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Land for peace? Israel-Palestine through the lens of game theory

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Abstract

Why have Israel and the Palestinians failed to implement a "land for peace" solution, along the lines of the Oslo Accords? This paper studies the application of game theory to this question. I show that existing models of the conflict largely rely on unrealistic assumptions about what the main actors are trying to achieve. Specifically, they assume that Israel is strategically interested in withdrawing from the occupied territories pending resolvable security concerns but that it is obstructed from doing so by violent Palestinians with other objectives. I use historical analysis along with bargaining theory to shed doubt on this assumption, and to argue that the persistence of conflict has been aligned with, not contrary to, the interests of the militarily powerful party, Israel.

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1 Introduction

Strategic political interactions between individuals, political organizations, and states can sometimes be understood as "games" among rational or semi-rational actors. For this reason, game theory has been increasingly applied in political science to subjects such as public choice (Rowley and Schneider, 2004), voting theory (Acemoglu, 2010), lobbying (Aitken-Turff and Jackson, 2006), civil war (Blattman and Miguel, 2010), and inter-state conflict (Powell, 2002).

This paper contributes to the literature on game theory applications to inter-state political conflict; specifically, I investigate the application of game theory to one of the most protracted conflicts of the past century, the Israeli-Palestinian one. I examine papers that use game theoretic principles to explain key components of the conflict and highlight what they assume about the actors' strategic interests. I then offer a critique of some of the predominant assumptions in the literature, and draw on bargaining theory to exemplify different ways that game theory can more realistically model strategic interests and explain the endurance of the conflict.

The review of the game theoretic literature on Israel-Palestine makes three things clear. First, the application of game theory to the subject has been limited even though the conflict is one of the most protracted and hotly debated of the twentieth century. The number of studies is small and many of them follow in the fifteen year period immediately after the initiation of the Oslo Peace Accords in 1993. The Accords, signed by Israel and the Palestine Liberation Organization (PLO), promised a five year plan for Israel to withdraw from the territories it occupied in 1967 and grant Palestinians sovereignty in exchange for Palestinian compliance with Israeli security demands; this is referred to as the two-state solution or "land for peace" paradigm. **Figure 1** shows the occupied Palestinian territories (West Bank, East

Jerusalem, and Gaza) over which the Accords were negotiated.

[Figure 1 here]

Second, the majority of papers aim to use the principles of strategic interaction and rational behavior to explain the increasingly obvious failure of the Oslo Accords in generating a two-state solution. Instead of two sovereign states, the post-Oslo period has been marred by continued Israeli settlement growth as well as episodes of violence, including during the second Palestinian Intifada or uprising (2000-2005). Eschewing the idea that the absence of a solution is illogical, these papers are interested in pointing to strategic interests that can explain continued conflict between Israel and the Palestinians. Methodologically, many use formal models though some apply game theoretic principles to Israel-Palestine without formal modelling.

Third, when distilled to their core assumptions, many papers, and most formal ones, assume that the Israeli state is strategically interested in withdrawing and granting the Palestinians sovereignty over the territory occupied in 1967 pending resolvable security concerns, but that all or some Palestinians have other objectives and use violence to achieve them, thereby explaining the collapse of any land for peace deal. Informed by these assumptions, the existing models largely present the conflict as an impasse or deadlock perpetuated by short-term hostilities, with the responsibility for this impasse falling on the shoulders of these Palestinian factions conducting or aiding hostilities.

The assumption that the militarily strong party, Israel, is willing to withdraw from the occupied territories in a land for peace deal is so embedded in these models that it often goes unexplained and undefended. Instead, the main debate (and difference between the models) concerns the motivations and strategies of the Palestinians spoiling this opportunity.

In contrast, I show that papers on Israel-Palestine that draw on the principles of game theory and strategic behavior but informally and using interdisciplinary methods suggest alternative explanations for the failure of the two-state solution. In particular, these papers suggest that Israel is possibly not willing, for reasons beyond security concerns, to withdraw from the occupied territories. However, the inference from these papers about the strategic interests of relevant parties is often implicit, not highlighted with clarity, and limited to the analysis of short time periods. The informal analyses also make a comparison with more formal contributions difficult.

After examining the above literature, I argue that the predominant assumption in the formal game theoretic models, that Israel is strategically interested in withdrawing from the occupied territories, is flawed. I do this by overviewing Israeli settlement policy since the beginning of the occupation in 1967, since settlements are very costly and difficult-to-reverse investments and are thus a credible signal of long-term strategic interest in the land. This analysis shows that Israel has pursued the expansion, not retrenchment, of its control in the occupied territories as a top national priority under all circumstances. I also show how Israel's security discourse can be understood in this context.

To highlight the importance of the land for peace assumption in driving any conclusions about the conflict, I sketch the outlines of an alternative game, adapted from Fearon (1997), that assumes that Israel instead sees the territories as highly strategic and integral for its future. Under these modified assumptions, the game can produce a moving equilibrium where Israel pursues nonstop settlement expansion in the territories, effectively blocking the possibility of a two-state solution and matching what we see on the ground. The conclusions thus become very different to those in the formal literature, and, as I argue, more historically plausible.

I conclude that it is plausible that the militarily dominant party (Israel) is not

interested in relinquishing control over the territories but the opposite, that this is not a temporary result of security concerns but rooted in the long term interests of the state in a highly strategic asset, and that this can help explain the worsening trajectory of the conflict. Moreover, contracts like the Oslo Peace Accords would by design fail to produce a two-state solution since they would not be self-enforced.

This paper's contribution is twofold. First, it illustrates how game theory has been applied to an important and ongoing conflict, driven, at least in the formal literature, by dubious assumptions about the strategic interests of the key parties involved. In turn, this renders the ability of these models to explain the trajectory of the conflict poor at best, and misleading at worst. Second, the paper helps clarify our thinking about Israel-Palestine by addressing head-on the question of strategic national interests, using analysis at the intersection of history and game theory. To my knowledge, this is the first paper to systematically tackle the application of game theory to Israel-Palestine.

The paper is structured as follows. Section 2 examines the literature that applies game theoretic principles to the subject, classifying papers by the assumptions they make about Israel and the Palestinians' strategic interests. Section 3 provides a historical overview of settlement policy to critique the predominant assumption in formal models about Israeli interest in land for peace, and situates Israel's security discourse in this context. Section 4 presents a game theoretic model where Israel (like the Palestinians) wants to maximize its control over the occupied territories because the territories are a highly strategic asset, and shows that this can be more useful for understanding and predicting the trajectory of the conflict. Section 5 summarizes and concludes.

2 The game theoretic literature

The papers that use game theory to analyze the interdependent strategic interest of Israel and the Palestinians can be broadly classified into two groups. One group assumes that Israel is interested in handing over the occupied territories to the Palestinians pending resolvable security concerns, and tends to present formal game theory models to make the case. In this interpretation, the failure of a land for peace deal owes to various Palestinian strategic motivations that do not align with such a deal.

The other group adopts alternative assumptions about Israel's strategic interests and about the root causes of a failure to generate a two-state solution. This literature tends to draw on and discuss the principles of game theory without formal modelling and to sometimes lack a systematic analysis of the actors' strategic interests, especially Israel's.

I analyze each in turn, omitting mathematical details in favor of a descriptive overview of the main assumptions and results of the games.

2.1 Israel as strategically interested in withdrawal/solution

As will be clear, the assumption that Israel is interested in withdrawing from the occupied territories encompasses a delicate tradeoff. It is assumed (explicitly or implicitly) that Israel would inherently rather retain its control over the occupied territories, but that there is conflict with or aggression by Palestinians which is sufficiently costly such that Israel would prefer to withdraw (if it can stop this violence) to the status quo. If Israel is strategically interested in withdrawal for peace, then logically the reason it has not withdrawn must be the interests and actions of Palestinians that are irreconcilable with this vision. The conceptualization of these Palestinian interests and strategies, and which Palestinians in particular are to blame for the

continuation of the conflict, is the main point of differentiation among these papers.

A few papers assume outright that all Palestinians have interests that are irreconcilable with a two-state solution. Although it is a short paper written by an economist who is affiliated with the Israeli political class for a think tank, rather than a peer-reviewed article, it is useful to start with Plessner (2001). This is because Plessner lays out very clearly, and in its most radical form, this assumption that Palestinians are simply not interested in peace and instead pursue a dominant strategy of violence. Even though he uses the language of game theory, Plessner does not explain the rationale behind this Palestinian obstruction, arguing that such mentality "cannot be construed as part of the pursuit of everyday individual happiness" (p.5). Of Israel, by contrast, "there can be no doubt [that it]... strives to achieve peace with insurance [and...] is prepared to let the Palestinians create an independent state" (p.7).[1] He suggests Israel must "get a lot tougher" and "exact a heavy price" on the Palestinians to alter the latter's dominant strategy (p.11).

