Collective Defense by Common Property Regimes: the Rise and Fall of the Kibbutz*

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Abstract

Common property regimes have long been considered inefficient and short lived, as they encourage high-productivity individuals to leave and shirking among those who stay. In contrast, kibbutzim – voluntary common property settlements in Israel – have lasted almost for a century. Recently, about 75% of kibbutzim abandoned the equal-sharing rule and paid differential salaries to members, based on their contributions. To explain the long persistence of the kibbutzim, as well as the recent kibbutz privatization, I develop a model that highlights the public defense provided by common property regimes. The model predicts that the privatization of common property regimes can be attributed to the decrease of external threats. To test this prediction, I construct a kibbutzim-level panel data set that contains the terrorist attacks near each kibbutz and the institutional status (i.e. preserving the equal-sharing rule or not) of each kibbutz in the years from 1986 to 2014. The empirical results show that an increase in the number of Israeli deaths near a kibbutz significantly decreases the probability that the kibbutz shift away from equal sharing.

1 Introduction

Common property regimes, a property rights arrangement in which a group of resource users share rewards and duties related to a resource, have long been considered inefficient.[1] The inefficiency comes from two sources: low-productivity individuals tend to remain in the regime, while high-productivity individuals tend to leave (adverse selection); and equal income sharing, regardless of effort, encourages shirking (moral hazard). As a result, most common property regimes are either short lived, such as early collectivize settlements at Jamestown, Plymouth, and Salt Lake City (Ellickson 1993), or based on coercion, such as the people's communes in China and kolkhozes in

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[1]Common-property regimes are often confused with common-property resources (see Ostrom and Hess, 2007). Among various , I focus on common property regimes where output are equally shared, as they are commonly practiced in gold mines (Umbeck 1977), alpine pastures, fishing grounds (Ostrom 1990), marriages (Allen 1992), and pirate organizations (Leeson 2007).

Russia. In contrast, kibbutzim - voluntary common property settlements in Israel - have lasted for a century.[2] The kibbutzim started in 1910, flourished during the 1936-1939 Arab revolt, and declined since 1977 (Near 1999, p1-9). Traditionally, all members received an equal share of total output of the kibbutz, regardless of individual productivity. From the late 1990s to the early 2010s, about 75% of kibbutzim abandoned the equal-sharing rule and introduced a "safety net" budget, which paid differential salaries to members, based on the working hours and the market value of their jobs. The long persistence, and the recent privatization, of the kibbutzim has been the research subject of sociologists, economists, and historians.

In traditional kibbutzim, members hold common ownership of all properties, ranging from clothing and shoes to housings and tractors. The members work from 8.5 to 9.5 hours, six days a week, in fields assigned by a work coordinator.[3] All their products and income, including reparation from the Germans, army pay, and royalties from copyright material, goes into a central treasury. To enforce the equal living standard among its members, the kibbutzim abolish private property. The moment newcomers arrive a kibbutz, they transfer all their belongings to the kibbutz treasury (Leiblich 1981, p19). Should they leave the kibbutz, they bring nothing with them, except some personal effects such as pictures, books, and gifts (Weisman 1966).[4]

The kibbutzim, in turn, centrally sell all the products in the market, and provide various goods and services, covering all the needs for its members, including clothing, food, concert tickets, razor blades, postage stamps, housing, laundering, mending, education, and medical care.[5] All members receive them according to the principle: "equality of supply for equal needs".[6] Thus, every member lives to the same standard, regardless of the amount or the quality of a member's work (Weisman 1966).

The kibbutzim also claim right to care for the children and educate them, thereby relieving women from child rearing. Instead of sleeping with their parents, children spent their nights in children's houses, which include sleeping quarters, play areas, dining faculties, washrooms and

[2]Kibbutz Gan Shmuel, established in 1913, was still a common property community by 2014.

[3]It is hard to fit the jobs to the members. Inability to find a satisfying job is the main reason for one to leave the kibbutz. On the other hand, some boring jobs, like carpentry and millwork, rotate among the members.

[4]Those things are the kibbutz's property while they are still the members of the kibbutz.

[5]The living standard increased over time. Housing, for example, improved from tent to wooden shack without sanitary facilities to permanent housing with bathroom and shower (Kerem 1962, p138).

[6]The members take turns in using goods, if the goods cannot be divided equally. In one kibbutz, the members rotated watches every three months (Kerem 1962, p107).

classroom facilities for children five years old and up. Children live, eat, sleep and study together. Members are assigned to take care of the children as part of their work. They graduate from one house to another as they grow up until the age of eighteen, by which time they become formal kibbutz members (Kerem 1962, p78-81).

The economic equality is further secured by the political equality among the kibbutz members. The basic instrument of government is the weekly meeting, on which every member has an equal vote on determining policy, electing a secretariat, and controlling the general operation of the community. While the weekly meeting determines the general policy and rules, the secretariat implements them. They are responsible for financing from banks, purchasing supplies, assigning daily work to the member, and selling kibbutz products (Kerem 1962, p25-26). The managerial positions are rotated every two years to prevent the formation of a privileged class.[7]

Sociologists typically view the kibbutz as a social experiment fuelled by the Zionist movement, and attribute the recent privatization of Kibbutzim to the decline of a "pioneering spirit", and the rise of individualism among kibbutzniks (Rosner and Getz 1996; Russel et al. 2013, p5).

Certainly, one should not underplay the important role of ideology in constructing Kibbutzim. However, ideology-based explanations are rarely testable and subject to concerns of reverse causality. In a recent field experiment, kibbutz members, when paired with city residents, were found as cooperative as city residents. Kibbutz members demonstrated a higher level of cooperation, only when they were paired with anonymous kibbutz members (Ruffle and Sosis 2006). The experiment results suggest that the kibbutz institution is the cause, rather than the consequence, of the ideologies of kibbutz members.

Economists have viewed the traditional kibbutzim as risk-sharing communities that provide insurance against fluctuations of income across its members. The fluctuations could result from malaria, illness, unemployment, disability and occupation-specific demand shocks (Abramitzky, 2008; Abramitzky, 2011). Some elements about the traditional kibbutz, however, are inconsistent with the objectives of full risk sharing. For example, members develop similar skills through rotating positions, and gain similar knowledge through collective education within the kibbutzim.

[7] In fact, being in a leadership position won't give one any material benefit, as every member is entitled to the same consumption. Consequently, "kibbutz elections are often one long series of declinations: one candidate protesting that his wife is sick, another confessing his inability to cope with the task. Elections in which candidates actively campaign for positions are unknown."(Kerem 1962, p116)

The kibbutzim neither allow members to work outside, nor hire outside workers. As a result, the low diversification of the human capital within the kibbutz hampers the efficacy of the insurance. The risk-sharing argument also fails to explain the rarity of the kibbutzim. The moshavim, an individually owned settlement, outnumbered the kibbutzim after the Independence of Israel, and became the dominant type of Israel rural settlement. Yet these settlements did not adopted the equal sharing rule. The difference could be due to different constraints, or because moshav members were different from kibbutz members. Abramitzky (2011) suggests the latter and attributes the differences to ideology, arguing that "the presence of ideologically committed members is important for maintaining equal sharing, while mitigating brain drain and moral hazard."

Historians, on the other hand, are on the right track in pointing out that the kibbutzim were the most appropriate type of settlement in defending enemy attack, as they were placed by the Jewish agency in strategical areas to form first defence lines, and played an important role in the war of independence (Near 1999, p58; Bowes 1990; Ben-David 2015, p58). The high defensive abilities of the kibbutzim, however, were attributed to their solidarity, discipline and ideologies.

To explore an alternative explanation for the timing of and the forces underlying kibbutz privatization, I develop a model of common property regimes that captures the tradeoff between the high level of public defense and the incentive to stay. In a private property community, public defense is under-provisioned, as the members tend to free ride on the contribution of others. Common property communities, on the other hand, can induce a first best level of public defense, since the private benefit of each resident is perfectly aligned with the aggregate benefit of the village - any choice that maximizes the wealth of the village is also the one that maximizes the wealth of each individual resident. Thus, common property regimes solve the free riding problem on the production of the public good.

The model then predicts that kibbutzim in safer environments tend to shift away from equal sharing. When the threat faced by kibbutzim faded away, the benefit of a higher level of public defense was outweighed against the cost of low productivity in private goods. Under the pressure of members, especially those of high productivity, kibbutzim introduced a differential wage system and abandoned the equal-sharing rule.

The independent and asymmetric timing of the income reform across various kibbutzim allows

a test of this prediction.[8] A kibbutzim-level panel dataset is constructed that contains the terrorist attacks near each kibbutz and the institutional status (preserving the equal-sharing rule or not) of each kibbutz in the years from 1986 to 2014. Using rainfall variation at the nearby refugee camp as an instrument for terrorist attacks, the empirical results show that a decrease in the number of Israeli deaths near a kibbutz significantly increases the probability that the kibbutz abandons its equal sharing rule. The results are robust to various measures for external threats.

The theoretical and empirical analysis of the kibbutz sheds light on the functions of common property regimes. In the current literature on property rights, a lower excluding cost is the benefit of common property regimes in managing existing resources such as fisheries, oil pools, forest (Lueck 1994, Ostrom and Hess 2010). However, there were no valuable natural resources near kibbutzim, as most kibbutzim were located in "substandard, poorly developed or undeveloped tracts of marsh, swamp, or sand dune..." (Anabtawi 1972). Instead, kibbutz members deliberately pooled all their output together through banning private assets, thereby inducing a high level of public defense aiming at protecting the whole community, instead of a low level of public defense aiming at protecting individual property.

This paper also presents a novel condition that determines the choice of property regimes. Current works attribute the emergence of private property rights to the increase in the value of the underlying asset (Demsetz 1974), or the decrease in the cost of enforcing property rights (Allen 2002). In the case of kibbutzim, it is due to the decrease in the threat level, since their Arab neighbours aimed at expelling them, not merely stealing their properties.

2 Background information

Although many states have been involved in conflicts, few have faced the repeated wars and persistent hostilities from all surrounding neighbours as Israel has for decades. Despite being the victor in six wars, Israel made little progress in negotiating peace treaties with neighbouring Arab countries. And when Israel finally made peace with Egypt in 1978 and Jordan in 1994, it were caught in a guerrilla war with armed Palestinian groups. Still today, it faces the missiles fired by Hamas

[8] Historically, kibbutzim were affiliated with several kibbutz federations, and mutually responsible for each other's debts. The kibbutz federations in 1989 formally permitted their member kibbutzim to introduce reforms, and ensured that each kibbutz was fully responsible for its own debt (Russel et al. 2013, p42).

(Islamic Resistance Movement) from the Gaza Strip.

2.1 The British Mandate: 1917-1947

Despite long-lasting conflicts between Israelis and Palestinians in the 20th century, historically "in the Holy Land, as elsewhere in Arab lands, Jews and Arabs lived together in harmony... No community trespassed on the rights of another..." (Hadawi 1967, p12). It was the Balfour Declaration in 1917, a support from the British government for the establishment of a "national home for the Jewish people" in Palestine, that exacerbated the tensions between the Arabs and the Jews (Schneer 2010). The Arab opposition to the establishment of a Jewish state eventually developed into the 1936-1939 Arab revolt in Palestine. In response to the revolt, the British Mandate issued "The MacDonal White Paper" in 1939, limiting the Jewish immigrants to 75,000 over next five years (Hadawi 1967, p64).

