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**Does It Pay To Pray?  
Evaluating the Economic Return  
to Religious Ritual**

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## **Abstract**

Time-consuming and costly religious rituals pose a puzzle for economists committed to rational choice theories of human behavior. We propose that religious rituals promote in-group trust and cooperation that help to overcome collective-action problems. To test this hypothesis we design field experiments to measure the in-group cooperative behavior of members of religious and secular Israeli kibbutzim, communal societies for which mutual cooperation is a matter of survival. Our results show that religious males (the primary practitioners of collective religious ritual in Orthodox Judaism) are more cooperative than religious females, secular males and secular females. Moreover, the frequency with which religious males engage in collective religious rituals predicts well their degree of cooperative behavior. We use our results to understand differences in the return to religious observance in capitalist and developing economies.

**Keywords:** economics of religion, field experiment, religious ritual, cooperation, signaling, kibbutz.

**JEL classification codes:** C72, C93, P32, Z12.

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# 1. Introduction

## 1.1 Background

“Religion ... is a nearly ubiquitous form of human behavior, culturally established in complex elaborations, but absolutely useless, from a crudely technological standpoint, in the accomplishment of the primary economic, domestic, and political tasks of mankind” (Wallace 1966, vi).

The enormous resources devoted to religious ritual across cultures pose a challenge to economists committed to rational choice theories of economic behavior. One traditional response has been to write off religious behavior as primitive, superstitious and outside the realm of economic calculus. However, the universality and widespread revitalization of religion demands a more thoughtful response.

In an effort to make sense of seemingly irrational ritual practices, economists have recently proposed plausible accompanying benefits. Iannaccone (1992) suggests that costly sacrifices and stigmas serve to screen out free riders from the collective production of religious goods. Berman (2000) puts forth a model in which groups provide mutual insurance and charity, and rituals serve to signal members' commitment to the group. In addition, a long line of anthropologists, beginning with Durkheim (1995 [1912]), has conjectured that religious rituals increase group solidarity and bonding.

Despite the growing number of hypothesized benefits associated with religious ritual, there exists a dearth of empirical evidence.<sup>1</sup> In this paper, we test for a relationship between religious ritual and cooperative behavior by conducting common-pool-resource experiments on members of religious and secular communes, Israeli kibbutzim (the plural of kibbutz). We combine our experimental results with survey data on, among other variables, participation in various secular and religious rituals to examine the relationship between both religious and secular collective ritual performance and cooperative behavior. Our hypothesis is that the frequency of collective ritual performance, like communal prayer for observant Jewish males, predicts their degree of cooperative behavior.

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<sup>1</sup> Exceptions in the sociology and anthropology literatures include Barro and McCleary (2003), Kress et al. (2003), Sosis (2000), Sosis and Bressler (2003) and Sosis and Ruffle (2003). Note that all but the last of these studies focus on the relation between religiosity and group, rather than individual, benefits. Iannaccone's (1998) comprehensive survey of the economics of religion includes a review of studies that associate religious observance with beneficial social behavior (e.g., lower rates of crime and drug and alcohol abuse), more stable marriages and mental and physical health benefits.

The relationship between religiosity and cooperation can be readily tested in the framework of the Israeli kibbutz since kibbutzim are divided into those that are religious and those that are secular. Members of the 16 religious kibbutzim are modern Orthodox Jews. By contrast, secular kibbutzim are known to be the most secular element of Israeli society. This distinction allows us to measure the degree of cooperation of kibbutz members toward fellow members as a function of whether they belong to a religious or a secular kibbutz.

Moreover, the naturally occurring variation in collective ritual performance on religious kibbutzim, especially along gender lines, offers an opportunity to explore whether differences in individual cooperativeness in the experimental game can be explained by variation in the performance of collective ritual. Collective ritual obligations fall disproportionately upon men in Judaism. We gather individual-level data on collective ritual performance and explore the relationship between the extent of ritual participation and cooperative behavior. Because the lives of members of secular kibbutzim are not structured by religious ritual (but are otherwise very similar to those of religious kibbutz members), they provide a natural comparative population to assess the impact of collective ritual performance on cooperation.