Mizrahi et al (2001)[2] also assume that Palestinians adopt a dominant strategy of being violent. Israelis, by contrast, support "giving up territory in exchange for peace" (p.52).[3] They assume that Israelis are not interested in ceding land if Palestinians are peaceful, but, if Palestinians are violent, Israelis would rather cede land than engage in even more escalated mutual hostilities. In a simple 2x2 setup, the result is as an asymmetric chicken game, with the resultant Nash equilibrium that Israel cedes

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[1]The author backs this with the unsupported claim that Israel has not constructed new settlements and is only pursuing organic growth of existing settlements.

[2]This paper is in a peer-reviewed journal, as are all subsequent ones.

[3]The authors base this on the results of a peace index (Yaar and Hermann, 1997) constructed from interviews with a sample of Jewish Israelis, which suggests Israelis are more left leaning and tend, as a group, to favor conceding territory for peace. However, what territory exactly is up for withdrawal is left ambiguous, and further examination of this peace index shows that it asks participants if they support the Oslo Accords process, not if they support withdrawal from the 1967 territories; the ambiguity of what the Oslo Accords mean to Israelis is discussed in Section 3.

territory while Palestinians continue to be violent.

Jacobson and Kaplan (2007) focus on the second Intifada as a "sustained terror campaign" (p.789) and suggest Palestinian terrorists decide on how frequently to attack Israeli civilians and that they derive utility from killing said civilians. Meanwhile, the Israeli government decides how often to kill suspected terrorists ("targeted killings" (p.772)) and derives utility from minimizing Israeli and Palestinian civilian casualties. Using a repeated two-period game model where the Palestinian terrorists first decide how many suicide bombings to carry out, after which the Israeli government decides how many "hits" to carry out, the authors calculate the resulting rate of terror attacks and counterterror hits. The authors do not present a meaningful discussion of Palestinian strategies other than terror attacks, nor of the relationship between terror tactics and interest in the land. The implication is that Palestinian terrorism is at the heart of the conflict and is an end goal in and of itself, offering utility from the act of killing.

The more influential interpretation in the literature, however, is not that all Palestinians obstruct a land for peace deal. Rather, it is that a specific extremist (Palestinian) faction spoils the peace process between Israel and more moderate Palestinians.

de Figueiredo and Weingast (2001) model a dominant ingroup (Israel) against moderate and terrorist sub-groups of an outgroup (Palestinians). The authors assume Palestinian extremists want control over all the land, including Israel proper, while moderates are content with an intermediate share such as the occupied territories. In the second stage of the game, Israel and the Palestinians reach a bargain over the division of the land which is more favorable to Palestinians the more extreme (closer to extremists) the moderates are. Foreseeing this, in the first stage the extremists may terrorize Israel to elicit suppression on themselves and alienate moderates due to

Israeli "targeting error" (killing innocent Palestinians) and "triggering sympathies" (p.10). If the moderates are highly suggestible, and if the cost of terrorism to Israel is sufficiently high, it is possible to have an equilibrium with continuous cycles of Palestinian violence and Israeli suppression. This delays a move to a bargain and demonstrates as enduring conflict.

While above the Palestinian extremists are delaying peace to improve the bargaining position, another conceptualization is that Palestinian extremists want to thwart the bargain altogether and are able to do so for various reasons. Kydd and Walter (2002) model Israel as the government while Palestinians are split into moderates and extremists. The authors suggest that the Israeli government most strongly prefers mutual fulfillment of the Oslo Accords. The problem, however, is not only that Palestinian extremists want to overthrow the Accords, but also that Palestinian moderates with whom Israel can make a deal could subsequently betray it ("relaunch the struggle", p.268).

Specifically, in the first stage of the game, the extremists may launch attacks on Israel and the moderates may try to suppress those (successfully or unsuccessfully); Israel cannot see the suppression effort but uses the outcome to revise its expectations of moderates' trustworthiness, and hence its decision to fulfill its end of the peace deal in the second stage. Knowing this, the extremists can attack to drive a wedge between Israel the moderates. This may reduce Israel's trust in the moderates below what is necessary to implement a deal, thereby thwarting the deal. This is what the authors suggest happened, arguing that "terrorist violence ... reduced the value Israelis placed on peace ... [with] an opponent they increasingly viewed as untrustworthy" (p.285).

Berrebi and Klor (2006) also draw on the theme of trust (of Israel in the Palestinians' future actions) and use it to explain the absence of a solution despite presumed Israeli interest. In the model, Israel would like to continue occupying the territories,

but it is willing to withdraw to stop Palestinian violence. Palestinians are divided into moderates and extremists, both with the potential to engage in terrorist violence, but their objectives are different. Moderates want to establish a sovereign state on 1967 territory while extremists want a state that eradicates Israel. Therefore, unlike moderates, extremists will not accept an agreement whereby Israel withdraws (only) from 1967 territory in exchange for a cessation of violence. Knowing this, Israelis may believe violence is coming from the extremists and hence be unwilling to concede territory. Therefore, the stalemate owes to extremist Palestinian objectives which fracture Israel's trust in the efficacy of an agreement for achieving security from attacks.

In de Mesquita's (2005b) model, Israel's utility increases with counterterror efforts and decreases with concessions to Palestinians, while Palestinians are all terrorists who obtain utility from destroying Israel to two varying extents, differentiating them into moderate and extremist terrorists. In equilibrium, Israel may offer concessions to the moderates if they aid it in counterterror efforts (against extremists) and the moderates may accept, after which the two play a simultaneous commitment game. Because concessions are costly to Israel and counterterror aid is costly to moderates, the game degenerates into a prisoner's dilemma where neither concessions nor aid are followed through on, even though both Israel and the moderates prefer land for peace to the status quo. The author shows that in an infinite game with trigger strategies, mutual cooperation can become self-enforcing, but opines that what thwarted peace efforts was the lack of commitment of the Palestinian moderates.[4]

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[4]Referring to the Oslo Accords, de Mesquita writes "as recent events have demonstrated, the Israelis seem to have concluded that they overestimated the helpfulness of the Palestinians in counterterror" (p.165). It is unclear why Palestinians would not be "helpful" unless the trigger strategy is not sufficiently incentivizing due to concessions being too low. The author does not elaborate on this point, noting casually instead that information problems (not modeled) may have created inaccurate expectations for Israel, but it is unclear why in a repeated setup and prolonged conflict information and expectations do not self-correct.

In another paper, de Mesquita (2005a) abstracts from the commitment problem on the Israeli side altogether and focuses on the (lack of) credibility of the Palestinian moderates arising from the unobservability of counterterror effort. In the model the moderates play first and, if they succeed in counterterror, Israel grants the agreed upon concessions. If they fail, Israel will not enact concessions and, making deductions about the moderates' ability and effort, may choose to "replace the former terrorist leadership with a new negotiating partner" (p.237). The author shows that if the threat of replacement is not sufficiently tied to counterterror performance, the moderates will have an incentive to exert low effort and to claim they tried but failed.[5] Therefore, whereas Israel commits to peace, it may be obstructed from withdrawal by the presence of moral hazard in moderate Palestinians' counterterror efforts.

Berman and Laitin (2008) concede that there are Palestinian moderates but focus on Palestinian terrorists and model the strategic considerations within these organizations that inform their makeup and rules (instead of modeling the interaction of Palestinians and Israelis). Regarding strategic interests, they suggest that the goal of Palestinian organizations like Hamas is far more extreme than a two-state solution and involves the conquest of the entire territory comprising Israel-Palestine. Though Israeli interests are not modeled (Israel is represented as simply wanting to thwart extremist attacks), it is plausible that these factions stand in the way of any land for peace plan, since even if Israel were to withdraw from the occupied territories, attacks would not desist.[6]

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[5]The author suggests the replacement threat will not be credible if the alternative moderates are too weak, so that current leadership knows it will not be replaced regardless of effort, or too strong, so that it knows it will be replaced regardless. He suggests that this has prompted Israel to "encourage relatively equal, rival factions within terrorist movements [...] Israelis followed precisely such a strategy during the first Intifada by supporting extremist Islamic movements which gave rise to Hamas and Islamic Jihad" (p.253). This leaves the question of why, if this policy was successful, a resolution has not been forthcoming (with high effort and concessions).

[6]Though the paper suggests terror is a tool of the weak resorted to when conventional warfare

2.2 Israel as possessing other strategic interests

An early game theoretic exposition of Israeli interests other than land for peace is found in Hirsch (1996), who examines the conflict over occupied East Jerusalem and suggests that Israel is strategically unwilling to relinquish this land and is thus involved in a zero sum game with the Palestinians. Hirsch does not formalize his intuition, but to the extent that the game over East Jerusalem is a zero-sum game then it is not a prisoner's dilemma; there is no room for cooperation even with trigger strategies because one party will value mutual defection over mutual cooperation.