After fruitless protests to the "White Paper", the Jewish agency, anticipating the upcoming conflicts with the Arab states, went out of its ways to smuggle arms from abroad, and organize illegal Jewish immigration to Palestine.[9] Most of the illegal immigrants, however, were intercepted by the Royal Navy, and were sent to internment camps. By the establishment of the State of Israel in 1948 and the breakout of the Israel-Arab War, some 28,000 Jews were still interned in the Cyprus camps (Tucker and Roberts 2008, p280). Albeit cautiously hidden in several young kibbutzim, 33 arms caches containing over 500 weapons and a large quantity of munitions (a significant part of Haganah's armouries) were confiscated by the British mandate during the Operation Agatha (Charters 1998; Wagner 2008). As a consequence, the arms and the soldiers of the Haganah, a Jewish paramilitary organization and the backbone of the Israel Defence force (IDF), were still insufficient at the eve of the 1948 Arab–Israeli War.[10]

2.2 Middle-East wars: 1948-1977

Egyptian, Syrian, Iraqi, and Jordanian armies invaded Israel on 15 May 1948. In the first three weeks of the war, the Haganah troops, inferior in manpower and firepower, managed to halt and

[9] Against the backdrop of the Arab revolt, Ben-Gurion, the head of the Jewish Agency, had jotted down in his diary: "The danger we face is not riots—but destruction. Because the attackers will not be only the Arabs of Palestine but perhaps [also] Iraq and Saudi [Arabia], and they have aircraft and artillery. And we must draw a political and military conclusion [from this]." (Morris 2008, p199)

[10] On 15 May, only 60 percent of Haganah troops were equipped (Morris 2008, p204).

contain the four-pronged assault.[11] During the truce from June 11 to July 8, the Haganah transformed from a paramilitary group into a regular army. They built up their supply of arms from Czechoslovakia, and almost doubled their manpower with the arrival of immigrants. Since then, the strategic initiative had passed from Arab into Israeli hands, and was to remain there for the duration of the war (Morris 2008, p263)

Alongside the clear victory for Israel, the 1948 war also left some 700,000 Palestinian refugees, former inhabitants of Arab villages conquered by the Jewish State, in its wake. Starting in June 1948, thousands of refugees, settling no more than three or four hours' walk from their abandoned homes, illegally crossed the border lines into Israel. Initially the refugees came unarmed, sought to retrieve their possessions, reap crops, and resettle in their native villages. Increasingly, the refugees came armed with the purpose of stealing from Jewish settlements, and attacked Israelis for revenge. Egypt and Jordan also trained and sent infiltrators called fedayeen ("self-sacrificers") to attack Israelis. Due to the long and unnatural borders, especially the one between Israel and Jordan along the West Bank, the Israel Defense Forces was too thinly spread to effectively prevent such incursions.[12] The recorded number of infiltration cases peaked at 16,000 in 1952, and gradually dropped to 7,018 in 1953, 4,638 in 1954, 4,351 in 1955, and 2,786 in the first four months of 1956 (Morris 1995, p28). From 1949 to 1956, infiltration resulted in the death of some two hundred Israeli civilians and direct economic damage of 2.6 million Israel shekels (about 710,000 in 1950 US dollars) for stolen farm animals and agriculture equipment, and even larger losses due to the extra expenditure and manpower on anti-infiltration measures. (Morris 2011, p271; Morris 1995, p99-101). Worse still, settlers in some half dozen moshavim were so demoralized by the constant thefts, sabotage, and the occasional murder that they completely abandoned their settlements. The abandonment created gaps in the national defensive network and fresh access routes for infiltration.

Fed up with the constant harassment, the closure of the Suez Canal to Israeli shipping, and the blockade of the Gulf of Aqaba, the Israeli troops attacked the Egyptian armed forces on 29 Oct 1956 (Klausner and Bickerton 2007, p123-127). Fearing the assault from British and French ground forces, Egypt withdraw its troops in the Sinai to the west of the canal. As a result, Israel smoothly conquered the entire Sinai before it accepted the United Nations demand for a cease-fire on 11 Nov

[11] See Morris 2008, p204-206 for the comparison of military forces from both sides.
[12] See Morris 1995, p1-2 for a detailed account of the problematic border lines of Israel.

1956. Although Israeli troops later retreated to pre-war position, it obtained the guarantees from the United Nations of free passage through the Gulf of Aqaba and an emergency force (UNEF) between Israel and Egypt (Morris 2011, p296-300). This removed the fedayeen problem temporarily from the Israel-Egyptian border.

After the Suez Crisis, Egyptian and Jordanian leaders decided to control their borders to prevent the risk of another conflict. Consequently, Israelis enjoyed a long period of calm along Israel's borders, perhaps the longest in the Israel history. During the decade after the Suez Crisis in 1956, only 35 Israelis were killed by acts of hostility (Cohen 2010, p37).

The end of the Six-Day War in 1967 found Israel's occupation of the Sinai, the Golan Heights, the West Bank, and the Gaza Strip. The new territories provided Israel with strategic depth, more defensible borders, and bargaining counters that could be traded for peace. Israel offered withdrawal from the newly occupied regions in exchange for peace treaties with the neighbouring Arab countries (Klausner and Bickerton 2007, p153 document 6-4). And the answer they received was "no peace, no recognition, and no negotiations".

The military defeat of 1967, along with the loss of territory, left Arab countries with a driving urge for revenge, and made another round of conflict almost a certainty. In the following three years, Egypt, with the modern weaponry and thousands of military advisors supplied by the Soviet Union, waged a limited warfare, later known as the "War of Attrition", based on intermittent artillery bombardment and occasional cross-Canal raids. Albeit thousands of deaths, the Egyptian army was able to inflict heavy casualties on the seemingly invincible IDF, and reacquired a self-confidence that had been destroyed in the previous defeats. More importantly, the Soviet-Egyptian air defense system had found a way to neutralize the air superiority maintained by the Israel Air Force (IAF) and advanced its army to a supremely advantageous starting position for the upcoming war (Morris 2011, p347-p363).

The showdown came in 1973. On Oct 6, Egyptian and Syrian armies jointly launched a surprise attack on the Israeli forces. In the Sinai Peninsula, the Egyptian armor demolished all twenty two but one Israeli fortifications, and breached the Israel defence lines along the Suez Canal. By the second day, with 100,0000 men, 1,020 tanks, and 13,500 vehicles having crossed the waterway, the Egyptians forced the Israelis to retreat to a new defense line in the Sinai, and effectively regained the control of the Suez Canal. The Egyptian forces were only halted at the boundary of their anti-

aircraft umbrella. On the Golan Heights, the Syrian armor broke through the Israel defense lines, and was rolling down the slopes toward the Jordan valley. The situation for Israel was precarious and "the Third Temple [the State of Israel] is in danger" (warned by Dayan, the Israeli Defense Minister). Worse still, the Israel Air Force (IAF) failed to destroy the Syrian SAM anti-aircraft missiles, and hence unable to provide air support to the Golan battle. With the collapse of the 188th Armored Brigade, the one defending the Southern Golan Heights, Israel had to send the strategic reserve, originally to be deployed to the Sinai front, to contain the Syrian advance. Just as the Israeli defense were almost at the point of collapse, the Syrians, meeting fresh Israeli armour, broke first and withdrew.[13] On Oct 24, the Soviet-American cease-fire proposal put an end to the 1973 war, without a decisive result (Morris 2011, p387-p440; Klausner and Bickerton 2007, p163-p171)

Israel turned the tide, but only at the edge of collapse. The narrow victory convinced many Israelis that the Sinai Peninsula could not be held indefinitely, certainly without American airlift. On the other hand, the 1973 war restored the honor of the Arabs, thus enabling their leaders to contemplate peace with Israel. With the help of American mediation, Egypt and Israel signed a peace treaty in 1979 (Morris 2011, p484-486). [14]Within three years, Israel withdrew all armed forces and civilian settlements from the Sinai, effectively handing over the territory back to Egypt. In return, Egypt became the first Arab country to officially recognize Israel, and established a "normal relationship" with Israel.[15] The peace treaty won Israel a far less dangerous Middle East. Since then, no Arab states have waged a regular war against Israel.

2.3 The Rise of The Palestine Liberation Organization

While Israel and Arab states were shelling each other, the occupation of the Gaza Strip and the West Bank instilled a growing sense of separateness from the Arab governments among the Palestinians. Prior to the 1967 war, the Palestinians relied on the Arab governments to liberate them from the Jewish. The Palestine Liberation Organization (PLO) and its military department Palestine

[13]Colonel Ben-Gal, a brigade commander, was later to say: "I was already set to order all [my] forces to withdraw. I had already picked up the radiotelephone. But I said to myself: Let's wait a little longer.... I was sure we had lost the battle. Had it gone on for another half an hour, an hour, we would have lost. For some reason, the Syrians broke first and decided to retreat."

[14]The peacemaking momentum was interrupted by the collapse of the Nixon Administration as a result of the Watergate affair.

[15]The normal relationship means "full recognition, diplomatic, economic and cultural relations, termination of economic boycotts and discriminatory barriers to the free movement of people and goods."(Morris 2011, p484)

Liberation Army (PLA), originally established in 1964 on a council convened by Jordan, were financially dependent on, and served as an instrument of the Arab governments (Klausner and Bickerton 2007, p141). Fearing the retaliation strikes from Israel and being drawn into conflicts at inappropriate times and places, the Arab governments deliberately restrained popular armed struggles and suppressed independent initiatives.[16]However, the humiliating defeat in the 1967 war discredited the Arab governments along with the old PLO parliament(Klausner and Bickerton 2007, p141, p158).

In the meantime, Palestine National Liberation Movement, or Fatah, gained enormous popularity among the Palestinians through highly publicized guerrilla acitivities. In March 1968, Fatah fighters, aided by Jordanian regulars, fiercely resisted an Israeli assault and inflicted heavy casualties on the enemy at a border town, Karameh. The heroic resistance of Fatah in Karameh became an instant legend, which earned itself financial supports from the Persian Gulf states, and thousands of young volunteers (Morris 2011, p368-370). Within a few months, the number of Fatah fighters grew from a couple of thousand to ten to fifteen thousand. In 1969, Fatah completely took over the Palestine Liberation Organization. Its leader, Yasser Arafat, was elected as the chairman of the executive committee (and hold this position until his death) (Klausner and Bickerton 2007, p158-159).

In the following two years, the PLO launched more than a thousand of attacks in the Gaza Strip, across the Jordan River, and over the Lebanese-Israeli Frontier. The IDF finally cracked down the armed struggle in the Gaza Strip in late 1971, after killing some 100 guerrillas and capturing some 700 others. The guerrilla bases in the Jordan, however, were demolished by the Jordan army. After the Karameh incidence, the PLO moved its base to Amman and turned northern Jordan into a state-within-a-state. As the strength of the PLO grew, some groups within the PLO openly called for overthrowing the Jordan regime, and attempted to assassinate the Jordan monarch, King Hussein. After having survived two assassinations, King Hussein had no choice but to order his army to attack the PLO in 1970, successfully forcing the PLO fighters to move on to southern Lebanon (Morris 2011, p371-373). The reallocation of the PLO bases turned out to be a nightmare for Israel and eventually dragged Israel into the 1982 Lebanon war.

[16]On January 2, 1965, Jordanians intercepted a Fatah squad, on its way back from a failed sabotage of the National Water Carrier in Israel, and arrested all of them (Morris 2011, p364).

Stemming from the delicate Christian-Muslim balance, the government of Lebanon was too weak to restrain the guerrillas. The PLO quickly turned Palestine refugee camps in the southern Lebanon into forward bases, virtually forming an armed state-within-a-state. Terrorist operations from Lebanon against targets in northern Israel increased dramatically during the years 1970-1975, even though dozens of terrorist groups were intercepted when crossing the border. In 1974 alone, 61 Israelis were killed by terrorists from Lebanon. Interrupted by the Lebanese civil war in 1975, the PLO emerged better armed from battles with the Christian Lebanese, and continued to raid northern Israel. In 1978, 11 PLO members hijacked a bus near Haifa, killing 38 Israeli civilians, including 13 children. To retaliate, Israel launched "Operation Litani". During the week-long operation, the IDF crossed the Israel-Lebanon border, and destroyed the PLO military bases in the southern Lebanon, but failed to engage large numbers of PLO forces, who retreated to the north. The operation ended with the IDF withdrawing to a security zone some six miles from the frontier, after a UN force was deployed to assure the demilitarization of the area (Morris 2011, p499-502).

During the following three years, the PLO transformed into a paramount "army" , with some 250 artillery pieces and rocket launchers, four infantry "brigades", 100 obsolescent tanks, several dozen antiaircraft guns, and a few shoulder-held SAM-7s antiaircraft rockets. At the same time, PLO guerrillas were still able to launch artillery and rocket attacks against Israel, or crossed through the Security Zone and attacked targets in Israel. Despite repeated bombardment on PLO bases and military infrastructure, the PLO kept up sending rockets and shells against two northern Israel towns, Kiryat Shmonah and Nahariya, forcing thousands of border settlers to leave their homes (Morris 2011, p507-517).