To measure cooperation, we design a common-pool resource game that resembles the types of day-to-day problems confronted by kibbutz members. Kibbutz members play the game paired with anonymous members from their own kibbutz.

Using the same experimental game, previous research establishes that kibbutz members behave more cooperatively toward one another than do city residents (Ruffle and Sosis 2003). The current paper reveals that not all kibbutz members are equally cooperative: religious men (the primary practitioners of collective religious ritual in Judaism) are more cooperative than religious women. What is more, religious men who attend synagogue daily (the primary collective ritual obligation for men only) are more cooperative than any other group, including religious women, secular men, secular women and religious men who attend synagogue less frequently. In fact, religious men who do not attend synagogue daily are no more cooperative than religious women, suggesting the importance of frequent collective ritual for cooperative behavior.

Our results are used to explain the finding that religious kibbutzim have been economically more successful than their secular counterparts (see, e.g., Fishman and Goldschmidt 1990). Moreover, the strength of religion and religious ritual in the

developing world in particular can be seen as mechanisms to solve frequently encountered collective-action problems in the absence of substitute economic, institutional and legal structures.

## **1.2 The Economic Benefits of Religious Ritual**

Iannaccone (1992) models religion as a club good with a positive externality to increased participation. An individual's utility thus depends not only on his or her own inputs in religious activities, but also increases with others' inputs. Individuals who are less committed to the religion's doctrine are tempted to free ride off those who are more devout. Costly sacrifices and prohibitions in Iannaccone's model serve to screen out free riders with the result that members' average participation levels, and thus their utility levels, are higher.

Iannaccone's pioneering model illustrates the effectiveness of costly sacrifices in screening out free riders. He tests his model's predictions using self-reported survey data from the National Opinion Research Center's General Social Survey, 1986-1990. The individual-level data include measures of religious observance and participation. He categorizes the different churches to which respondents belong according to the stringency of their demands. Controlling for demographic factors, Iannaccone finds that the stricter the church, the higher the average levels of church attendance, contributions and frequency of prayer. Subsequent research also supports the screening role of costly sacrifices in Iannaccone's model (see, for example, Iannaccone 1994).

Berman (2000) extends Iannaccone's club-good model of religion to understand the Israeli Ultra-Orthodox community's need for costly sacrifices to signal commitment and to exclude free riders from their network of charity and mutual insurance. Berman shows that subsidies to club membership are largely dissipated since they induce even more costly sacrifices to signal group commitment. He uses his model to argue that the Israeli government's subsidies to the Ultra-Orthodox sector has resulted in inefficient sacrifices, such as male *Yeshiva* attendance (and thus their non-participation in the labor force) until age 40 on average, well beyond that of Ultra-Orthodox males outside of Israel.

Anthropologists have long noted that one of the primary functions of religion is to promote group solidarity, and most have recognized ritual as the mechanism

through which this solidarity is achieved. Guided by Durkheim (1995 [1912]), who was among the first to appreciate the unifying nature of religious ritual, anthropologists have argued that collective rituals enable the expression and reaffirmation of shared beliefs, norms, and values and are thus essential for maintaining communal stability and group harmony (e.g., Douglas 1966, Radcliffe-Brown 1952). For Durkheim, collective rituals are the means by which individuals bond with one another in the community. He claims that the “effervescent” state of ritual performance minimizes individual distinctions and emphasizes the unity of the group. Turner (1969) also views this “effervescent” state as central to ritual’s efficacy. He observes that the temporary removal of adolescents from society during rites of passage increased a sense of *communitas*, which he characterizes as a strengthening of social bonds and heightened solidarity among ritual performers.

More recently, evolutionary researchers have extended these early anthropological analyses and argued that religious behaviors serve to promote cooperation among their performers (Cronk 1994, Irons 2001, Rappaport 1999, Sosis 2003, Sosis and Alcorta 2003, Steadman and Palmer 1995, Wilson 2002). For example, Irons maintains that rituals have enhanced our ability to overcome the collective-action problems we have likely faced throughout our evolutionary history. The significant time and energetic costs incurred in the performance of ritual serve as signals of group commitment and loyalty and thus permit a net benefit from successful collective action.