If cooperation is relinquishing some of the claim over East Jerusalem, the party blocking mutual cooperation will be the one that benefits more from a continuation of the mutual defection status quo, which Hirsh suggests is inarguably Israel, the party in control of East Jerusalem. He also argues that the negative payoffs from sharing East Jerusalem are particularly high for Israel due to the construction of new settlements, a strategy which "illustrates the technique of preemption or irrevocable commitment [... This] increases the negative payoffs [of relinquishing claim over the city] and reduces the likelihood Israel will adopt such a move" (p.710).

Whereas Hirsch confines the zero sum aspect to East Jerusalem, Pape (2003) suggests there is a strong zero sum aspect over the remaining occupied territories as well. Studying the strategic motivation of Palestinian suicide attacks in the mid to late 1990s, Pape argues their end goal had not been to thwart a negotiated settlement where Israel withdraws from the territories occupied in 1967 but to pressure Israel to do so, using war of attrition, when negotiations are viewed as a failure; the im-

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is not an option and the other state is too strong, it is not clear how the operations relate to the Israeli occupation. The authors focus on poverty and the absence of sufficient social provision by the Palestinian Authority as creating space for Hamas, without tying those to Israel's policies in the territories.

plication is that extremists are different from moderates not in goal but in method. Examining the timing of suicide attacks in 1994-1995, he shows that attacks followed not Israeli concessions, but Israeli delays of Oslo's agreed-upon deadlines for military withdrawals from population centers.

On Israel, and in other occupation contexts as well, Pape argues suicide attacks may pressure the occupying state into granting modest and reversible concessions but "are unlikely to affect the target state's interests in the issues at stake" (p.355), which are usually to retain control over the occupied territories. He notes Israel's concessions to the Palestinians in 1994-1997 involved "temporary and partial withdrawal" from important areas at the same time that settlements doubled and there was "little to hinder the Israeli Defense Forces' return" (p.356). Therefore, this paper overturns the land for peace paradigm on its head: it is not that Israel wants to withdraw but is prevented from doing so by a highly successful terrorist campaign, but rather that Israel does not want to withdraw and will not be forced to do so by weakly coercive terrorist attacks.

In a qualitative discussion, Kydd and Walter (2006) support the idea that suicide bombings are an attrition strategy tool employed by weak actors and suggest that a major determinant of whether attrition works is the occupying state's "level of interest in the issue under dispute", since "states with ... important interests at stake rarely do [capitulate to terrorist demands]" (p.60). They note that a state's strategic interests are often forward looking, with an eye to how territorial concessions today may reduce bargaining power and result in further territorial loss later. Regarding Israel, they point that "Israel is unlikely to withdraw from East Jerusalem" (p.61). However, they do not generalize this notion, of a high strategic priority of the land to Israel and unwillingness to permanently withdraw, to the wider occupied territories.

Like Pape, Bloom (2004) questions the spoiler game theoretic accounts that sug-

gest Israeli withdrawal from the territories was forthcoming but spoiled by terrorism. Since the acceleration of attacks in 2002 "took place against a political backdrop with few substantive peace negotiations between Israel and the PA [...] It is unclear how effective the attacks are at spoiling a peace no one believes in" (p.64). Bloom shows Palestinian support for military movements was low (less than one third) but soared in 2000 once it was clear to Palestinians that they were not reaping any sovereignty dividends from Israel, and that the rate of attacks followed pace. Bloom also shows that Israel responded to attacks post-2000 with extreme violence and not with land concessions, even reoccupying Palestinian territories at various points. Though the connection is not explicit in her paper, this reifies the observation that attacks are unlikely to significantly alter a state's national interests in occupied territories and suggests Israel is unwilling to withdraw regardless.

Pearlman (2009) also critiques standard spoiler accounts and demonstrates more reasons (besides war of attrition) that persistently blocking sovereignty would encourage the use of violence by weak actors even when these methods generate limited concessions. Examining the history of the Palestinian national movement in two peace negotiation episodes including Oslo, she suggests that not everything is driven by external utility considerations and that internal contestation dynamics also matter, especially in a non-state entity like occupied territories. The dominant faction having most to gain will negotiate while those excluded may resort to violence, particularly once it is clear negotiations have failed. Therefore, continued absence of sovereignty is likely to fuel violence not just to pressure withdrawal but also to differentiate one's party domestically and carve out a space in the contested non-state entity. Like Bloom, Pearlman does not directly address Israel's strategic interests, but one interpretation is that continued violence is a reaction to, not a roadblock toward the implementation of, Israel's strategic interests in the territories.

Abrahams (2019) presents a qualitative discussion of principal-agent problems to analyze recent developments in the relationship between Israel (principal) and the Palestinian Authority (agent), seen as the moderate faction. He argues that security efforts by the PA have been met with financial rewards, not sovereignty, by Israel. Between 2007-2013, the PA under Prime Minister Fayyad cracked down extensively on militant factions, with one IDF general remarking that Israel and the PA "are close to the ceiling of security cooperation" (p.19). Fayyad presented this to the Palestinian people as a necessary compromise for sovereignty, but, eventually, his inability to deliver on the sovereignty promise led to popular backlash and his ejection. Abrahams observes that the post-Fayyad government has continued to comply with Israel's security platform without any serious prospect for a sovereign state, and in exchange for private benefits (recognition and funding), but has avoided Fayyad's predicament by increasingly using repression instead of political legitimacy to rule.

While the above accounts shed doubt on the assumption that Israel has been strategically interested in withdrawing from some or all of the territories but prevented by violence, Schiff (2012) provides the clearest rational-behavior exposition and criticism of this assumption. Drawing on negotiation theory and on publicly documented discourse within the Israeli Knesset (parliament) and between the Israeli government and the public in 1992-1995, Schiff argues there was never a real plan to withdraw to 1967 borders and to allow a sovereign Palestinian state to emerge, and rather that the Accords were a tactic in continuing conflict management for Israel.

Schiff shows that Rabin presented the agreement internally as one which for Israel left "all options open for the negotiation process to follow" (p.78) and which did not necessitate nor require Palestinian sovereignty. Speaking to the Knesset in August 1993, he emphasized that the Declaration of Principles (DOP), which was the interim agreement that Israel and the Palestinians signed in the Oslo Accords, does not discuss

a Palestinian state but rather "it is about an interim agreement for five years. Our opinion against a state is well known. Any attempt to connect the Interim agreement to the permanent status agreement is nonsense" (ibid). By contrast, the Palestinians supposed (or hoped) the interim agreement was paving the way for statehood by providing the agenda and the suggested timeframes. Schiff argues that despite the fundamental incongruence of the long-term interests of the two parties, the signing of the Accords was facilitated technically by some of the ambiguous language[7] and driven strategically by the desire of Rabin and Arafat to score points externally and domestically.[8]

Two exceptions to the non-formal methodology in this group of papers are Baliga and Sjostrom (2012) and Konyukhovskiy and Grigoriadis (2019). Baliga and Sjostrom use a game with incomplete information to model the conflict as one where the two sides would have reached a resolution but were prevented from doing so by the provocative actions of extremists. They point specifically to the actions of Israeli Prime Minister Sharon, whose visit to East Jerusalem in September 2000 helped spark the second Intifada, as an example of extremist provocation, suggesting that in the absence of such provocation a solution would have been possible. Core Israeli strategic interests are still implicitly seen within the land for peace paradigm with more hawkish tendencies modeled as a fringe aberration, making this paper a rela-

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[7]One example is use of "withdrawal from territories" instead of "the territories" in the English version. Also see Zartmann (1997) on this point.

[8]Schiff argues Rabin hoped that peace talks would lead to a breakthrough in the normalization of Israel's relationship with the Arab bloc headed by Syria, and wanted present to the Israeli public an agreement "that could be portrayed [...] as a minimal costs agreement that brings many advantages" (p.86). For Arafat, the recognition of the PLO as the sole representative of Palestinian people and the creation of the Palestinian Authority gave the PLO both representation powers and funding; Rabin knew these were crucial to Arafat given the deteriorating external context for the organization. Domestically, Arafat could present "some achievement that would be considered a breakthrough on the road to a Palestinian state" (p.82).

tively nominal departure from the literature that assumes Israel is interested in land for peace.[9]

Konyukhovskiy and Grigoriadis (2019) model the conflict as constituting a proxy war for global parties. The proxy relationship is analyzed within a principal-agent setup, with the United States acting as principal for Israel and (up to the 1980s) the Soviet Union for the Palestinians. The authors do not rely on the land for peace paradigm to model either party's strategic interests, suggesting instead that both parties benefit from an aggression parameter but want to reduce the cost they pay for escalation from this aggression. In the model, a balanced bilateral proxy war can lead to a stable resolution of the conflict; the authors argue that the deterioration of viable proxies for Palestinians, and consolidation of the US-Israel alliance, have therefore worsened the conflict. Despite its insight into the role of superpowers, however, the paper does not offer an in-depth analysis of Israeli or Palestinian strategic interests, taking them more as a given while focusing on the role of third parties.