As the Israel Defence Forces was proved incapable of silencing the PLO guns and rocket launchers through air raids, the full-scale ground invasion became the only remaining option. Thanks to the peace treaty with Egypt, Israel was able to commit its entire army in Lebanon. On 6 June 1982, the IDF re-invaded Lebanon, and sieged the West Beruit, where PLO bases located, within one week. To avoid unacceptable level of casualties in street battles, the Israel Defence Forces bombarded the city, cut off food and water supplies, and disconnected the electricity for seven weeks, but the PLO appeared to be unbending. The Israel Air Forces, assisted by agents with transmitters on the ground, also attempted to assassinate the PLO leaders by bombing their bunkers. At the cost of the destruction of numerous apartment houses, hundreds of Palestinians and Lebanese lives,

the missions failed. In August, with US mediation, a peace agreement was finally implemented. Retaining their light weapons, the PLO guerrillas evacuated the besieged city, and dispersed to Syria, Algeria, Yemen, Iraq, Jordan and Sudan. The leadership reestablished its headquarters in Tunisia (Morris 2011, p518-539).

According to the original plan, Israel was to install a pro-Israel Christian regime in Lebanon, sign a peace treaty between the two countries, and withdraw its troops. But the assassination of the newly elected Lebanon president, Bashir Gemayal, ruined the whole plan. The Israel Defence Forces had to delay its withdrawal, and reoccupied West Beirut. The seemingly indefinitely occupation stirred bitterness among the Islamic Shi'ites. A group of devout families, led by a handful of Shi'ites clerics, organized themselves into Hizbollah, or the "Party of God". With fighters recruited mainly from the Shi'ite refugees, who lost their homes by Israel Defence Forces artillery and air power, and with funds and arms supplied by Iran and Syria, the Hizbollah dominated the anti-Israeli guerrilla campaign, from spring 1983 on. Along with ambushes and roadside explosions, suicide bombers also emerged as a regular weapon in the Shi'ite armory, as they believed that their sacrifice would send them straight to Heaven. Despite the retaliation from the IDF after each major incident with mass arrests, intermittent raids, and occasional assassination of suspected Shi'ite militants, the Hizbollah guerrillas stepped up their activities, mounting about one hundred attacks per month by mid-1984. The usual cycle of insurgencies from the Hizbollah and reprisals from the IDF spun out of control. Both sides took heavy casualties, but the Shi'ites, with their resolution and defiance of death, proved to be more endurable than the Israelis. In 1985, Israel withdrew to the security zone, leaving some 650 dead and close to 3,000 wounded in 1982 Lebanon War (Morris 2011, p540-566).

Israel expelled the PLO from Lebanon. But the vacuum was filled by the Hizbollah, which was far more deadly and determined than the PLO. The Hizbollah continued to attack the IDF in the Security Zone and in northern Israel, until the IDF fully withdrew from Lebanon in 2000.

The successful Shi'ite guerrilla campaign also boosted the moral of Palestinians in the occupied territories - the West Bank and the Gaza Strip. Between 1967 and the early 1980s, the average living standards, personal income, and health conditions of Palestinians in the occupied territories increased considerably. But large scale of extreme poverty continued to exist, especially in the refugee camps. Moreover, the inequality in water and land resources between the Palestinians and the Israelis widened, with the exploding Palestinian population. By 1987, the Israeli settlers in

the Gaza Strip, some 0.4 percent of the total regional population, controlled over 28 percent of the total land. They used twelve times as much water as did Palestinians. To protect the Israeli economy, the Israel government also blocked Arabs from setting up manufacturing plants, turning Palestinians into menial labors, and the occupied territories into a vast market for Israeli goods. The feelings of discrimination, humiliation, and inequality coalesced into a time bomb, which was eventually ignited by a traffic accident (Morris 2011, p561-573).

In 8 Dec 1987, an Israel Defence Forces tank hit a number of vans carrying workers from the Jibalya refugee camp, killing four Palestinians and wounding six others. This tragic accident resulted in the first "Intifada", the popular uprising in the occupied territories, with the aim to end Israel's occupation in the West Bank and Gaza Strip. Initially, the spontaneous uprising were organized by the various local groups. Above them, a loose umbrella organization, the "United National Leadership of the Uprising" (UNLU) emerged under the leadership of the PLO. Under the PLO prohibition, the rioters rarely used rifles, shotguns, and pistols, in order to maintain the revolt's "popular" image. During the first eighteen months of the Intifada, out of the 41,000 "violent incidents" registered by the Israel government, there were 41 light-weapons attacks; thirty-nine with grenades; 127 bombs; and 102 incidents involving "cold" weapons such as knives and hatchets. The civil disobedience mainly consisted of general strikes, demonstrations, refusal to pay taxes, and sabotages of Israel infrastructure within the West Bank and Gaza Strip. The Israelis tried almost everything: shooting to injure, beatings, mass arrests, torture, trials, detentions, and economic sanctions. All failed (Morris 2011, 575-592).

The Intifada came to a stalemate. The Palestinians were unable to expel the Israelis from the occupied territories, and the Israelis were unable to stop the violence. Meanwhile, the end of the Cold War and the collapse of the Soviet Union left the United States as the only superpower in the world. United States seized the golden moment, convening a Middle East peace conference, in Madrid, Spain, on 30 October 1991. The conference ended the first Intifada, and paved the way to the first peace accord in Oslo in 1993, in which the State of Israel and the Palestine Liberation Organization (PLO) formally recognized one another, and initiated the Oslo Process to negotiate a solution to their decades-long conflict.

In the early year, Israelis survived from constant military threats from its hostile Arab neighbours, through defeating the invasions and expanding its territory. But the military success came

at the cost of millions of Palestinian refugees, who lost their homeland to Israeli settlements. the resentment of the refugees eventually turned into organized terrorist attacks starting in the late 1980s, and continued until now. The terrorist attacks from Palestinian armed groups, which caused thousands of civilian casualties, then became the major threat to Israeli settlements.

3 The Model

Consider a community with N members. The community foresees an expected damage T caused by surrounding enemies. The damage can be mitigated by the aggregate public defense contributed by members, and remaining damage is equally shared among members.

Each member is endowed with one unit of total effort, which is allocated between producing a private good (food), and a public good (public defense). Defense involves involving patrolling, digging trenches, building fences, manufacturing and laying mines, standing sentry etc.

Members are heterogeneous in their food productivity. However, it is assumed that members are homogeneous in the productivity of public defense, as every member receives the same military training and holds a gun on guard duties.

Member i's production function for food and public defense are $z_i F(e_i)$ and $G(1-e_i)$ respectively , where z_i is a shift parameter in food productivity and follows a uniform distribution $\alpha \sim U(0,1)$. Both production functions are increasing and concave in effort, with $z_i F'(1) = 0$ and $G'(1) = 0$.

3.1 First Best Solution

In terms of a benchmark, consider the first best solution (the zero transaction cost solution). Here, the objective is to maximize remaining food output surviving from the damage caused by enemies, subject to the constraint that any public good larger than the damage will be wasted.

$$\begin{aligned} &\max_{e_1,e_2 \ldots e_N} \sum_{i=1}^{N} z_i F(e_i) - [T - \sum_{i=1}^{N} NG(1-e_i)] \\ s.t. \quad &\sum_{i=1}^{N} NG(1-e_i) \leq T \end{aligned} \tag{1}$$

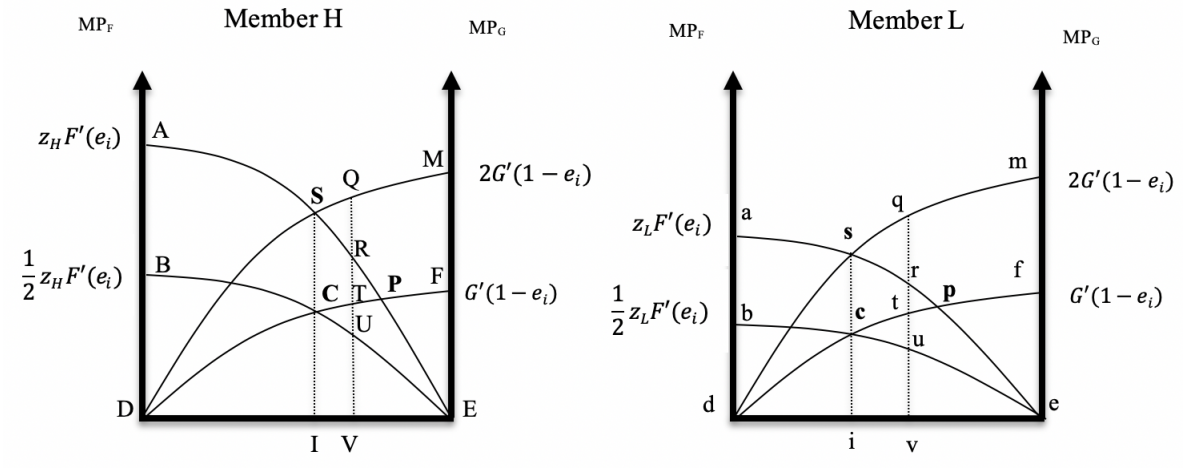

Figure 1: First best allocation of effort between food and public defense

The equilibrium effort e_i^* of every member is one that equates the marginal product of the food and the public defense for the *whole community*:

$$\frac{dz_i F(e_i^*)}{de_i} = \frac{NdG(1-e_i^*)}{d(1-e_i)} \tag{2}$$

Let the aggregate public defense at the current level be $D^* = \sum_{i=1}^{N} NG(1-e_i^*)$. It should be noted that the above equilibrium happens only when the constraint is not binding ($D^* \leq T$). In this case, there are some damage not mitigated, since it is not worthwhile for any more effort to be exerted on the public defense.

Figure 1 illustrates a simplified case, where $N = 2$. In a community Doubletown, there are two members, H and L. Member H has higher productivity in food than Member L. The social optimal choice for H(L) is point $S(s)$ where the marginal productivity curve of food intersects the marginal productivity curve of public good for the *whole community*. In this case, total output of public defense — sum of area $SIEM$ and area $siem$ — is less than the damage.

When the damage caused by enemies is smaller than the above equilibrium public defense (ie. $T < D^*$), members will save their effort on the public defense, and spend it on the private good instead. The equilibrium e_i^* then satisfies

$$\frac{dz_i F(e_i^*)}{de_i} = \alpha(T)\frac{NdG(1-e_i^*)}{d(1-e_i)} \tag{3}$$

where $\alpha(T)$ is chosen such that the amount of public good just mitigates the damage (i.e. $\sum_{i=1}^{N} NG(1-e_i^*) = T$). Equation (3) states that for each member the ratio of the marginal product of the food to the public defense for the whole community must be equal to a constant $\alpha(T)$, when the constrain is binding (i.e. $T < D^*$).

Intuitively, when the expected damage decreases, the members will shift their effort from the public defense to the food in the most efficient way. That is, members will try to maximize the increase in the food, when they can reduce part of the public defense that is higher than the damage. Assume the redundant public defense is 100 units. If the ratio of marginal productivity of food to marginal productivity of public good were *constant*: 10 for member A, and 5 for the other member B, then A should shift his effort away from the public good until the public good were reduced by 100 units and the food were increased by 1000 units.

Of course, the ratio is *not constant* in the model. As member A shifts his effort away from the public defense, the marginal productivity is decreasing in food and increasing in public defense, and the ratio of those two is decreasing. At one point, the ratio for A will be lower than the ratio for B, and B starts to shift his effort away from the public defense. Thus, each member rotates in shifting their effort away from the public defense and onto the food, until a total of 100 units of public defense have been reduced. At the margin, each member has the same ratio between food productivity to the public defense productivity.

In Doubletown (Figure 1), members H and L reduce their effort on the public defense, when previous equilibrium point $S(s)$ provides redundant public defense. At the equilibrium, member H(L) exerts effort at point $V(v)$, where both members have the same ratio of marginal productivity of food to marginal productivity of public defense ($\frac{VR}{VQ} = \frac{vr}{vq}$), and total public defense (sum of area $QVEM$ and area $qvem$) just mitigates the damage.

In a nutshell, under the first best effort, the ratio between the marginal productivity in food is and the marginal productivity in public defense equal to one, when the damage is larger than or equal to the first best threshold D^*. The ratio is less than one when the damage is below the first best threshold D^*, and decreases as the damage decreases (see Figure 4 for an illustration).