The benefit upon which we focus is economic cooperation. We hypothesize that collective religious ritual promotes economic cooperation among the practitioners of the ritual. As proposed by Iannaccone, strict, demanding rituals screen out opportunistic members not wholly committed to the religion’s ideals. However, members willing to incur the costs of regular ritual performance are likely to vary considerably in their degree of ritual participation. Screening cannot account for how such individual variation may explain differences in members’ cooperative behavior. Costly signaling theory can: the extent to which an individual partakes in time-consuming collective religious ritual, and thus foregoes other activities, signals to members of the religion that individual’s degree of commitment (Irons 2001, Sosis 2003). To be effective, religious rituals must be performed collectively so that a

member's participation is publicly observable.<sup>2</sup> The anthropological literature on the functionality of religion and religious ritual suggests that high levels of mutual, observable ritual practice create a sense of solidarity, group bonding, trust and willingness to cooperate among practitioners. Increased cooperation may be observed in a business transaction, a collective enterprise such as farming, building a house or providing a public good, or day-to-day interactions requiring cooperation.

Others have also documented economic benefits associated with individual religious observance. Ensminger (1997) argues that the vast number of African societies that have converted to Islam can be understood in terms of increased trade opportunities for those who convert. By adopting Islam, Ensminger contends, the African converts earned the trust of traders from North Africa and the Middle East, which allowed for the extension of credit to expand further trade possibilities. Moreover, Islam provided a legal code to adjudicate financial contracts and disputes and a common language of trade (Arabic). The high entry costs into Islam in the form of daily prayer, abstinence from alcohol and pre-marital sex, fasting during Ramadan, and the pilgrimage to Mecca served as signals of trustworthiness among traders. In other words, these rituals and taboos are costly signals of commitment that screen out free-riders, restricting the benefits of more efficient trade to those who are willing to undertake such demanding rituals and prohibitions.

The success of Ultra-Orthodox Jews in the diamond industry is another example of the economic benefits achieved by close-knit religious communities. Shield (2002, p. 104) describes the level of trust among Ultra-Orthodox Jews who work in New York's diamond district as "unheard of." Multi-million dollar transactions are sealed by nothing more than Yiddish and a handshake (Shield 2002, p. 2). Among those who work in the diamond industry, trust is essential for business activity since traders are often handling valuable stones that could easily be lost or pocketed. Ultra-Orthodox Jews attain this high level of trust and mutual cooperation through costly religious demands, such as particular dress and hairstyle, restrictions on permitted food, thrice daily prayer, among many others, which are required for entry into their community. This has enabled them to out compete others unable to achieve such high levels of cooperation, thus resulting in their prominence in the industry throughout the world.

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<sup>2</sup> Private rituals appear to serve an alternative purpose, such as convincing oneself that one believes in the theology ascribed to the rituals (Rappaport 1999, Sosis 2003).

Nowhere is cooperation more necessary than for communes whose survival and success hinge on it. In comparative work on a sample of 200 19<sup>th</sup> century U.S. communes, Sosis (2000) shows that religious communes are between two and four times more likely to survive in every year of their life course than their secular counterparts (also see Kanter 1972). In subsequent work, Sosis and Bressler (2003) use historical documents and monographs to construct a database on the requirements and constraints that these communes imposed on their members. Their analyses show a robust, positive correlation between the costliness of the requirements and constraints that communes imposed on their members and communal success. Here we examine the relation between individual ritual performance and the cooperative behavior of members of an extant communal population, the Israeli kibbutz.

The Israeli kibbutz is among the best known, most enduring and successful examples of a modern commune. Kibbutz members live together, typically work and socialize together, and share equally all earned income, independent of an individual member's occupation, skills or work effort. Moreover, the kibbutz pays for individual members' consumption of housing, food, utilities and transportation, among other goods. These facts make the kibbutz rife with occasions for free riding and opportunistic behavior. The imposition of costly, collective religious rituals can serve to increase the participant's sense of commitment to the group, signal this commitment to others and increase the participant's willingness to cooperate with other members. At the same time, the screening role ritual plays in Iannaccone's model can also operate in the kibbutz setting: costly rituals can serve as a tax, too costly to bear for potential members merely seeking the guaranteed standard of living offered by the kibbutz.