3   Strategic interested reexamined

As shown above, the majority of the formal economics literature on strategic behavior in Israel-Palestine assumes that Israel is interested in relinquishing its control over the occupied territories in exchange for peace but obstructed by Palestinian violence that has other objectives. Another group of papers uses game theoretic principles more informally, and with reference to historical context, to suggest alternative reasons, predominantly incongruent claims over the land, for the failure of a solution.

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[9]The question here is the plausibility of framing the interests of the prime minister of a democratic country as fringe and not representing those of the country more broadly. It is also historically questionable whether Israeli behavior has been different under more leftist governments and in the absence of such provocations (see Section 3).

However, papers in this group sometimes lack an explicit and systematic analysis especially of Israeli interests, and focuses on short time periods.

This section argues that settlement policy demonstrates systematically that Israel is interested in expanding its control over the occupied territories as a top national priority. Settlements are very costly investments, making them a more credible arbiter of strategic interests than potential cheap talk like proclamations or signed agreements (which are less costly to send and easily reversible). Therefore, because settlements in the occupied territories make Israeli withdrawal extremely difficult, it is highly instructive to examine Israel's strategic interest in these territories by examining settlement policy since 1967.

I show how settlement policies have been consistent across different Israeli governments, suggesting the presence of a national consensus around the strategic value of the occupied territories, and how such policies have been largely unperturbed by acts of Palestinian violence or lack thereof. I also briefly address how Israeli demands for security can be understood in this context. This then sets the stage for discussing one example of how such "alternative" assumptions can be integrated into a formal game of the conflict.

3.1   Settlement policy since 1967

Israel began to settle members of its population in the Palestinian territories as soon as it occupied them in 1967. Under the direction of the left-leaning Labor party, and within weeks of winning the June 1967 war, the government demolished 160 Palestinian houses in East Jerusalem and appropriated 600 buildings so they can be rebuilt for Israelis (UN, 1982). In July of that year, defense minister Yigal Allon presented the Allon Plan to the Prime Minister, the basic outline of which was that Israel would annex the Jerusalem corridor, retain control over the western component

of the West Bank, and create separate and noncontinuous enclaves for Palestinians in the region connected by specific roads (ECF, 1967).

Settlement drives intensified over the next ten years under Labor rule, reaching 90 settlements populated by 10,000 settlers by 1977. There was also active planning for the road, electricity, and water networks among settlements, and discussion of future plans for highways that can link existing settlements and facilitate the rise of new ones. During that time, Prime Minister Yitzhak Rabin (who would later be reelected in the 1990s and sign the Oslo Accords) declared that settlements increase Israel's security and that it is important to "renew, expand [the settlements]" and "establish defensible borders for the State of Israel" by bolstering settlements along the Jordanian border, in Jerusalem and Hebron, and south of the Gaza Strip (US Congress Committee, 1977, p.14).

There was little question of the extent of the government's involvement in settlement expansion. The Israeli government had allocated 400 million US dollars to settlements over that ten year period, equivalent to about 2.3% of its yearly GDP. This included direct subsidies to encourage settlers to transfer to the occupied territories through the use of tax exemptions, inexpensive loans, and material assistance with water, electricity, and phone services and with transportation facilities (UN, 1982). The Ministry of Agriculture also dedicated a growing portion of its budget to settlements, as did the Ministry of Housing for the construction of new building units in new settlements (National Lawyers Guild, 1978).

The more right-wing Likud won elections in 1977 on the platform that the territories are part of the historic Land of Israel and that "no part should [...] be handed over to foreign rule" (Israel Ministry of Foreign Affairs), and elaborated on the settlement policy initiated by its Labor predecessor. Ariel Sharon, then minister of agriculture who would become prime minister in 2001, put forth a plan for an extension

of Jewish settlements, partially based on the Allon Plan, that was approved by the government in October 1977. The plan suggested establishing settlement urban areas in the western part of the West Bank, extending Jewish settlements in the eastern part, building roads connecting these eastern and western settlements, and encircling Jerusalem with a "belt" of settlements (ECF, 1977). Sharon's long-term vision was that the settlements would reach two million settlers by the year 2000 and constitute a "second axis" of Jewish population parallel to the coastal one in Israel proper (US Senate Committee, 1978).

During that period, while the Labor party supported handing over populated centers in the occupied territories to Jordan, "its position on the existing Jewish settlements was much less clear cut: it never declared that these should be removed for peace" and there was approval in its political bureau of trade union participation in building settlement infrastructure (Demant, 1983).

Though in 1973 Israel had signed the Camp David Accords with Egypt which stipulated that Israel would grant occupied Palestinians autonomy after five years, domestically Israeli policymakers were frank that autonomy could only mean limited population self-rule, not territorial sovereignty, and that settlement policy was strategically meant to prevent the rise of a Palestinian state. Matityahu Drobles, an appointee of Prime Minister Begin, head of the Settlement Division in the World Zionist Organization, and author of the influential Drobles Plan for settlement expansion (adopted by the government), wrote in 1980 stating clearly that the creation of settlements is a "race against time" intended to "create facts on the ground" to prevent withdrawal from the occupied territories (UN, 1982).[10] A year later, in 1981,

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[10]The full quote is illuminating: "In light of the current negotiations on the future of Judea and Samaria, it will now become necessary for us to conduct a race against time [...] It is significant to stress today, mainly by means of action, that the autonomy does not and will not apply to

Prime Minister Begin himself publicly swore that he would never give up "Judea and Samaria".[11]

The Likud government was reelected in 1981 and escalated its settlement construction endeavors, including in response to a plan by Ronald Reagan in 1982 to freeze settlements. Though Reagan, in defiance of the UN and Geneva Conventions, suggested settlements were not illegal and only pushed for granting Palestinians self-rule without a sovereign state, his call to freeze settlements was unanimously rejected by Israel's cabinet. The cabinet declared that "settlement is a Jewish inalienable right and an integral part of our national security" and emphasized that prior agreements like Camp David were about "autonomy to inhabitants not territory" (Shipler, 1982). Immediately after the Reagan plan was announced, Israel established new settlements, and there were discussions about increasing the number of settlers from 30,000 to 100,000 by 1986 to form a bloc "strong enough to block any significant territorial concession" (Demant, 1983).

With the first Intifada and growing organization of Palestinian protestors, a united Likud-Labor government proposed a "peace initiative" in 1989 which stated that "Israel yearns for peace [...] by means of direct negotiations based on the principles of the Camp David Accords [...and] *Israel opposes the establishment of a Palestinian state* in the Gaza district and in the area between Israel and Jordan" (emphasis mine) (ECF, 1989). The plan also opposed any negotiations with the PLO, and, like Camp David, proposed a five-year interim period during which Israel would "accord Palestinian inhabitants self-rule by means of which they will conduct their affairs of

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the territories but only to the Arab population thereof. This should mainly find expression by establishing facts on the ground [through settlements ...] There mustn't even be even a shadow of a doubt about our intention to keep the territories [...] for good."

[11]"Judea" and "Samaria" are biblical terms for the West Bank meant to popularize the notion that they are inherently Jewish and part of the greater Land of Israel.

daily life [while] Israel will continue to be responsible for security, foreign affairs, and all matters concerning Israeli citizens [in the occupied territories]." After five years, permanent status negotiations would aim to achieve "a permanent solution acceptable to the negotiating parties" and arrange for "peace between Israel and Jordan", with explicit refusal of Palestinian statehood. (ibid)

In 1993, the Labor government under Yitzhak Rabin signed the Oslo Accords which were negotiated directly with the PLO and where refusal of Palestinian statehood was not explicit, but domestically Rabin made it very clear that Israel was still fundamentally opposed to Palestinian statehood and to withdrawal from or even freezing of settlements. In a speech to the Knesset in October 1995, Rabin outlined the desired permanent solution as the state of Israel "alongside a Palestinian entity which will be a home to most of the Palestinian residents living in the Gaza Strip and West Bank [...] We would like this to an entity *which is less than a state* [...] The borders of the state of Israel, during the permanent solution, will be beyond the lines which existed before the [1967] War. *We will not return to the 1967 lines.*" (emphasis mine) He emphasized that "we committed ourselves before the Knesset not to uproot a single settlement in the framework of the interim agreement and not to hinder building for natural growth" and that, in the permanent agreement, his government envisions a "united Jerusalem" as well as "the establishment of blocs of settlements in Judea and Samaria."

These were not empty words. In the first three years of the Oslo peace process, instead of withdrawing, Israel actually expanded the number of settlers from about 250,000 at the beginning of 1993 to 305,000 by 1996, not just through "natural growth" but also the construction of new settlements.