However, the first best solution only exists in a zero transaction costs world. In the real world, the allocation of effort is costly to measure. Members may save effort on public defense by reducing the frequency of patrolling the community border, taking a nap while standing sentry, building low

quality fences, or simply carrying one's duty absently. Whenever the community incurs unmitigated damage, everyone knows the public defense is under provided, but it is hard to blame any specific member, as enemies never tell you why they can sneak in the settlement. The reason can be a section of crumbling fences, shirking of sentries, absence of patrollers, or a combination of several factors. Since every member's effort on the public defense is mixed together, no one can be solely hold accountable for the under-provision of the public defense.

In the presence of transaction costs — in this case, the cost of monitoring and enforcing other members' effort on public defense — economic outcomes differ under various types of property regimes. I analyze two property regimes: the private property regime, under which each member consumes the food produced by their effort, and the common property regime, under which each member equally shares the aggregate food produced all members.

3.2 Private Property Regimes Solution

Under a private property regime, a member maximizes his or her own food consumption:

$$\begin{aligned} &\max_{e_i} z_i F(e_i) - \frac{1}{N}[T - \sum_{i=1}^{N} NG(1-e_i)] \\ s.t. \quad &\sum_{i=1}^{N} NG(1-e_i) \leq T \end{aligned} \tag{4}$$

The equilibrium effort $\hat{e}_i$) of every member is one that equates the marginal product of the food and the public defense for *oneself* (see Figure1 for an illustration):

$$\frac{dz_i F(\hat{e}_i)}{de_i} = \frac{dG(1-\hat{e}_i)}{d(1-e_i)} \tag{5}$$

Let the aggregate public defense at the current level be $\hat{D} = \sum_{i=1}^{N} NG(1-\hat{e}_i)$

It should be noted that the above equilibrium happens only when the constraint is not binding ($\hat{D} \leq T$). In this case, there are some damage not mitigated, since it is not worthwhile for any more effort to be exerted on the public defense.

If Doubletown is under a private property regime (Figure 2), member H(L) will choose point $P(p)$ where the marginal productivity curve of food intersects the marginal productivity curve of

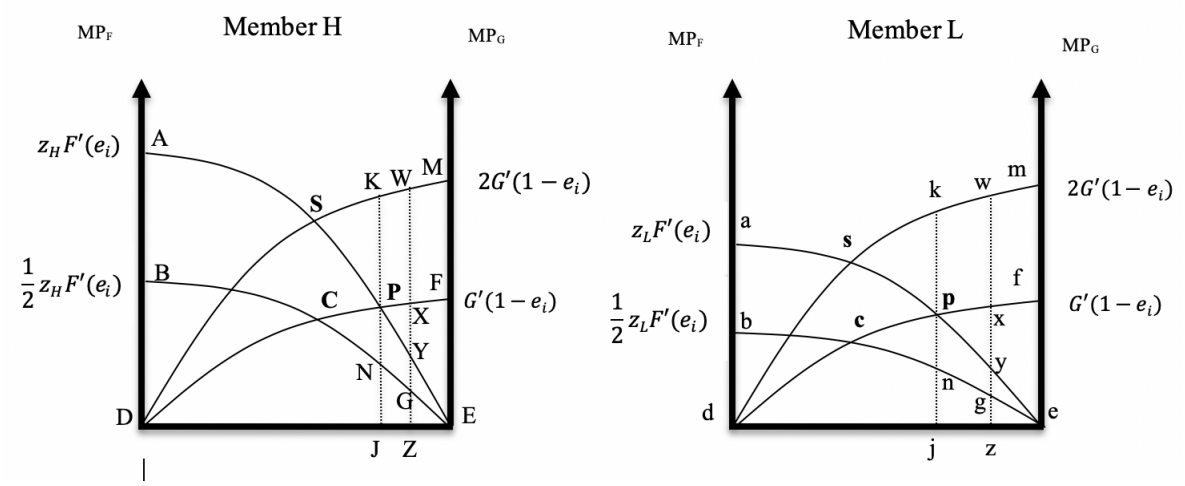

Figure 2: Allocation of effort between food and public defense under a private property regime

public good for *himself*. In this case, total output of public defense — sum of area $KJEM$ and area $kjem$ — is less than the damage.

When the damage caused by enemies is smaller than the above equilibrium public defense (ie. $\hat{D} > T$), members will save their effort on the public defense, and spend it on the private good instead. The equilibrium $\hat{e}_i$ then satisfies:

$$\frac{dz_i F(\hat{e}_i)}{de_i} = \beta(T) \frac{dG(1-\hat{e}_i)}{d(1-e_i)} \tag{6}$$

where $\beta(T)$ is chosen such that the amount of public good just mitigates the damage ($\sum_{i=1}^{N} NG(1-\hat{e}_i) = T$). Equation (6) states that under a private property regime, for each member the ratio of the marginal product of the food to the public defense for *oneself* must be equal to a constant $\beta(T)$, given $\hat{D} > T$.

In Doubletown (Figure 2), members H and L reduce their effort on the public defense, when previous equilibrium point $P(p)$ provides redundant public defense. At the equilibrium, member H(L) exerts effort at point $Z(z)$, where both members have the same ratio of marginal productivity of food to marginal productivity of public defense ($\frac{ZY}{ZW} = \frac{zy}{zw}$), and total public defense (sum of area $WZEM$ and area $wzem$) just mitigates the damage.

Proposition 1

Under a private property regime, the public good is under provided, as $G(1-e_i^*) \geq G(1-\hat{e}_i)$

The public good is under provided, because members only consider their own benefit and ignore the positive externality on the whole community. Yet, a contract over the level of effort on the public defense is not feasible, as the effort allocation is not observable.

3.3 Common Property Regimes Solution

Under a common property regime, a member maximizes his or her own share of food consumption:

$$\begin{aligned} &\max_{e_i} \frac{1}{N}\sum_{i=1}^{N} z_i F(e_i) - \frac{1}{N}[T - \sum_{i=1}^{N} NG(1-e_i)] \\ s.t. \quad &\sum_{i=1}^{N} NG(1-e_i) \leq T \end{aligned} \tag{7}$$

The equilibrium effort $\tilde{e}_i$ of every member is one that equates the marginal product of the food for *oneself* and the public defense for the *whole community* (see Figure **??** for an illustration):

$$\frac{dz_i F(\tilde{e}_i)}{de_i} = \frac{N dG(1-\tilde{e}_i)}{d(1-e_i)} \tag{8}$$

Let the aggregate public defense at the current level be $\tilde{D} = \sum_{i=1}^{N} NG(1-\tilde{e}_i)$. Again, the above equilibrium happens only when the constraint is not binding ($\tilde{D} \leq T$). In this case, there are some damage not mitigated, since it is not worthwhile for any more effort to be exerted on the public defense.

If Doubletown is under a common property regime (Figure 3), member H(L) will choose point $C(c)$ where the marginal productivity curve of food intersects the marginal productivity curve of public good for the *whole community*. In this case, total output of public defense — sum of area $SIEM$ and area *siem* — is less than the damage.

When the damage caused by enemies is smaller than the above equilibrium public defense (i.e.

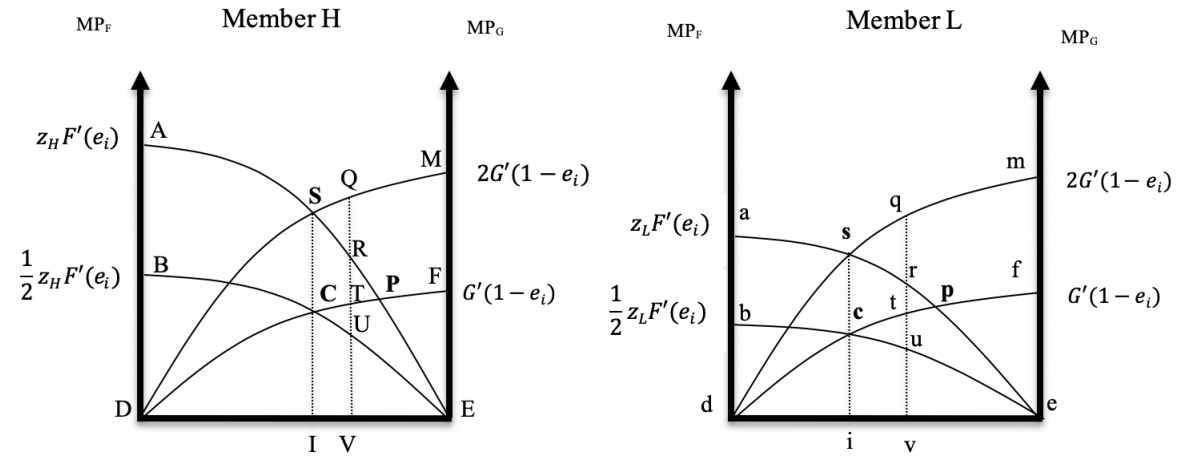

Figure 3: Allocation of effort between food and public defense under a common property regime

$\tilde{D} > T$), members will save their effort on the public defense, and spend it on the private good instead. The equilibrium $\tilde{e}_i$ then satisfies:

$$\frac{dz_i F(\tilde{e}_i)}{de_i} = \gamma(T) \frac{N dG(1-\tilde{e}_i)}{d(1-e_i)} \tag{9}$$

where $\gamma(T)$ is chosen such that the amount of public good just mitigates the damage ($\sum_{i=1}^{N} NG(1-\tilde{e}_i) = T$). Equation (9) states that under a private property regime, for each member the ratio of the marginal product of the food for the *oneself* to the public defense for the *whole community* must be equal to a constant $\beta(T)$, given $\hat{D} > T$.

In Doubletown (Figure 3), members H and L reduce their effort on the public defense, when previous equilibrium point $C(c)$ provides too much public defense. At the equilibrium, member H(L) exerts effort at point $V(v)$, where two members have the same ratio of marginal productivity of food to marginal productivity of public defense ($\frac{VR}{VQ} = \frac{vr}{vq}$), and total public defense (sum of area $QVEM$ and area $qvem$) just mitigates the damage

Proposition 2

Under a common property regime, the provision of the public good is back to the first best level, as $G(1-\tilde{e}_i) = G(1-e_i^*)$ and $\gamma(T) = \alpha(T)$

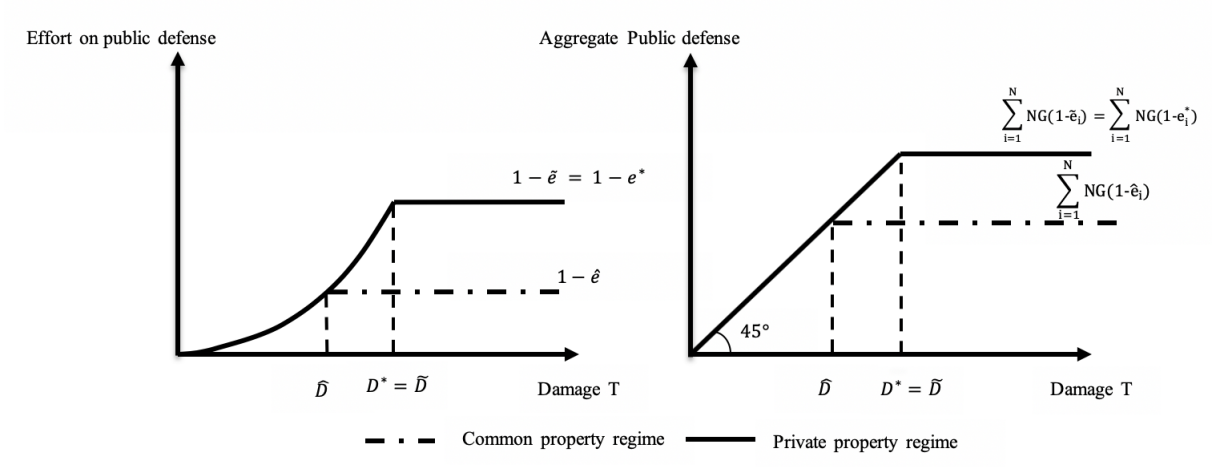

Figure 4: Dynamics of public defense and damage under different property regimes

Under a common property regime, the incentive in producing the private good, food, is suppressed, as each member only gets one out of N share of his own food production. This moral hazard problem decreases the effort level on the private good, food, and increases the effort level on the public good, public defense. As a result, the effect of the moral hazard (the over-provision of the public defense) counteracts the effect of the positive externality on the public good (the under-provision of the public defense). Thus, a common property regime bring back the provision of the public good to the first best level.