In the next section, we provide some background on the Israeli kibbutz. In section 3, we outline the strategy we adopted to select the religious and secular kibbutzim that participated in our research. We also detail the experimental game and procedures. Section 4 makes explicit the experimental hypotheses we test. The results are presented in section 5. In Section 6, we discuss the necessity of frequent costly collective rituals, offer an explanation and a mechanism underlying the success of religious kibbutzim and discuss some implications of our results for religious practice in developing countries. Section 7 concludes.



## **2. The Israeli Kibbutz**

### **2.1 Background on the Kibbutz**

The kibbutz was originally conceived as a small collective farming settlement in which members based their social and cultural lives on the collective ownership of property and wealth. The first kibbutz, Degania, was established in the Galilee in 1909. Today there are approximately 270 kibbutzim located in every region in Israel. The 124,000 or so kibbutz members comprise around 2% of the Israeli population.

The kibbutz developed out of an egalitarian ideology rooted in Socialist-Zionism as well as the pragmatism of group living by Eastern European Jews during the years leading up to the establishment of the modern State of Israel. Guided by the dictum “From each according to his abilities, to each according to his needs,” the traditional model of the kibbutz prescribes that each member receives food, shelter, clothing, education, health care, and an equal share of the income generated by the kibbutz. That all kibbutz members earn an equal income holds whether one is the dishwasher in the communal dining hall, the CEO of the computer chip plant, the kibbutz gardener, an eye surgeon who works in Tel Aviv or retired. Income earned on and off the kibbutz is thus divided equally between all members regardless of profession, skill or effort level. In this sense, production or the generation of income is a public goods problem. Consumption on the kibbutz, by comparison, represents a classic tragedy of the commons problem: kibbutz members enjoy equal and unrestricted access to rival consumption goods. For example, in the traditional kibbutz, the costs associated with an individual’s consumption of housing, food, water, electricity and the use of communal cars are borne by the kibbutz, not the individual.

We design an experimental game that focuses on the common-pool-resource aspect of kibbutz consumption. Unlike other common-pool-resource problems, such as fishing grounds, groundwater basins, oil fields and grazing areas, for which licenses, externally-enforceable agreements restricting access to the resource and the assignment of private-property rights are possible solutions,<sup>3</sup> such measures are impractical for the kibbutz without drastically altering its fundamental nature. Rather,

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<sup>3</sup> Ostrom (1991) examines the success and failure of such methods through numerous case studies involving the collective management of natural resources. See also Ostrom, Gardner and Walker (1994) for a thorough theoretical, experimental and empirical treatment of common-pool resources.

cooperation and voluntary self-restraint are necessary to prevent the depletion of its common-pool resources and to ensure the continuity of the kibbutz.

Indeed, the continuation of the kibbutz should not be regarded as self-evident for several reasons. First, the short-lived communal experiments throughout history (the American communes of the 18<sup>th</sup> and 19<sup>th</sup> centuries and the 1960s are among the best known examples) attest to the difficulty in sustaining cooperation over time and across generations. Moreover, many kibbutzim have shown signs of decline and economic hardship in recent years. Beginning in the 1950s and 1960s, kibbutzim found themselves economically unable to survive by farming alone. Consequently, through bank loans, kibbutzim started to diversify their range of economic activities by developing manufacturing and service industries. Today, kibbutzim are engaged in the production of the entire gamut of goods and services in high technology, manufacturing, tourist and agricultural industries using the most modern production techniques.