Since 1996 the Israeli government has alternated between Likud and Kadima (a centrist faction), but settlement growth has remained strong, with the number of set-

tlers reaching an estimated 655,000 by 2018 and with growth post-2000 largely driven by settlements in the West Bank. Though Prime Minister Sharon unilaterally pulled the 8,000 settlers out of Gaza in 2005 after the second Intifada, this disengagement was simultaneous with an even bigger expansion of West Bank and East Jerusalem settlements; therefore, it was not part of a larger withdrawal plan. Rather, the Gaza Strip was seen as an extremely high-density region (over 2 million Palestinians in only 40 km squared by 2005) such that the demographic threat from annexing it outweighed any territorial advantages. The plan also indefinitely maintained complete military control over the Strip, with the Israeli army deployed on the borders of the Gaza Strip, controlling its airspace, and patrolling its coast.

Most recently, under the auspices of the Trump administration, Israel has entered into mutual-benefit "peace" deals with various Arab governments, with no conditions relating to withdrawals from the occupied Palestinian territories (or any territories). In fact, Israel's settlement approvals had hit record highs in 2020 relative to the decade prior (Peace Now, 2020), while the new year 2021 was ushered with the Israeli government issuing 2,500 new tenders for settlement homes on the eve of Biden's inauguration in the US (Aljazeera, 2021). All signs point to the de jure materialization of the annexation vision verbalized in 2020 by Prime Minister Netenyahu and greenlit by former US Secretary of State Pompeo.[12]

At this juncture, by the very permanence of settlements, it is very difficult to justify settlement growth as a tactical response to Palestinian violence that still makes

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[12]In 2019, the Israeli government had started to openly plan to annex at least a third of the West Bank, including all the land on which settlements are present, and with explicit support for the first time from the White House. In April 2020, a deal was reached between the Likud government and the Blue and White (centrist/liberal) coalition to allow Prime Minister Netenyahu to move forward with this annexation plan, with US Foreign Secretary Mike Pompeo giving the green light by stating that "for the annexation of the West Bank, the Israelis will ultimately make those decisions [...] that's an Israeli decision" (Aljazeera).

room for a two-state solution should violence desist. If Israel is interested in Palestinian commitment to a land for peace solution and needs to use a strategy to ensure that such commitment is forthcoming, it would not be logical to use a strategy that makes this commitment impossible to begin with.

Figure 2 demonstrates the growth in the settler population from 1967 to 2018; B'Tselem (2019) estimates that 60% of growth comes not from "natural" expansion but new settler families.

[Figure 2 here]

To emphasize that this trend is secular of Palestinian violence and nonviolence, **Figure 3** plots the number of Israelis killed by Palestinians (Israeli fatalities) per year from 1987-2019, the period for which data is available, showing the absence of plausible correlation between the two trends. For perspective on the asymmetric coercive power of the two parties, it also plots the number of Palestinians killed by Israeli security forces (Palestinian fatalities) per year during that period.

[Figure 3 here]

3.2 The security discourse

In using the above assessment of strategic behavior, it is useful to address the possible critique that Israeli interest in controlling the occupied territories, albeit demonstrable, may not be rational at all because it compromises Israel's security, and hence difficult to justify in any framework that assumes semi-rational actors. This is usually based on the idea that retaining control over the occupied territories (i) diminishes Israel's security in a physical sense by inviting continued attrition type of violence, and more importantly (ii) diminishes its security in a demographic sense by compromising the Jewish majority in the land under its control. In fact, these

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considerations are what drive much of the formal literature to assume at face value that Israel is committed to withdrawing to achieve its security, both physically and demographically.

The issue of physical security has been partly addressed by some of the above literature. Given the huge asymmetry of power between Israel and the Palestinians and the internal divisions between Palestinian factions, Palestinian violence to pressure Israel to withdraw appears to be a weakly coercive strategy that has become even weaker in recent years, as Israel has successfully outsourced much of its security operations to the Palestinian Authority post-Oslo in exchange for financial resources, but not sovereignty. As shown in **Figure 3**, with exception of second Intifada, Israel has been able to keep a very tight grip on security concerns, through the cooperation of the PA and through escalating attacks on noncooperating Palestinians.[13] The latter can be understood as part of a "peace for peace" strategy in which Israel "instead of buying peace by creating a viable Palestinian state, buys peace by moving out of densely populated Palestinian areas and convincing the Palestinians that if they are aggressive they can become the target of hugely asymmetric attacks" (Khan 2009, p.17).

To sum, it appears that Israel's vastly superior military strength and its security cooperation with the PA allows it to suppress Palestinian attrition violence without needing to satisfy its demands for a state.

The second argument is trickier but necessary to address, especially since Israeli leaders have in their internal discourse emphasized that expanding settlements increases the security of the Jewish Israeli national project. Why is that? Only a deeper dive into Israeli politics, beyond the scope of this paper, can answer this ques-

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[13]See for example the attacks on Gaza in 2009 and 2014.

tion fully. However, one possible explanation put forth by Khan (2005) is that, beside wanting to retain a Jewish majority, Israel is equally or even more concerned about maintaining preferential rights for the Jewish demographic whether in a majority or not.

While giving Palestinians in the occupied territories sovereignty alleviates the majority concern, it is not clear that it alleviates the preferential rights concern and may even make it worse. This would be the case if sovereignty in the occupied territories emboldens the Palestinian citizens of Israel (20% of Israel's population) to demand equal rights which they currently do not have (Adalah, 2017) and/or if it emboldens Palestinian refugees to demand their right, by international law, to return to their homelands in Israel proper. Unless Israel can force Palestinians within Israel and in the Diaspora to accept transfers to the occupied territories, which is very unlikely, then granting sovereignty to the Palestinians in the territories does not guarantee "demographic security" for Israel and may even make it worse.

Understood this way, Israel's strategic interest in expanding control over the occupied territories is not orthogonal to its security concerns. Furthermore, while Israel's precondition of security is superficially understood to mean only the (very sensible) demand that it not suffer from physical violence and hence a resolvable precondition for withdrawal, it may more importantly signal very sensitive (and less internationally acceptable) concerns that are irreconcilable with withdrawal and Palestinian sovereignty, and where Israel's "Palestine problem" has no permanent solution and must be perennially contained. In this case, the notion that Israel's security is undermined by Palestinian statehood rings both true and, from a human rights perspective, alarming.

4 Integrating the history into the theory

To bring into sharp focus how the analysis can change when key assumptions are altered, and the possible merits of this, it is useful to provide an example of what happens when the alternative assessment of strategic interests presented in Section 3 is integrated into a formal model.

If Israel is strategically interested in control over the occupied territories and since Palestinians want sovereignty over these territories, then a noncooperative bargaining model is one example of an appropriate representation of the conflict, since a key feature of noncooperative bargaining is that the parties have orthogonal interests over a specific object: each wants to maximize its share at the expense of the other. They attempt to bargain with one another by one player offering a specific division and seeing if the other agrees, and so on over potentially infinite periods.

In most bargaining models there is also an outside option available, so that a player could exit the game and attempt to impose a division some other way. However, exiting the game is costly to both parties and so in equilibrium, an agreed upon division is reached within the bargain. The party with the better outside option has stronger bargaining power and obtains a larger share of the pie, without actually exiting the game.

Since the outside option determines bargaining power and the equilibrium outcome, a crucial point in the noncooperative bargaining literature is what constitutes and determines the outside option. The literature on bargaining between states or political entities usually assumes the outside option is an all-out war where one side swiftly wipes out the other, and that each party's strength is determined by the probability p that it wins such a war and the cost c it pays to wage a war. (Powell 2002, 2006) In most models the probability of winning and the costs are exogenous to the

model, but Fearon (1997) makes the probability of winning endogenous to the share of the object held in the previous period. For example, if Player 1's share is x_t at time t, then $p_{t+1} = f(x_t)$ where $f' > 0$. The idea is that the object not only yields utility today but helps improve bargaining power and therefore improves one's ability to obtain more of it tomorrow. Therefore, it is a strategically important asset.

I apply a slightly modified version of this model to Israel-Palestine and argue that it is one example of a helpful formal representation of the conflict. Therefore, I am assuming not only that both parties want to maximize their share of the occupied territories (defended in Section 3) but also that the occupied territories are a source of future bargaining power. The positive effect of more land on the probability of winning a war can operate through having more military bases, a localized supportive population (in the case of Israel, the settlers, who are also heavily armed), and potentially a more expansive intelligence network. In fact, the very placement of settlement on the hilltops has been argued to serve a security and intelligence function for Israel (Weizman, 2007).