Figure 4 summarizes the equilibrium effort levels under different property regimes. When the damage faced by a kibbutz increases, under both regimes, aggregate public defense goes up, as the members exert more effort on public defense. The public defense under private property regimes first reach the binding level of public defense (dashed line in the graph), and the members stop increasing their effort. However, the level of public defense can be further increased under common property regimes (solid line in the graph).

3.4 The Choice over Property Regimes

Though common property regimes always induce the first best effort on the public good, there must be a cost. Otherwise, common property regimes like kibbutzim would not be so rare, and the majority of kibbutzim would not have privatized. The cost comes in the form of adverse selection —

the most productive (in food) members could get more food consumption under a private property regime, at the cost of lower aggregate public defense.

Assume members can vote to decide the property regime of the community. Once the approval rating for a certain property regime is greater than a threshold, the community adopts the property regime.

Consider the net benefit of staying in a common property regime community for member j:

$$\pi_j = \frac{1}{N}\sum_{i=1}^{N} z_i F(e_i^*(T)) + \frac{1}{N}\sum_{i=1}^{N} NG(1-e_i^*(T)) - z_j F_j(\hat{e_j}(T)) - \frac{1}{N}\sum_{i=1}^{N} NG(1-\hat{e_i}(T)) \qquad (10)$$

Proposition 3

(a), For $T \geq D^*$, π_j stays the same as damage T decreases.

(b), For $T \in (\hat{D}, D^*)$, π_j decreases as damage T decreases.

(c), $\pi_i > \pi_j$ whenever $z_i < z_j$

Proposition 3(a) and 3(b) states that as the community becomes safe, the net benefit of the common property regime over the private property regime decreases. Proposition 3(c) states that the more productive (in food) a member is, the smaller the net benefit he has.

When a community locates in a dangerous area, and foresees a large damage, members choose the common property regime to maintain a high level of public defense. As the damage to the community decreases, the benefit of the additional public defense provided by the common property regime diminishes; initially the most productive member, then the second most productive one, then the third ... will vote for the private property regimes. As the number of members voting for the private property regimes increases, the community will, at one point, abandon the equal sharing rule and go privatized.

In Doubletown, suppose member H and L can vote for the type of property regime. L always prefers common property regime, as he enjoys the extra food shared by H, in addition to the high provision of public defense. H's choice, however, depends on the size of damage T.

When the damage is large, H(L) chooses point $C(c)$ in Figure 5 under a common property regime. H gets half food output produced by himself, area $BDIC$, and half food output produce by L, area $bcsa$. H receives public defense produced by himself, area $SIEM$, and public defense

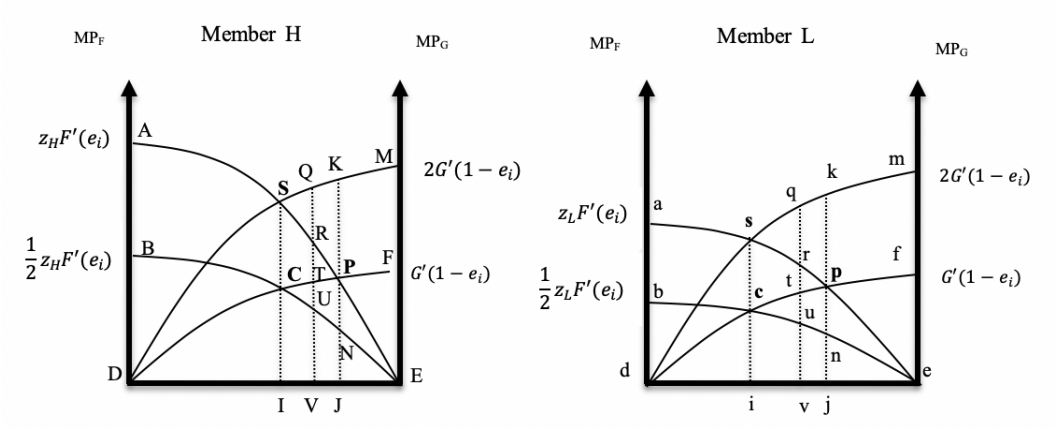

Figure 5: Total surplus under different property regimes

produced by L, area $siem$. The combined output received by H under common property regime is area $BDIC+bcsa+SIEM+siem$. If both members live under a private property regime, then H(L) chooses point $P(p)$. H gets all food output produced by himself, area $ADJP$. He receives public defense produced by himself, area $KJEM$, and public defense produced by L, area $kjem$. The combined output received by H under a private property regime is area $ADJP + KJEM + kjem$. The surplus of H choosing private property regime is area $ABCS - SPK - abcs - sijk$, where area $ABCS - abcs$ is the gain from avoiding the equal sharing of food with L, and area $-SPK - sijk$ is the loss from the under-provision of public defense.

When the damage decreases, H(L) chooses point $V(v)$ under a common property regime. H gets half food output produced by himself, area $BDVU$, and half food output produce by L, area $abur$. H receives public defense produced by himself, area $QVEM$, and public defense produced by L, area $qvem$. The combined output received by H under common property regime is area $BDVU + abur + QVEM + qvem$. If both members live under a private property regime, then H(L) still chooses point $P(p)$. The combined output received by H under a private property regime remain the area $ADJP + KJEM + kjem$. The surplus of H choosing a private property regime is area $ABUR - QRPK - abur - qvjk$, where area $ABUR - abur$ is the gain from avoiding the equal sharing of food with L, and area $-QRPK - qvjk$ is the loss from the under-provision of public defense.

When the damage decreases, H's gain from choosing a private property regime increases from $ABCS - abcs$ to $ABUR - abur$, while his loss decreases from $-SPK - sijk$ to $-QRPK - qvjk$. As

the total surplus of staying under a private property regime decreases, H will vote for the private property regime.

The model yield two interrelated predictions: 1) when members in a community foresee large external threats, they will choose a common property regime and equal share all private goods. 2) when the community becomes safe, the members will privatize the community and choose a private property regime.

4 Application to Kibbutzim in Early Years

Kibbutzim were not the only form of settlements in Israel. The other main form is moshav (plural form moshavim), where members individually produce their goods, and collectively market their goods. Based on the prediction 1) of the model, kibbutzim are expected to yield a higher level of public defense, compared to moshavim. Indeed, kibbutzim were the dominating settlement forms in Israel before the Independence, since they were essential for the Jewish to control strategic areas, thereby defending the infiltrations of local Arabs and the invasions from the surrounding Arab countries (see Figure 6). For an independent country, a regular army should be responsible for civil security and national defense. However, the Jewish, under close surveillance of the British Mandate before 1948, only organized a paramilitary organization — Haganah, which was both outmanned and outgunned by the Arab invading armies at the eve of the 1948 Arab–Israeli War. They had to rely on civil settlements — kibbutz to delay the advance of their enemies. As a result, more than 200 kibbutzim were established before 1948 (see Figure 7). Many of them were located in places of military importance, and kibbutz members "lived with a constant knowledge that they might be called upon ... in any night, to guard life and property, ... or repel an Arab attack." (Kerem 1962).

Kibbutz defensive abilities in the 1948 Arab–Israeli War surpassed the expectation. With limited help from the newly created Israeli defense forces, kibbutzim delayed, if not halted, the advance of Arab forces, and "made a vital contribution to the eventual victory" (Near 1999).

The Independence did not bring peace to Israel immediately. Israel annexed the Sinai Peninsula from Egypt and the Golan Heights from Syria through three major wars: Sinai campaign 1956, Six-Day war in 1967 and Yom Kippur war in 1973. Though Israel gained considerable strategic depth, the Israelis still lived in the shadow of armed incursions. Facing the continuing advance of the

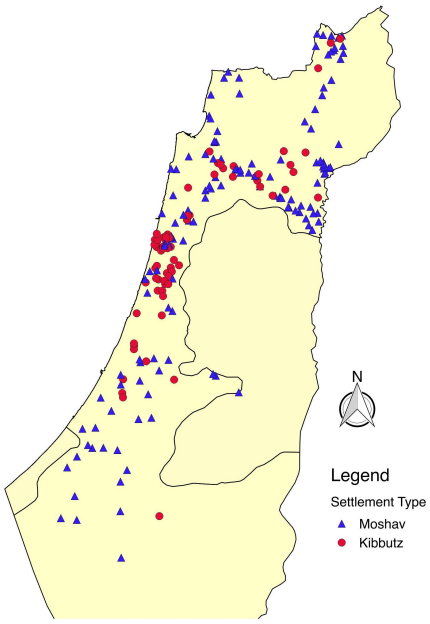

Figure 6: Location of Israeli settlements

Syrian and Egyptian armies on the Golan and the Sinai during the 1973 war, Moshe Dayan warned that "the Third Temple [the State of Israel] is in danger". The Israel Defence Forces managed to defeat the enemies only after sending all their strategic reserves.

It was the Camp David Accords in 1978 and the peace treaty with Egypt in 1979 that made Israel borders secure. In the meantime, the first major reform was adopted in kibbutzim — children slept with their parents instead of in the children's houses. If the time spent with children can be viewed as a private good for the parents (as in Weiss and Willis 1985), then the children's houses could be used to forbid the consumption of the private good, and sustain an efficient level of effort on public defense. As the external military threats decreased, such forbidden went away with the closure of the children's houses.

In the following years, kibbutzim introduced many reforms. For example, each kibbutz was no longer liable for the debt of other kibbutzim in the same movement (Ashkenazi and Katz 2009); members could work outside the kibbutz, though their income was still handed over to the kibbutz; kibbutzim started to hire outside managers to run their businesses. Among all the reforms, the most fundamental one was the adoption of the "safety net" budget. Kibbutz members received differential, contribution-based wages, but were taxed progressively to maintain a minimal living standard for older and weaker members (Palgi 2002). The "privatization" (in an economic sense

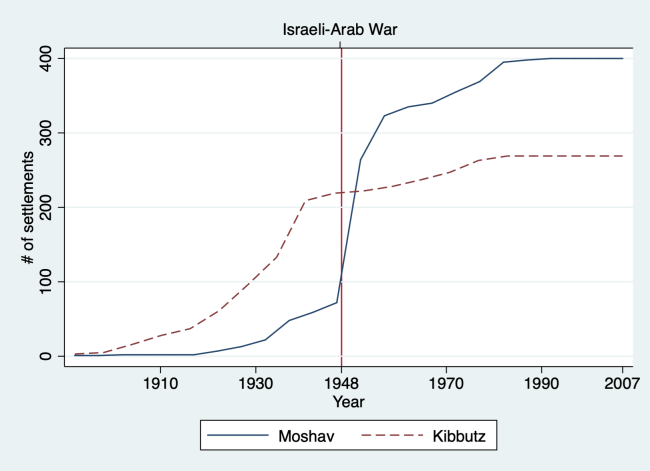

Figure 7: Number of Israeli settlements

as well as in kibbutz jargon) started in kibbutz Ein Zivan and Snir in 1992(Getz 2008). By 2014, there were 268 kibbutzim, of which 75% were privatized.

5 Data

To empirically test the prediction 2: when the community becomes safe, the members will privatize the community, data from different sources were combined to construct a panel dataset, which comprises 223 kibbutzim over the 20 years from 1986 to 2014. These different sources are explained below (see Table 1 for the summary statistics).

Kibbutz Data The kibbutz-level data are compiled by Ran Abramitzky (Abramitzky 2018),[17] and contains information for 223 secular kibbutzim, which accounts for 83% of the 268 kibbutzim in total. Kibbutzim that were excluded either have not yet decided on whether to adopt reforms, or about which there is not enough information. Variables include the year the differential wage system adopted, the average household size in 1995, whether the kibbutz belonged to the ideological movement Artzi, and the economic strength assessed by the banks and the government in 1995. Additional controls like the kibbutz population in 1995 and the ages of kibbutz are obtained from the Israel government.[18]

Terrorist Attacks After the peace treaties with Egypt and Jordan, Israel alleviated the mil-

[17] Retrieved on March, 2018 from https://ranabr.people.stanford.edu/sites/g/files/sbiybj5391/f/data-on-kibbutzim.docx

[18] Accessed on May 11, 2018 from http://www.cbs.gov.il/webpub/pub/text_page?publ=47&CYear=2006&CMonth=1.html

itary threats from its two most powerful Arab neighbours. The terrorist attacks from Palestinian armed groups, which caused thousands of civilian casualties, then became the major threat to Israeli settlements. Since terrorist attacks directly targeting kibbutzim were scarce, the analysis measures the threats faced by a kibbutz by the number of Israeli civilian deaths under terrorist attacks near each kibbutz. [19] A large number of civilian deaths near a kibbutz means the kibbutz locates in a place vulnerable to terrorist attacks, and requires a high level of local public defense, in addition to security service provided by the government.

