises game theory to evaluate strategic decisions between Venezuela, Guyana, Brazil (a regional player), and the USA (a permanent global power). This is done to articulate the decision-making processes in the conflict, which may involve both competition and cooperation. The main goal is to foster an understanding of how these interactions shape regional stability and the implications for global energy security. The paper applies the prisoner's dilemma, stag hunt, and iterative game models to ascertain possible outcomes. The analysis suggests that cooperative efforts, particularly through mediation by Brazil, may lead to mutual gains. However, a lack of mutual trust between the two warring parties may reinforce mutual defection as a suboptimal yet stable outcome. The research seeks to provide insights for policymakers in the region who aim to navigate the security--related strategies therein.

Keywords: game theory, geopolitics, Guiana region, territorial dispute, energy security

Ropa, energia i strategia: analiza teorii gier interakcji geopolitycznych w regionie Gujany

Streszczenie

W artykule tym analizuje się istniejące napięcia w regionie Guinana w Ameryce Południowej między Gujaną a Wenezuelą dotyczące regionu Essequibo. Do oceny decyzji strategicznych podejmowanych przez Wenezuelę, Gujanę, Brazylię (jako gracza regionalnego) oraz USA (jako stałą potęgę globalną) wykorzystano teorię gier. Celem jest ukazanie procesów decyzyjnych w konflikcie, które mogą obejmować zarówno rywalizację, jak i współpracę. Głównym zamierzeniem jest zrozumienie, w jaki sposób te interakcje wpływają na stabilność w regionie jakie mają skutki dla globalnego bezpieczeństwa energetycznego. W artykule zastosowano modele dylematu więźnia, polowania na jelenia oraz gry iteracyjnej, aby ustalić możliwe wyniki. Z analizy wynika, że działania oparte na współpracy, szczególnie przy mediacji ze strony Brazylii, mogą prowadzić do obopólnych korzyści. Brak wzajemnego zaufania między dwiema skonfliktowanymi

stronami może jednak utrwala obustronnego odstępowania od współpracy jako rozwiązanie nieoptymalne, ale zapewniające stabilność. Badanie ma na celu dostarczenie wniosków decydentom politycznym w omawianym regionie, którzy dążą do opracowania strategii związanych z bezpieczeństwem.

Słowa kluczowe: teoria gier, geopolityka, region Gujany, spór terytorialny, bezpieczeństwo energetyczne