I add to Fearon's model to include a second channel in which the object can be strategic: by reducing the cost of waging a war. In the case of territorial disputes, this can operate through the generation of economies and geographies of scale in the use of military technology. It can also operate through reducing the cost of suffering international consequences due to belligerency, if major world powers side with or provide immunity to the party that more successfully acquires land should a war break out, given that its territorial advantages and strengths make it a more desirable ally. There is evidence that both cost channels are relevant to Israel-Palestine.[14]

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[14]As a rough indicator of the potential burden of military spending for a future all-out war, one can consider current military spending as a percent of GDP. For Israel this fell from 30% of GDP in 1975 to an all-time low of 5.6% in 2016 (World Bank), coinciding with more, not less, appropriation

Finally, to reflect the asymmetric bargaining power between Israel and the Palestinians, I use (as in Fearon) a take-it-or-leave-it bargaining protocol whereby only one of the two parties is in a position to make offers every time period. The other party can either accept or resort to its exit option. In this context, this would be Israel and the Palestinians respectively. The Palestinians are under Israel's military occupation, the ultimate form of asymmetric bargaining power, and it is unclear how they could seriously "offer" Israel a land agreement. By contrast, Israel can (and does) make effective bargains by expanding or removing settlements. Importantly, Palestinian "acceptance" of a move by Israel does not necessarily imply they are happy with it; rather, that due to low bargaining power they prefer to acquiesce over engaging in an all-out, game-ending war with Israel.

The adapted model is as follows. I assume the amount of land is 1 where the share of State 1 (Israel) is x while the share of State 2 (Palestinians) is $1 - x$. Each party's utility increases with its own share, and I use a simple linear utility function so that $u_{1t} = x_t$ and $u_{2t} = 1 - x_t$, where u_N is the utility of player N at time t. Utilities are discounted by a discount factor δ every period. With respect to bargaining power, S1's probability of winning is p while S2's probability of winning is $1 - p$, where endogeneity implies:

$$p_t = p(x_{t-1}) \qquad p' > 0 \qquad (1)$$

Therefore, as S1's share of the land increases, its chance of winning a war in the next period increases while S2's chance decreases. Endogenous costs, which unlike

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of land in the oPt. Similar calculations are not feasible for Palestinians who do not have a military, but it is not farfetched that military costs to Palestinians of fighting Israel in a game-ending war are extremely high. Regarding international support, the US began its fervent support of Israel in 1967 when the latter successfully defeated Arab armies and Israel's growing military strength since has been instrumental in solidifying its position as a top US ally.

probability do not have to add up to 1, are given by:

$$c_{1t} = c_1(x_{t-1}) \qquad c_1' < 0 \tag{2}$$

$$c_{2t} = c_2(x_{t-1}) \qquad c_2' > 0 \tag{3}$$

Therefore, as S1's share of the land increases, its future costs for waging a war decline while S2's costs increase.

Starting from an exogenous initial division $(x_0, 1 - x_0)$, S1 first makes an offer x_1 to S2 at t_1. There are two possibilities:

- If S2 accepts, the period ends with a division $(x_1, 1 - x_1)$ with commensurate utilities. S1 will make another offer x_2 in the next period, and the resultant payoffs are discounted by δ.

- If S2 rejects, it will end the game by using its outside option. For S1, this means receiving the whole pie with probability p and nothing with probability $1 - p$, so it expects $p(1) + (1 - p)(0) = p$. Since war is a game-ending move, it will actually secure this payoff every period, hence p this period, δp next period, $\delta^2 p$ after that, and so on. Summed to infinity this is $\frac{p}{1-\delta}$, from which we subtract the cost of fighting c_1. Therefore, S1's expected total lifetime utility from this exit at time t is $\frac{p(x_0)}{1-\delta} - c_1(x_0)$. Similarly, the expected utility from this exit for S2 is $\frac{1-p(x_0)}{1-\delta} - c_2(x_0)$.

Figure 4 demonstrates the resultant bargaining tree, with the payoffs in brackets for S1 and S2 respectively, for the first 3 periods of this game.

[**Figure 4 here**]

One can solve for the equilibrium offer at time t by calculating the offer at which S2, taking its future expected utility into account, is indifferent between acquiescence

and rejection. This yields the following appeasement condition, which shows the minimum offer x_t which S2 would acquiesce to or appease:

$$(1 - x_t) + \delta \left[\left(\frac{1 - p(x_t)}{1 - \delta} \right) - c_2(x_t) \right] \tag{4}$$

$$= \left(\frac{1 - p(x_{t-1})}{1 - \delta} \right) - c_2(x_{t-1})$$

Solving Equation (4) for a time path requires imposing a specific functional form for the endogenous bargaining power parameters. For simplicity I impose linear functions, so that $p(x_t) = \beta x_t + \frac{1}{2}(1 - \beta)^{15}$ and $c_2(x_t) = \phi x_t + c_2$. $\beta > 0$, since the probability of winning for S1 increases with its share, and $\phi > 0$, since the cost for S2 increases with S1's share. The exogenous cost parameter for S2, c_2, is also positive.

Substituting these linear forms into Equation (4) and rearranging yields the first difference equation:

$$x_t = \left[\frac{\beta + (1 - \delta)\phi}{\delta\beta + (1 - \delta)(1 + \delta\phi)} \right] x_{t-1} \tag{5}$$

$$+ \left[\frac{(1 - \delta)^2 c_2 + \frac{1}{2}(1 - \beta)(1 - \delta)}{\delta\beta + (1 - \delta)(1 + \delta\phi)} \right]$$

We can solve for an equilibrium, if it exists, by setting $x_t = x_{t-1} = x^*$ but for the purposes of this paper an even more important question concerns the *stability* of equilibrium. If the parties start at an exogenous division $x_0 \neq x^*$, do they move toward x^* and stay there, or do they move away? Within the context of Israel-Palestine, these can be understood respectively as (i) some form of stable two state solution versus (ii) an ongoing expansion by one state at the expense of the other until

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[15]This form guarantees that $p(1/2) = 1/2$, so that whomever has half the land has half the probability of winning. The parameter β affects the slope around this midpoint (whether a small increase (decrease) raises (lowers) the probability of winning by a little or a lot).

one is eliminated. Since stability depends on the coefficient on the lagged variable in Equation (5) being less than one, any division is stable if and only if:

$$\beta + (1 - \delta)\phi < 1 \tag{6}$$

The more strategic the asset is, the higher are β and ϕ and the less likely is Equation (6) to hold. Therefore, the more important the asset is to future bargaining power, the more likely it is that any division is unstable and that the outcome is a moving "equilibrium" where one state increasingly dominates; in turn, which state expands depends on the initial conditions relative to the equilibrium. Starting with a more favorable scenario for S1, so $x_0 > x^*$, will generate increasing movement up from x^* so that S1 gradually grabs more land, acquiesced to by S2 until S2 is eliminated. Therefore, $x_0 < x_1 < x_2 < x_3$ and so on until $x_t \to 1$ as $t \to \infty$. This is the "salami tactics" (p.1) approach to expansion.[16] By contrast, starting with a more favorable scenario for S2, $x_0 < x^*$, will lead to growing movement down from x^* and hence compounding concessions by S1 to S2.

The stability condition is illustrated more clearly in **Figure 5**. The combination of β and ϕ under the line, such as point O, generates stability but anything above it such as point N generates the increasing dominance of one party.

[**Figure 5 here**]

Albeit highly stylized, this noncooperative bargaining game can, when applied to Israel-Palestine, help explain the endurance of the conflict as well as the worsening prospects for a two-state solution. The model is appropriate if Israel and the Pales-

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[16]Thomas Schelling originally discussed the use of "salami tactics", or piece-wise expansionism that strengths over time, in his book *Arms and Influence* (1966).

tinians are both strategically interested in maximizing their control over the occupied territories and if these territories are important in determining future bargaining power. As argued above, there is evidence to support both of these propositions.

In this case, the model shows that if the land is highly strategic then a stable division is unlikely, and predicts that one state will consistently grow stronger by gradually making land grabs that its opponent acquiesces to as it becomes increasingly weaker. This roughly mirrors the long-running pattern of Israeli settler expansion into the occupied territories shown in **Figure 2**.

Therefore, whereas in other models the absence of a solution is contrary to the strategic interests of the militarily dominant party (Israel), here it is aligned with them. No solution (in fact, deteriorating prospects for one) emerges as the natural result of incongruent demands over highly strategic territory. That the outcome matches trends on the ground points to the merit and plausibility of such an approach.

The model's high level of abstraction leaves many details wanting when applied to a historically entrenched real-world conflict, but this does not necessarily negate its usefulness. One issue is that the full information aspect does not allow us to examine episodes of violence on both sides, which may be understood as signaling mechanisms to showcase strength in an attrition conflict. However, abstracting from such information problems may be helpful; for example, if the second Intifada was a failed attempt by Palestinians to signal strength to Israel (Shang, 2003) then because that signal was not credible it does not alter the broader dynamic of the conflict.