The terrorist attacks are obtained from Global Terrorism Database (GTD)[20]. This database contains data on more than 180,000 terrorist attacks from 1970 to 2017, and is the most complete source of data on terrorist attacks currently available. It includes attack types (assassination, bombing/explosion, shooting, etc.), attack dates, and characteristics of the victims. As specified in the GTD guidebook, the analysis only includes incidences that meet the three criteria for terrorist attacks: 1) the act must be aimed at attaining a political, economic, religious, or social goal; 2) there must be evidence that the act had an intention to coerce, intimidate, or convey some other message to a larger audience than the immediate victims; and 3) the act must be outside the context of legitimate warfare activities.

To focus on the incidents of most concern to Israeli civilians, the analysis restricts the sample to attacks happening in Israel and targeting Israeli civilians. All projectile attacks (mortars, missiles, and rockets) are excluded, as they are not defendable by a settlement. This leaves a sample of 1259 terrorist attacks resulting in 1128 civilian deaths from 1986 to 2014. The threat level faced by each kibbutz in each year is then measured by the total number of civilian deaths, within 30 kilometres of each kibbutz in the previous six years [21]. Since a large number of civilian deaths near a kibbutz may simply because that the kibbutz is located in a densely populated area, and that one death in a remote town can be more worrisome than two deaths in a large city. Therefore, the death number is divided by the population density at the incidence locations, to take the population density into account.[22]

[19] Only two terrorist attacks happened in kibbutzim: five civilians were killed in Kibbutz Metzer in 2002, and one civilian was killed in kibbutz Nir-Oz in 2008.

[20] National Consortium for the Study of Terrorism and Responses to Terrorism (START). (2018). Global Terrorism Database [globalterrorismdb_0718dist.xlsx]. Retrieved from https://www.start.umd.edu/gtd

[21] The number of Israeli civilian deaths within 10km, 20km, and 40km of the kibbutz is also used for robust tests

[22] The population density data is obtained from Gridded Population of the World. Incidents before 2000 are normalized by the population density in 2000; Incidents between 2000 and 2005 are normalized by the population density

Since terrorist attack data in 1993 is missing, the number of civilian deaths in 1993 is imputed by the average of 1992 and 1994 data. To address concerns regarding potential imputation errors, the analysis includes an imputation dummy variable in all regressions.[23]

Refugee Camp and Rainfall Data To construct an instrument for terrorist attacks, the analysis exploits the rainfall variation at the nearest refugee camp to each kibbutz. The Palestinian Central Bureau of Statistics provides the population of 19 Palestinian refugee camps in West Bank and 8 in Gaza Strip in 1996.[24] The analysis then links each kibbutz to its nearest refugee camp, as well as the rainfall at the camp in every year. The rainfall information is obtain from the daily gridded observational dataset for precipitation, temperature and sea level pressure in Europe (E-OBS). [25] Using the ECA&D blended daily station data, the E-OBS daily gridded dataset provides rainfall estimates at 0.1 degree (11km at the equator) latitude longitude intervals. Considering the small size of Israel, this high spatial resolution data is crucial to obtain reasonable rainfall variation.

6 Terrorist Attacks and the Privatization of the Kibbutzim

6.1 Cox Model Specification

The kibbutzim privatization can be best described as a survival process, in the sense that once a kibbutz abandoned its equal sharing rule, it never readopted the rule. Therefore, a Cox proportional survival model is a natural candidate for analyzing the probability of kibbutz privatization.[26] The Cox model assumes that the probability of a kibbutz i after s years since 1989 (when kibbutzim were formally permitted by kibbutz federations to introduce reforms) is equal to

$$h_{ijt}(s) = h_0(s) \exp\left(\beta_D \log\left(Death_{ij,t,t-5}\right) + \beta_X X_i + \theta_j + \eta_t\right) \tag{11}$$

in 2005; Incidents between 2005 and 2010 are normalized by the population density in 2010.
Center for International Earth Science Information Network - CIESIN - Columbia University. 2016. Gridded Population of the World, Version 4 (GPWv4): Population Density. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). http://dx.doi.org/10.7927/H4NP22DQ. Accessed DAY MONTH YEAR.

[23] Corresponding estimates without imputing terrorist attack data in 1993 are in Appendix 2. They are qualitatively very similar to the estimates in Table 3.

[24] Accessed on April 9, 2019 from http://www.pcbs.gov.ps/Downloads/book31.pdf

[25] I acknowledge the E-OBS dataset from the EU-FP6 project UERRA (http://www.uerra.eu) and the Copernicus Climate Change Service, and the data providers in ECA&D project (https://www.ecad.eu)

[26] Corresponding estimates based on the Logit model are in Appendix 3. They are qualitatively very similar to the estimates in Table 3.

Table 1: Summary Statistics

	Mean	Std.Dev.
Normalized number of Israeli civilian deaths within 10 km in the previous six years	0.0116	0.0399
Normalized number of Israeli civilian deaths within 20 km in the previous six years	0.0300	0.0621
Normalized number of Israeli civilian deaths within 30 km in the previous six years	0.0536	0.0871
Normalized number of Israeli civilian deaths within 40 km in the previous six years	0.0769	0.1072
Total Rainfall surplus at the nearest refugee camp in the previous six years, multiplied by the distance between the kibbutz and the nearest refugee camp, then divided by the population of the nearest refugee camp	0.0212	0.8237
Total Rainfall surplus at the nearest refugee camp in the previous six years	57.7415	308.4676
Population of the nearest refugee camp in 1996 (in millions)	0.0159	0.0245
Distance to the nearest refugee camp	0.2515	0.4876
Average number of people in the household in each kibbutz	2.1986	0.3249
Population of the kibbutz in 1995	453.9596	224.5101
Number of years has passed since the establishment	43.6906	14.9037
A binary variable for the movement affiliation of the kibbutz 1 if the kibbutz belongs to the most ideological movement – Artzi 0 if the kibbutz belongs to the other movement – Takam	0.3139	0.4641
A category variable for economic strength of the kibbutz in 1995 from 1 to 4, with 1 being the weakest and 4 being the strongest	2.3802	0.8993

where h_{ijt} reflects the hazard rate of kibbutz i in district j, in year t; h_0 is the baseline hazard function; $Death_{ijt}$ is the number of civilian deaths within 30 kilometres of the kibbutz in the previous six years, (my proxy for the threats faced by kibbutz i in district j);[27] θ_j is a district fixed effect; η_t is a year fixed effect; and X_i is a vector of kibbutz specific control variables, which I will explain below.

6.2 Cox Model Result

Table 2 reports regression results of the Cox model, where external threats is measured by the number of Israeli civilian deaths in the previous six years within 10 km (Column 1,2), 20 km (Column 3,4), 30 km (Column 5,6), or 40 km (Column 7,8) of each kibbutz, normalized by the population density at the attack location. Control variables are included in Columns 2, 4, 6, and 8. These additional controls include economic strength, movement affiliation, average household size, kibbutz population in 1995 as well as the age of kibbutz in 1989.

An Increase in the number of civilian deaths in the previous six years near each kibbutz reduces

[27] Results are robust to civilian deaths within 10, 20, or 40 km

Table 2

Hazard Rate	(1) 10km	(2) 10km	(3) 20km	(4) 20km	(5) 30km	(6) 30km	(7) 40km	(8) 40km
Civilian deaths	-6.631**	-5.744	-3.245***	-2.789**	-1.164	-0.971**	-0.245	-0.310
	(2.706)	(4.239)	(0.666)	(1.303)	(0.919)	(0.485)	(1.318)	(0.428)
Population in 1995		-0.000987		-0.000923		-0.000923		-0.000923
		(0.000847)		(0.000844)		(0.000847)		(0.000839)
Average household size		0.00227		0.0387		0.0650		0.0807
		(0.683)		(0.657)		(0.663)		(0.652)
Age at 1989		-0.00811		-0.00740		-0.00853		-0.00939
		(0.00892)		(0.00919)		(0.00904)		(0.00821)
Movement affiliation		-0.424**		-0.442**		-0.453***		-0.456***
		(0.184)		(0.178)		(0.174)		(0.167)
Economic strength		-0.279***		-0.287***		-0.284***		-0.279***
		(0.0684)		(0.0705)		(0.0743)		(0.0711)
District fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Number of observations	3297	2791	3297	2791	3297	2791	3297	2791
Number of subjects	223	189	223	189	223	189	223	189
Number of failures	173	149	173	149	173	149	173	149

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Kibbutzim were exposed to the decision of privatization in 1989, when they were formally permitted by kibbutz federations to introduce reforms. A failure happens when the kibbutz privatizes (adopt the partial payment reform). **Civilian deaths**: the number of Israeli civilian deaths in the previous six years within 10 (**column1,2**), 20 (**column3,4**), 30 (**column5,6**), or 40 (**column7,8**) km of the kibbutz, normalized by the population density at the attack location **Economic strength**: the economic strength assessed by the banks and the government in 1995. A number from 1 to 4, with 1 being the weakest and 4 being the strongest. This variable is only available for 192 kibbutzim. **Movement affiliation**: 1 if the kibbutz belongs to the most ideological movement – Artzi, 0 if the kibbutz belongs to the other movement – Takam. **Average household size**: the average number of people in the household. This variable is only available for 219 kibbutzim. **Age at 1989**: the number of years have passed since the establishment of the kibbutz. Standard errors are clustered at district level. All regressions include an imputation dummy for years affected by the imputed terorrist attacks in 1993.

the privatization probability of the kibbutz across all specifications, which is consistent with the prediction of the model. Because a large number of civilian deaths means the kibbutz is located in a dangerous area, the kibbutz maintains the equal sharing rule under the common property regime, thereby inducing a high level of public defense from its members.

Regarding magnitude, the point estimate of -5.744 (Column 2 in Table 2) suggests that a one standard deviation increase in the number of civilian deaths within 10km in the previous six years reduces the privatization probability of a kibbutz by $1 - \exp(-5.744 \times 0.0116) = 20$ percent. The magnitude decrease to 16 percent for civilian deaths within 20km, 8 percent for civilian deaths within 30km, and 3.3 percent for civilian deaths within 40km, showing a diminishing effect of civilian deaths as the area increases.

The coefficients are significant at the 95 percent level for civilian deaths within 20km and 30km (Column 4 and 6 in Table 2), even when controlling for a number of other factors that potentially affect the privatization. The number of civilian deaths within 40km (Column 8 in Table 2) has diminished explanatory power, while the number of civilian deaths within 10km (Column 2 in Table 2) is too noisy to yield a significant result, due to the small number of terrorist attacks (see Table 1 for the average number of civilian deaths).

6.3 Instrumental-Variables Strategy

Nevertheless, even after including a large set of controls, the death of civilians could be correlated with some components of the error term. For example, kibbutzim were largely identified with the Labor Party. The rule of the Likud party, known for its support of Israeli settlements in the West Bank and Gaza Strip, may provoke the terrorist attacks of Palestinians, while at the same time reduced the official support for kibbutz. Year fixed effects already capture most of the year-to-year variation in terrorist attacks, but there might still be regional variations in terrorist attacks that are correlated with the unobserved impact.

To address this potential concern, the analysis uses an instrument for the number of civilian deaths under terrorist attacks near each kibbutz. The instrument is the total rainfall surplus in the previous six years at the nearest refugee camp to each kibbutz, multiplied by the camp population, and then divided by the distance between each kibbutz and the nearest camp.

Before directly testing the first-stage assumption, I want to give some intuition as to why it is

expected to find strong correlation between the number of civilian deaths near a kibbutz and the rainfall deficit at the nearest refugee camp to the kibbutz.

Under the harsh and often brutal occupation of Israel, Palestine refugee camps were the breeding ground for terrorist attackers. The First Intifada (the Palestinian's war for independence from Israel) started with a mass demonstration in the Jibalya refugee camp, and soon spread to the other refugee camps in the Gaza Strip and in the West Bank (Morris 2011, p573-574). In the following years, military operations against Israeli targets gained more support from Palestine residents in refugee camps than residents in cities and villages (Bloom 2004). The share of suicides in the refugee camp were represented more than twice of the share in the general population (Yufit and Lester, 2004).

One of the main factors that fuels the resentment of Palestinians is any water crisis arising from the over-abstraction by Israel settlements and the constraints on the water supply and sanitation infrastructure imposed by the occupying power.

Most of the West Bank's natural water resources lie beneath its soil in three shared aquifers collectively known as the "Mountain Aquifer", of which rainfall and snowmelt is the main source of recharge. While the Palestinians extract 20% of the estimated aquifer potential lying beneath the West Bank, which is in line with its allocation in the Oslo agreement, the Israelis over-extract by more than 50%, in addition to the balance of the estimated potential.[28] The over-abstractions of the aquifers has lowered water levels in the West Bank, and reduced Palestinian abstractions from 138 MCM (Million Cubic Metre) in 1999 to 113 MCM in 2007. As a result, more than 200,000 people in West Bank are served by rainwater and poor quality tanker water (World Bank, 2009).

The water supply coverage in the Gaza Strip is better than in the West Bank, but the quality of water has been deteriorating, with high concentrations of salts and nitrates. In the past three decades, heavy over-drafting of groundwater and a decline in the rainfall, the main source of groundwater recharge, has led to the groundwater quality decline and seawater intrusion (Baalousha 2006). Consequently, agriculture productivity is harmed, and less than 10% of water supplied through the network in Gaza Strip meets potable standards (World Bank, 2009; UNOCHA, 2010).

Water supply and sanitation infrastructure could have mitigated the water crisis in the West

[28] In 1995, the Oslo II agreement Article 40 recognized Palestinian water rights, and assigned 20% of estimated rechargeable potential of West Bank aquifers to the Palestinians, 80% to the Israelis.

Bank and the Gaza Strip. The 1995 Oslo agreement aimed to provide a stable framework for investment in water infrastructure, and improve water and sanitation services, but the actual outcome has been the opposite. It is often impossible for Palestinians to obtain Israeli permits to construct or repair of infrastructure, including digging new wells, restoring old wells and constructing water collection structures (UNCTAD, 2015). Only 38 out of the 202 well-drilling projects and 3 out of the 16 waste water projects submitted by the Palestinians were eventually implemented. No agricultural water applications, whether linked to drilling of new or replacement wells or mobilization of surface water streams, has been approved (World Bank, 2009). Israeli governments have also denied the establishment of small and medium-sized dams that could have been used to store such water and release it at appropriate times throughout the year (UNCTAD, 2015); at the same time, numerous dams on the Israeli side cut the upstream water supply, drying the Wadi coastal wetlands in Gaza Strip (Shomar, 2011).

Given the low coverage and the poor quality of the water network, rainfall in Palestine is vital for those who live there to recharge groundwater and prevent seawater incursion. Though the amount of rainfall is exogenous, the Palestinians have good reasons to blame the Israelis for their low living standard in a dry year, and direct their rage on nearby Israeli settlements. Thus, it is expected that variation in rainfall at the nearest refugee camp is strongly correlated with the number of civilian deaths under terrorist attacks near a kibbutz in a given year.

A valid instrument also needs to satisfy the exclusion restriction that absent terrorist attacks, distance to the nearest refugee camp interacted with the rainfall variation at the camp, and the population of the camp has no effect on the timing of kibbutz privatization. This is unlikely to be true, as the instrument, determined by the relative location of kibbutzim and refugee camps, and the local climate, is probably correlated with kibbutz's access to Palestinian labour and the productivity of rain-fed products. These characteristics may affect the privatization decision.

To address this problem, the analysis only uses the rainfall deviation from the long-term (years 1980 to 2017) average rainfall at refugee camps. Furthermore, the analysis controls for the distance between each kibbutz and its nearest refugee camp, the population at the nearest refugee camp, and the interaction between the two. In the following analysis, these are called "standard controls". To control for broad geographic characteristics, the analysis also includes six district fixed effects. Identification then only stems from short-term variation in rainfall at the nearest refugee camp,

which is arguably exogenous and only affects the number of civilian deaths.

The analysis uses a two-step control function approach as in Blundell and Powell (2003).[29] The approach requires running a first-step regression of the endogenous variable on the instrument plus the other explanatory variables, and computing the residuals. Specifically, the following first-stage regression is estimated:

$$Death_{ij,t,t-5} = \beta_{IV}(Rainfall_{ijt} \times Pop_{ij} \div Dist_{ij}) + \beta_X X_i + \theta_j + \eta_t + \epsilon_{ijt} \tag{12}$$

where $Death_{ijt}$ is the number of civilian deaths within 30 kilometres of the kibbutz in the previous six years;[30] θ_j is a district fixed effect; η_t is a year fixed effect; X_i is a vector of kibbutz specific control variables, explained in detail above; $Rainfall_{ij,t,t-5}$ is the total rainfall surplus above the historical average in the previous six years at the nearest refugee camp to kibbutz i; Pop_{ij} is the population at the nearest refugee camp to kibbutz i in 1996; $Dist_{ij}$ is the distance between kibbutz i and its nearest refugee camp; ϵ_{ijt} is the error term.

In the second stage, the hazard is estimated, including the residual from the first step as a regressor, to control for endogeneity of the main regressor:

$$h_{ijt}(s) = h_0(s)\exp(\beta'_D Death_{ij,t,t-5} + \beta_X X_i + \theta_j + \eta_t + \hat{\epsilon}_{ijt}) \tag{13}$$

where $\hat{\epsilon}_{ijt}$ is the residual from the first stage. The coefficient β'_D captures the causal effect of civilian deaths on kibbutz privatization under those terrorist attacks affected by rainfall variation at the nearest refugee camp.

6.4 Instrumental-Variables Results

Table 3 reports results of the Cox model under control function approach, where external threats is measured by the number of Israeli civilian deaths in the previous six years within 10 km (Column 1,2), 20 km (Column 3,4), 30 km (Column 5,6), or 40 km (Column 7,8) of each kibbutz, normalized by the population density at the attack location. Control variables are included in Columns 2, 4, 6, and 8.

[29] The usual Two-Stage Least Squares method generally yields inconsistent estimates of the structural parameters, when the second stage is nonlinear (Blundell and Powell 2003).

[30] Results are robust to civilian deaths within 10, 20, or 40 km

Table 3: First Stage and Main Effects

A.Dependent variable:				First Stage				
Civilian deaths	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	10km	10km	20km	20km	30km	30km	40km	40km
Rainfall× Pop÷ Dist	-0.00305***	-0.00373***	-0.00553***	-0.00605***	-0.00645***	-0.00674***	-0.00542***	-0.00664***
	(0.0000367)	(0.0000441)	(0.0000949)	(0.0000795)	(0.000771)	(0.000565)	(0.00121)	(0.000909)
Standard Control	yes	yes	yes	yes	yes	yes	yes	yes
District fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
N	6021	5103	6021	5103	6021	5103	6021	5103
F-statistics	6910.59	7136.87	3389.56	5788.17	69.89	142.32	20.07	53.29
B.Dependent variable:				Main Effect				
Hazard Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	10km	10km	20km	20km	30km	30km	40km	40km
Civilian deaths	-77.45***	-81.76***	-45.14***	-52.14***	-38.61***	-48.78***	-48.23***	-50.70***
	(14.79)	(10.86)	(9.879)	(7.506)	(8.226)	(7.140)	(10.86)	(8.324)
Population in 1995		-0.00184**		-0.00115		-0.000695		-0.00124
		(0.000787)		(0.000845)		(0.000879)		(0.000851)
Average Household size		-1.203*		-0.00406		-0.355		-0.0150
		(0.726)		(0.714)		(0.741)		(0.710)
Age at 1989		-0.00328		0.00705		0.00221		0.00881
		(0.00476)		(0.00537)		(0.00530)		(0.00616)
Movement affiliation		-0.369**		-0.545***		-0.858***		-0.588***
		(0.145)		(0.121)		(0.109)		(0.123)
Economic strength		-0.146***		-0.0886		-0.204***		-0.137**
		(0.0536)		(0.0617)		(0.0677)		(0.0665)
Standard Control	yes	yes	yes	yes	yes	yes	yes	yes
District fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
N	3297	2791	3297	2791	3297	2791	3297	2791

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Kibbutzim were exposed to the decision of privatization in 1989, when they were formally permitted by kibbutz federations to introduce reforms. A failure happens when the kibbutz privatizes (adopt the partial payment reform). **Civilian deaths**: the number of Israeli civilian deaths in the previous six years within 10 (**column1,2**), 20 (**column3,4**), 30 (**column5,6**), or 40 (**column7,8**) km of the kibbutz, normalized by the population density at the attack location **Economic strength**: the economic strength assessed by the banks and the government in 1995. A number from 1 to 4, with 1 being the weakest and 4 being the strongest. This variable is only available for 192 kibbutzim. **Movement affiliation**: 1 if the kibbutz belongs to the most ideological movement – Artzi, 0 if the kibbutz belongs to the other movement – Takam. **Average household size**: the average number of people in the household. This variable is only available for 219 kibbutzim. **Age at 1989**: the number of years have passed since the establishment of the kibbutz. **Rainfall× Pop÷ Dist** is the rainfall surplus above the historical average in the previous six years at the nearest refugee camp to each kibbutz, multiplied by the population of the refugee camp in 1996, and then divided by the distance between the refugee camp and the kibbutz; **Refugee Pop** is the population at the nearest refugee camp in 1996; **Refugee Dist** is the distance between each kibbutz and its nearest refugee camp; **Pop÷Dist** is the interaction between **Refugee Pop** and **Refugee Dist**; **Standard Control** includes **Refugee Pop**, **Refugee Dist**, and **Pop÷Dist**. Standard errors are clustered at district level. All regressions include an imputation dummy for years affected by the imputed terorrist attacks in 1993.

First Stage The first-stage relationship between the rainfall surplus, augmented by the population of and the distance to the nearest refugee camp, and civilian deaths under terrorist attacks is strongly negative at the 99 percent confidence level across all specifications, and this relationship holds, and becomes stronger, when including kibbutz level controls (Columns 2,4,6,8 in Table 3). The lowest F-statistic on the excluded instrument among all specifications is 20.07.

Regarding magnitude, the point estimate of -0.00674 (Column 2 in Table 3) suggests that the civilian deaths within 10km of a kibbutz in the previous six years with an average distance to the nearest refugee camp of an average population reduces by $0.82 \times 0.00373 = 0.00306$, about 26 percent of the mean (0.0116), following a one standard deviation decrease in the rainfall at the nearest refugee camp. The magnitude decrease to 16 percent for civilian deaths within 20km, 10 percent for civilian deaths within 30km, and 7 percent for civilian deaths within 40km, showing a diminishing explanatory power of the instrument for civilian deaths further away from the kibbutz.

Main Effect The instrumental-variables point estimates are much larger than the analogous estimates without instrument variables: a kibbutz experiencing an average amount of civilian deaths is $\exp(-48.78 \times 0.0536) = 7.2\%$ as likely to privatize as a kibbutz experiencing no civilian deaths within 30km in the previous six years.[31] The coefficients of the civilian deaths are much bigger than any other variable, suggesting that a safe environment is the main driven factor behind the kibbutz privatization. The results are robust across all specifications and significant throughout at the 99 percent confidence level.

This finding once again supports the theoretical prediction that common property regimes are better at coordinating the public defense, and are maintained in relatively dangerous environment. Furthermore, wealthier kibbutzim and kibbutzim that belong to Artzi, the more ideological movement, are less likely to be privatized, which is consistent with findings in Abramitzky (2008,2011).

7 Conclusion

This paper proposes a model which establishes the theoretical relationship between types of property regimes and the level of external threats. Specifically, the equal-sharing rule in common property

[31] The result should be interpreted with cautious.The cox proportional model do not estimate the base line hazard rate. While the relative hazard rate increases for a kibbutz experiencing average level of terrorist attacks compared to a kibbutz experiencing zero terrorist attacks, it says nothing about their absolute hazard rates.

communities induces a first-best level of public defense, that would be under-provisioned under private property regimes. However, it also creates an issue of adverse selection. Hence, when the level of threats faced by a common property community decreases, the benefit of the higher level of public defense also decreases, and the common property communities are eventually privatized.