Another issue is that the focus on land does not allow us to examine other types of exchanges between the parties such as security cooperation by the Palestinian Authority in exchange for recognition, funding, and private benefits from Israel, as effected by the Oslo Accords. Still, Oslo may be understood as an outside factor that increased the exogenous cost c_2 to the Palestinians of entering an all-out war

with Israel, due to the PA's role in crushing armed movements; therefore, non-land exchanges can be understood through their effect on the ultimate bargaining power.

Finally, another limitation is that the game only has two players, Israel and Palestine, masking the heterogeneity of different players within each political entity. Nonetheless, this allows us to focus on the broader national interests of Israel and the Palestinians in the territories, which, irrespective of method of the faction involved, plausibly coalesce around maximum control or sovereignty.

5 Conclusion

The conflict in Israel-Palestine is one of the most protracted of the contemporary period, with past mediation efforts failing spectacularly in producing a two-state solution, seen internationally as the legally just and feasible resolution. Since game theory is the study of the interdependent strategic interests of rational actors, applying the principles of game theory to this conflict seems apropos for understanding the broad trajectory of the conflict, in a methodical way that does not resort to concepts of irrationality or zealotry nor to wishful thinking about the motivations of the parties involved. By investigating rationally the root causes of the continuation of the conflict, game theory can help point to likely future trajectories as well and to the probable success or failure of different solution paradigms moving forward.

This paper reviews the existing applications of game theory to Israel-Palestine, highlighting their assumptions about the interests and strategies of the parties involved and therefore the core roadblocks to a mutually acceptable solution. It shows that the application of game theory to the topic has been limited and, especially in the formal literature, highly reliant on the assumption that Israel is prepared to withdraw from the occupied territories pending resolvable security concerns. In this

"land for peace" paradigm, Israel is obstructed from fulfilling its withdrawal plans by Palestinians whose strategic interests and actions are irreconcilable with this vision. Most papers offering an alternative assessment do not offer a formal framework, making comparisons with the formal literature difficult, and they sometimes lack a systematic assessment of Israeli strategic interests.

Using a systematic overview of Israel's settlement policy since 1967, the paper reassesses this assumption on which most formal models are based and argues that Israel has in fact pursued the expansion, not retrenchment, of its control over the occupied territories as a top national priority under all circumstances. To formalize this argument, I draw on a model of noncooperative bargaining where the actors have orthogonal interests in an object which is important for future bargaining power. The model suggests that if the occupied territories are highly strategic, then a stable division of the land is unlikely to materialize in equilibrium, with one state instead making gradual land grabs to which the other acquiesces as it grows increasingly weaker. This mirrors the pattern of settlement expansion in the occupied territories since 1967. It also reifies the notion, supported historically, that settlement expansion is the result not of Palestinian violence or lack thereof but of the core strategic interests of the Israeli state, and helps make sense of the ongoing push by the Israeli government for outright annexation over parts of the territories.

The prognosis offered in this paper, that the lack of a two state solution fits in with rather than contradicts the strategic interests of the militarily dominant party, is at once plausible and extremely bleak. It sheds doubt not only on the assumptions of some of the academic literature on the subject but also on the broader approach to a resolution based on an unwavering yet wishful belief in "land for peace." Nonetheless, though bleak, this prognosis can help make sense of the prolonged and worsening nature of the conflict.

More broadly, the discussion in this paper reifies the importance of using historical evidence and interdisciplinary analysis to generate useful predictions from economic theory about conflict in general. Models driven by assumptions that abstract from and contradict core historical trends are of limited usefulness in explaining or predicting the trajectory of the issue at hand. By contrast, interdisciplinary analysis that grounds its assumptions historically is likely to shed light on at least some important mechanisms that give rise to, and that sustain, political conflict.

FIGURES

Figure 1: Israel and the occupied territories

Figure 1 shows the West Bank, East Jerusalem, and Gaza in brown, and Israel in yellow (it also includes Golan Heights, occupied by Israel in Syria). Source: The Palestinian territories' profile, *BBC News*, April 8 2019.
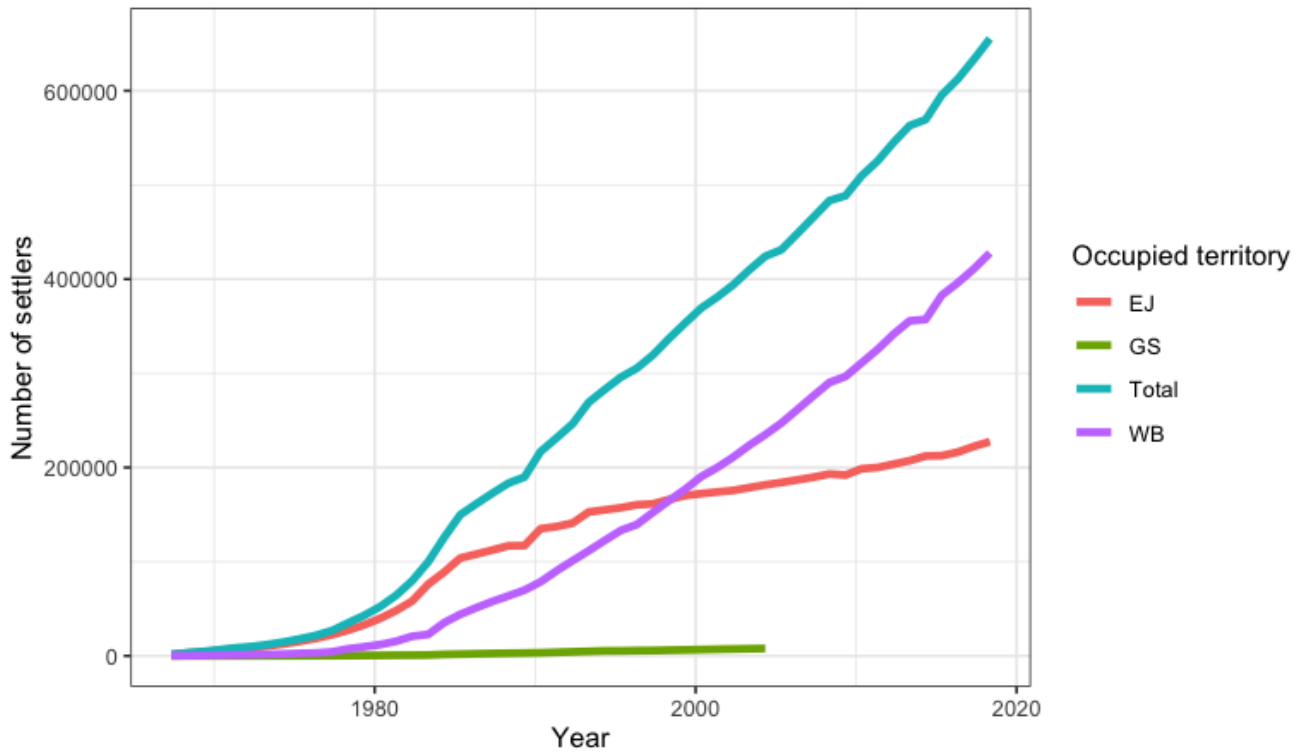
Figure 2: Settler growth in the occupied Palestinian territories, 1967-2018