The timing of the establishment and the privatization of kibbutzim is consistent with the model's prediction. The majority of kibbutzim were established either before or during Middle East wars. All, but two, kibbutzim were privatized after the general reconciliation of Israel with Egypt and Jordan.

Aside from the historical evidences, the prediction is also supported by evidences from a kibbutz-level panel data, which captures the idiosyncratic timing of the privatization of kibbutzim during the period from 1986 to 2014. A kibbutz experiencing an average amount of civilian deaths is 7.2% as likely to privatize as a kibbutz experiencing no civilian deaths within 30km in the previous six years.

While the results are based on a single case study of the kibbutzim in Israel, anecdotal evidence strongly indicates that the findings are likely to be relevant for settlements in other areas of conflict. Ellickson (1993) noticed that pioneers living in Jamestown, Plymouth and Salt Lake declined to establish private property communities at the early years, partly to defend against Indians. However, pioneers in places without strong Indian threat established city lots and farmstead within a month of arrival.

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Appendix 1: Proof of Proposition 3(b)

For $T \in (\hat{D}, D^*)$

$$\begin{aligned}
\pi_j =& \frac{1}{N}\sum_{i=1}^{N} z_i F(e_i^*(T)) + \frac{1}{N}\sum_{i=1}^{N} NG(1-e_i^*(T)) - z_j F(\hat{e_j}) \\
& - \frac{1}{N}\sum_{i=1}^{N} NG(1-\hat{e}_i) \\
\frac{d\pi_j}{dT} =& \frac{1}{N}\sum_{i=1}^{N} \frac{dz_i F(e_i^*(T))}{de_i^*(T)}\frac{de_i^*(T)}{dT} - \frac{1}{N}\sum_{i=1}^{N} \frac{NdG(1-e_i^*(T))}{d(1-e_i^*(T))}\frac{de_i^*(T)}{dT} \\
\frac{d\pi_j}{dT} =& \sum_{i=1}^{N} (\alpha(T)-1)\frac{NdG(1-e_i^*(T))}{d(1-e_i^*(T))}\frac{de_i^*(T)}{dT}
\end{aligned} \tag{14}$$

where the last equality comes from the envelope theorem.

$\frac{d\pi_j}{dT} > 0$, since $\alpha(T) - 1 < 0$, $\frac{NdG(1-e_i^*(T))}{d(1-e_i^*(T))} > 0$, $\frac{de_i^*(T)}{dT} < 0$

Appendix 2: Robust Checks

Table 4 replicates the results of Table 3, without imputing terrorist attack data in 1993. External threats is measured by the number of Israeli civilian deaths in the previous six years within 10 km (Column 1,2), 20 km (Column 3,4), 30 km (Column 5,6), or 40 km (Column 7,8) of each kibbutz, normalized by the population density at the attack location. Control variables are included in Columns 2, 4, 6, and 8. These additional controls include economic strength, movement affiliation, average household size, kibbutz population in 1995 as well as the age of kibbutz in 1989. The results are qualitatively very similar to the estimates in Table 3.

Table 4: Robust check by dropping 1993 data

A.Dependent variable:	First Stage							
Civilian deaths	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	10km	10km	20km	20km	30km	30km	40km	40km
Rainfall× Pop÷ Dist	-0.00297***	-0.00363***	-0.00523***	-0.00573***	-0.00585***	-0.00610***	-0.00456***	-0.00572***
	(0.0000451)	(0.0000441)	(0.0000797)	(0.0000437)	(0.000686)	(0.000502)	(0.00112)	(0.000820)
Standard Control	yes	yes	yes	yes	yes	yes	yes	yes
District fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
N	6021	5103	6021	5103	6021	5103	6021	5103
F-statistics	6910.59	7136.87	3389.56	5788.17	69.89	142.32	20.07	53.29
B.Dependent variable:	Main Effect							
Hazard Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	10km	10km	20km	20km	30km	30km	40km	40km
Civilian deaths	-79.59***	-83.97***	-47.82***	-55.15***	-42.93***	-54.10***	-57.58***	-58.95***
	(15.18)	(11.15)	(10.44)	(7.910)	(9.055)	(7.862)	(12.91)	(9.635)
Population in 1995		-0.00187**		-0.00120		-0.000704		-0.00126
		(0.000786)		(0.000843)		(0.000877)		(0.000849)
Average Household size		-1.286*		-0.0125		-0.369		-0.0117
		(0.727)		(0.717)		(0.742)		(0.711)
Age at 1989		-0.00597		0.00553		0.00166		0.00993
		(0.00475)		(0.00527)		(0.00525)		(0.00630)
Movement affiliation		-0.377***		-0.569***		-0.914***		-0.625***
		(0.145)		(0.120)		(0.109)		(0.121)
Economic strength		-0.138***		-0.0712		-0.195***		-0.117*
		(0.0531)		(0.0618)		(0.0675)		(0.0663)
Standard Control	yes	yes	yes	yes	yes	yes	yes	yes
District fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
N	3297	2791	3297	2791	3297	2791	3297	2791

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Kibbutzim were exposed to the decision of privatization in 1989, when they were formally permitted by kibbutz federations to introduce reforms. A failure happens when the kibbutz privatizes (adopt the partial payment reform). **Civilian deaths**: the number of Israeli civilian deaths in the previous six years within 10 (**column1,2**), 20 (**column3,4**), 30 (**column5,6**), or 40 (**column7,8**) km of the kibbutz, normalized by the population density at the attack location **Economic strength**: the economic strength assessed by the banks and the government in 1995. A number from 1 to 4, with 1 being the weakest and 4 being the strongest. This variable is only available for 192 kibbutzim. **Movement affiliation**: 1 if the kibbutz belongs to the most ideological movement – Artzi, 0 if the kibbutz belongs to the other movement – Takam. **Average household size**: the average number of people in the household. This variable is only available for 219 kibbutzim. **Age at 1989**: the number of years have passed since the establishment of the kibbutz. **Rainfall× Pop÷ Dist** is the rainfall surplus above the historical average in the previous six years at the nearest refugee camp to each kibbutz, multiplied by the population of the refugee camp in 1996, and then divided by the distance between the refugee camp and the kibbutz; **Refugee Pop** is the population at the nearest refugee camp in 1996; **Refugee Dist** is the distance between each kibbutz and its nearest refugee camp; **Pop÷Dist** is the interaction between **Refugee Pop** and **Refugee Dist**; **Standard Control** includes **Refugee Pop**, **Refugee Dist**, and **Pop÷Dist**. Standard errors are clustered at district level.

Appendix 3: Logit Regression

Table 5 runs a Logit model, where the dependent variable is whether the kibbutz was privatized in year i. It equals to 1 if the kibbutz was privatized in year i, 0 if not. The results are qualitatively very similar to the estimates in Table 3.

Specifically, the following first-stage regression is estimated:

$$Death_{ij,t,t-5} = \beta_{IV}(Rainfall_{ijt} \times Pop_{ij} \div Dist_{ij}) + \beta_X X_i + \theta_j + \eta_t + \epsilon_{ijt} \tag{15}$$

where $Death_{ijt}$ is the number of civilian deaths within 30 kilometres of the kibbutz in the previous six years; θ_j is a district fixed effect; η_t is a year fixed effect; X_i is a vector of kibbutz specific control variables, explained in detail above; $Rainfall_{ij,t,t-5}$ is the total rainfall surplus above the historical average in the previous six years at the nearest refugee camp to kibbutz i; Pop_{ij} is the population at the nearest refugee camp to kibbutz i in 1996; $Dist_{ij}$ is the distance between kibbutz i and its nearest refugee camp; ϵ_{ijt} is the error term.

In the second stage, the probability of privatization is estimated by the following Logit regression, including the residual from the first step as a regressor, to control for endogeneity of the main regressor:

$$Privatization_{ijt} = \alpha + \beta'_D Death_{ij,t,t-5} + \beta_X X_i + \theta_j + \eta_t + \hat{\epsilon}_{ijt} + u_{ijt} \tag{16}$$

where $Privatization_{ijt}$ equals to 1 if the kibbutz i in district j was privatized in year i, 0 if not. $\hat{\epsilon}_{ijt}$ is the residual from the first stage. The coefficient β'_D captures the causal effect of civilian deaths on kibbutz privatization under those terrorist attacks affected by rainfall variation at the nearest refugee camp. u_{ijt} is the error term.

Table 5: Logit Regression

A.Dependent variable:	First Stage							
Civilian deaths	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	10km	10km	20km	20km	30km	30km	40km	40km
Rainfall× Pop÷ Dist	-0.00305***	-0.00373***	-0.00553***	-0.00605***	-0.00645***	-0.00674***	-0.00542***	-0.00664***
	(0.0000367)	(0.0000441)	(0.0000949)	(0.0000795)	(0.000771)	(0.000565)	(0.00121)	(0.000909)
Standard Control	yes	yes	yes	yes	yes	yes	yes	yes
District fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
N	6021	5103	6021	5103	6021	5103	6021	5103
F-statistics	6910.59	7136.87	3389.56	5788.17	69.89	142.32	20.07	53.29
B.Dependent variable:	Main Effect							
Privitization	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	10km	10km	20km	20km	30km	30km	40km	40km
Civilian deaths	-85.17***	-91.37***	-49.68***	-58.62***	-42.31***	-54.80***	-52.87***	-57.03***
	(16.14)	(11.47)	(10.54)	(7.966)	(8.825)	(7.421)	(11.69)	(8.774)
Population in 1995		-0.00213**		-0.00136		-0.000838		-0.00146
		(0.000920)		(0.000979)		(0.000996)		(0.000971)
Average Household size		-1.369		-0.0295		-0.420		-0.0402
		(0.898)		(0.863)		(0.895)		(0.862)
Age at 1989		-0.00541		0.00634		0.000918		0.00835
		(0.00524)		(0.00605)		(0.00601)		(0.00691)
Movement affiliation		-0.460***		-0.656***		-1.005***		-0.702***
		(0.175)		(0.154)		(0.146)		(0.160)
Economic strength		-0.187***		-0.120		-0.250***		-0.175**
		(0.0658)		(0.0758)		(0.0807)		(0.0805)
Constant	-2.742***	2.425	-3.005***	-1.953	-2.583***	-0.195	-2.095***	-1.062
	(0.386)	(2.351)	(0.399)	(2.366)	(0.369)	(2.358)	(0.359)	(2.321)
Standard Control	yes	yes	yes	yes	yes	yes	yes	yes
District fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes	yes	yes
N	3297	2791	3297	2791	3297	2791	3297	2791

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Kibbutzim were exposed to the decision of privatization in 1989, when they were formally permitted by kibbutz federations to introduce reforms. The dependent variable is **Privatization**:1 if the kibbutz is privatized in this year, 0 if not. **Civilian deaths**: the number of Israeli civilian deaths in the previous six years within 10 (**column1,2**), 20 (**column3,4**), 30 (**column5,6**), or 40 (**column7,8**) km of the kibbutz, normalized by the population density at the attack location **Economic strength**: the economic strength assessed by the banks and the government in 1995. A number from 1 to 4, with 1 being the weakest and 4 being the strongest. This variable is only available for 192 kibbutzim. **Movement affiliation**: 1 if the kibbutz belongs to the most ideological movement – Artzi, 0 if the kibbutz belongs to the other movement – Takam. **Average household size**: the average number of people in the household. This variable is only available for 219 kibbutzim. **Age at 1989**: the number of years have passed since the establishment of the kibbutz. **Rainfall× Pop÷ Dist** is the rainfall surplus above the historical average in the previous six years at the nearest refugee camp to each kibbutz, multiplied by the population of the refugee camp in 1996, and then divided by the distance between the refugee camp and the kibbutz; **Refugee Pop** is the population at the nearest refugee camp in 1996; **Refugee Dist** is the distance between each kibbutz and its nearest refugee camp; **Pop÷Dist** is the interaction between **Refugee Pop** and **Refugee Dist**; **Standard Control** includes **Refugee Pop**, **Refugee Dist**, and **Pop÷Dist**. Standard errors are clustered at district level. All regressions include an imputation dummy for years affected by the imputed terorrist attacks in 1993.