Figure 2 shows the number of Israeli settlers in the West Bank, East Jerusalem, and Gaza, as well as the total over all territories, from 1967 to 2018. Source: Author's construction from B'Tselem settlement statistics, Foundation for Middle East Peace settlement population, and Peace Now settlement watch data. Missing data 1968-1971 and 1973-1975 imputed from trends.
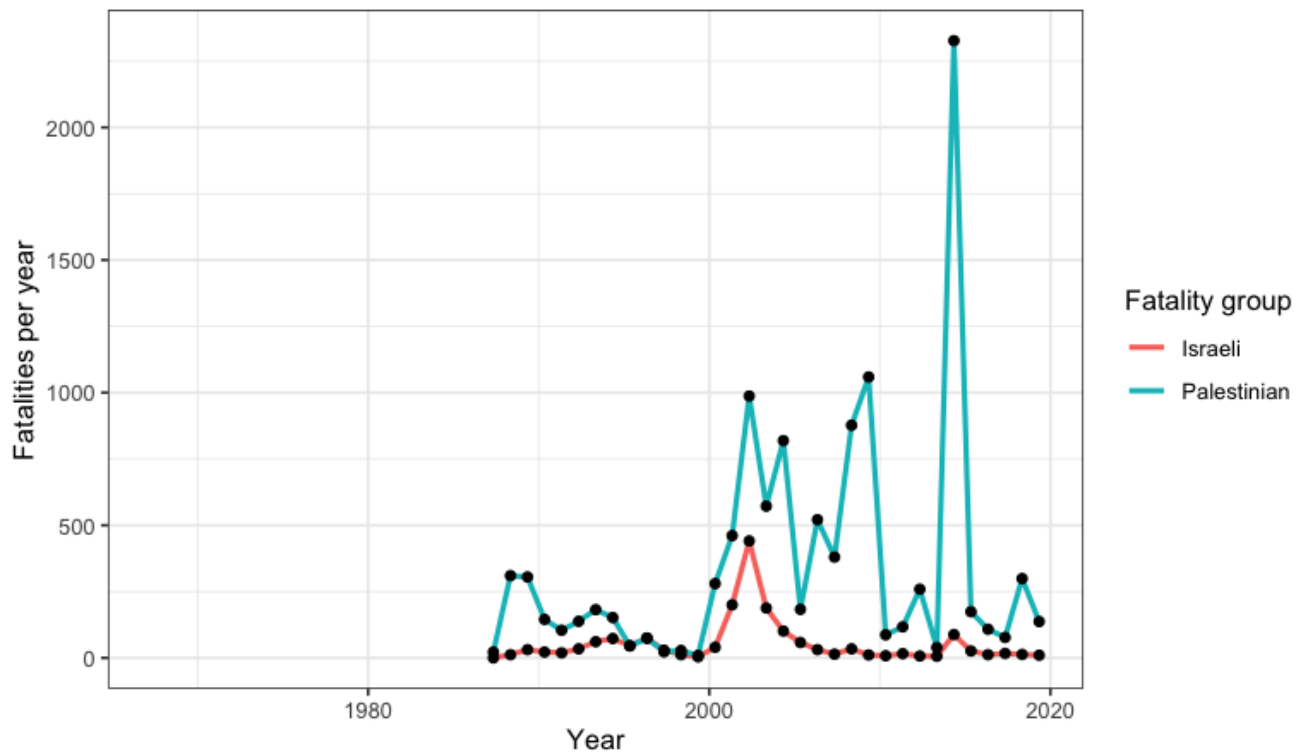
Figure 3: Israeli and Palestinian fatalities, 1987-2019

Figure 3 shows the number of Israeli and Palestinian fatalities per year from 1987 to 2019.
Source: Author's construction from B'Tselem fatalities statistics.

$t = 1$

S1

x_1

S2

Appease   Fight

x_1 $\frac{p(x_0)}{1-\delta} - c_1(x_0)$

$1 - x_1$ $\frac{1-p(x_0)}{1-\delta} - c_2(x_0)$

S1

x_2

S2

$t = 2$

Appease   Fight

δx_2 $\delta\left(\frac{p(x_1)}{1-\delta} - c_1(x_1)\right)$

$\delta(1 - x_2)$ $\delta\left(\frac{1-p(x_1)}{1-\delta} - c_2(x_1)\right)$

S1

x_3

S2

$t = 3$

Appease   Fight

$\delta^2 x_3$ $\delta^2\left(\frac{p(x_2)}{1-\delta} - c_1(x_2)\right)$

$\delta^2(1 - x_3)$ $\delta^2\left(\frac{1-p(x_2)}{1-\delta} - c_2(x_2)\right)$
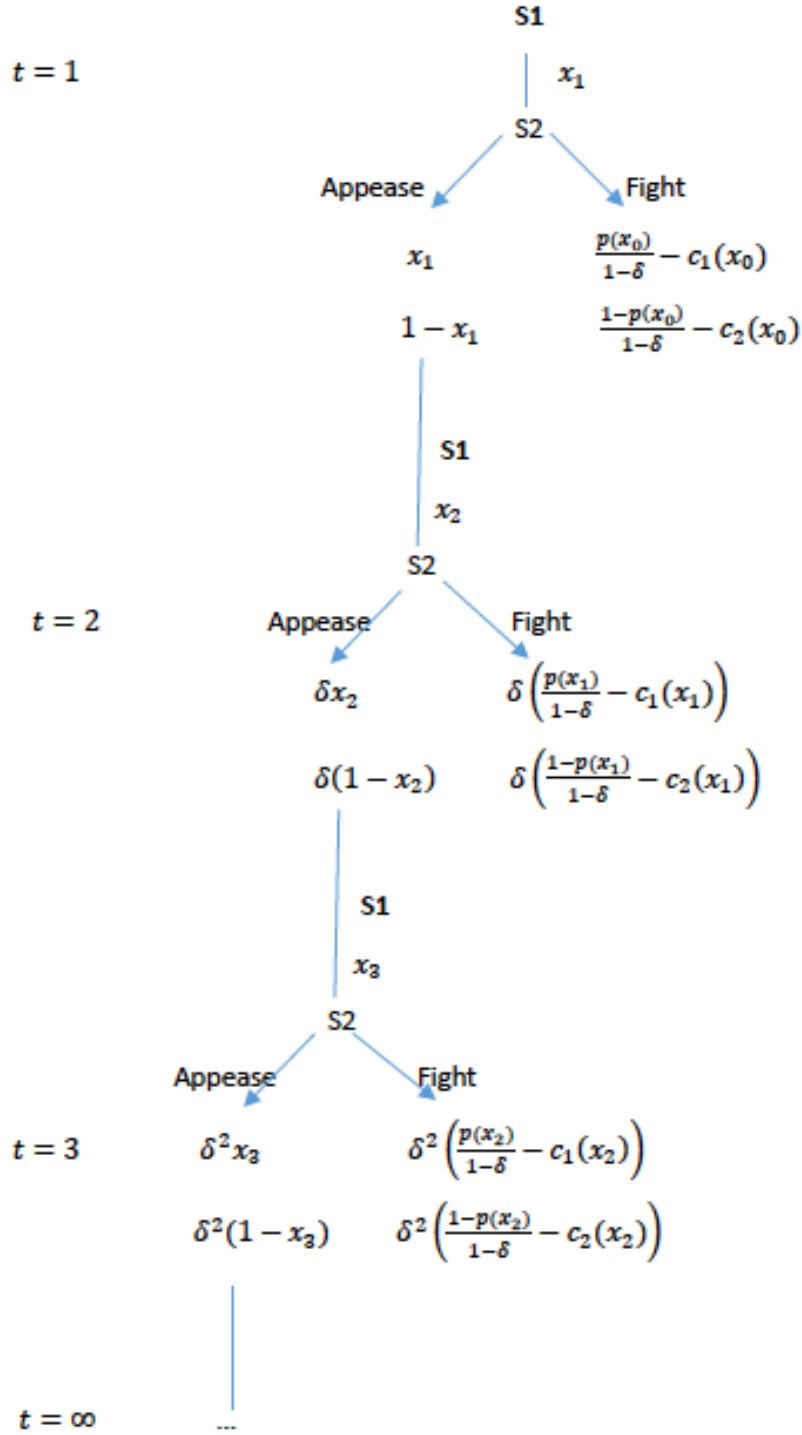
$t = \infty$

...

Figure 4: Game tree

Figure 4 illustrates the structure of the game in Section 4 for the first three periods. The payoffs at each node are for $S1$ and $S2$ respectively.
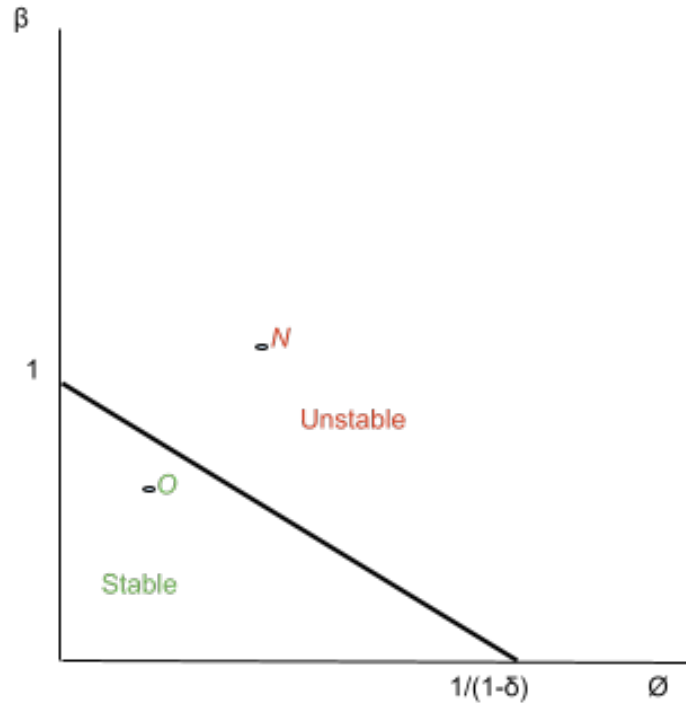
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Figure 5: The instability condition

Figure 5 captures the model's implications about equilibrium (in)stability. Combinations of β and ϕ below the line, such as O, indicate a low-level strategic object and ensure that the system is stable and offers converge toward an intertemporal equilibrium if one exists. Combinations of β and ϕ above the line, such as N, imply a highly strategic object; the system is unstable and offers diverge if the initial starting point is not at equilibrium.

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