The decline of many kibbutzim began in the mid-1980s when the Israeli economy experienced hyperinflation, soaring interest rates and a sharp drop in exports. Those kibbutzim that took on large amounts of debt in the late 1970s and early 1980s (at a time when banks began to index loans to the rate of inflation and to the dollar exchange rate) were particularly hard hit. Concerns for economic viability set in motion numerous structural changes on the kibbutz (see Ben-Rafael 1997 for further details). The most significant change adopted by some kibbutzim involved the transfer of control of certain resources from the collective to the individual household. This process, referred to as “privatization”, consists of numerous measures including: the requirement that individual households, rather than the kibbutz, pay for their private consumption of goods like travel, electricity, telephone calls and clothing; the cancellation of dinner in the communal dining hall thereby requiring kibbutz members to eat in their own homes at their own expense; and the encouragement of kibbutz members to seek work outside of the kibbutz. However, the most radical change – and typically the last one implemented by the small minority of kibbutzim that have decided to implement privatization fully – is differential salaries according to which individual kibbutz members earn incomes that reflect, at least in part, their productivity.<sup>4</sup>

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<sup>4</sup> We also conducted this research on a sample of privatized kibbutzim and a matched sample of traditional, highly collectivized kibbutzim (see Ruffle and Sosis, in progress).

Interestingly, religious kibbutzim emerged from the economic crisis of the 1980s relatively unscathed. For this reason, the banks did not force the religious kibbutzim to privatize nor did they choose to adopt such measures. In section 6.2 we offer our findings as a possible explanation for the relative economic success of the religious kibbutzim.

## 2.2 Religious and Secular Kibbutz Distinction

All kibbutzim belong to one of three kibbutz movements. The secular kibbutzim belong to either the Kibbutz Ha'Artzi or TAKAM federation,<sup>5</sup> while the 16 religious kibbutzim belong to the Religious Kibbutz Federation.<sup>6</sup> The clean distinction between religious and secular kibbutzim and the corresponding attitudes toward religion of their members provide a natural environment for our hypotheses concerning the role of religious observance and religious ritual in intra-group cooperation.

Having derived their ideology from their communist predecessors from Eastern Europe and the former Soviet Union, secular kibbutz members are similarly antagonistic toward religion. Indeed, studies of secular kibbutz members confirm their antipathy toward religion (see Spiro 1970 for a classic ethnography of the kibbutz). By contrast, members of religious kibbutzim practice a form of Judaism known as Modern Orthodoxy. Modern Orthodox Jews adhere to traditional Jewish law (*halacha*), but unlike Ultra-Orthodox Jews they do not shun modernity; for instance, they serve in the Israeli military, own televisions and read mainstream newspapers. Numerous prohibitions apply equally to men and women, most noticeably, kosher dietary laws, modest dress and the forbiddance of work on the Sabbath. Religious ritual plays a central and defining role in the lives of Modern Orthodox Jews. Yet the injunction to perform collective rituals does not fall equally upon men and women. Male ritual requirements are primarily publicly oriented, whereas female requirements are generally in the home or private. Indeed, of the three main ritual requirements imposed on women, two are private (namely, the laws of family purity such as attending a ritual bath (*mikveh*) and separating a portion of dough when baking

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<sup>5</sup> In 2001, approximately one year after the completion of our experiments, the merger of the Kibbutz Ha'Artzi and the TAKAM federations was announced.

<sup>6</sup> There are two Ultra-Orthodox kibbutzim (Hefetz Haim and Sha'alabim) that belong to their own movement known as the Workers' Union of Israel and three kibbutzim associated with the Progressive (Reform) Judaism Movement that belong to the TAKAM. These kibbutzim have been excluded from our sample, although they would make interesting case studies.

bread), and the third is performed in the presence of the family only (lighting Sabbath candles). Males, by contrast, are obliged to engage in a variety of collective rituals, thrice-daily public prayer in a *minyan* (a quorum of at least 10 men) being the most notable among them. There is no similar requirement for women to attend communal prayer. In fact, women who choose to attend sit separately from, and are not seen by, the men, and are not counted as part of the *minyan*.

Our hypothesis that collective rituals promote group commitment and cooperative behavior leads us to expect that religious males will exhibit higher levels of cooperation than religious females. Moreover, the more frequently a religious male partakes in religious ritual, the more cooperatively we expect him to behave. By conducting a common-pool resource game that measures kibbutz members' cooperative behavior with one another and by following up the game with a questionnaire that elicits individuals' degrees of participation in ritual performance, we will be able to evaluate the role that collective ritual plays in promoting cooperation.

### **3. Experimental Methodology**

#### **3.1 Choice of Sample**

To control for between-kibbutz differences unrelated to behavior, a matched-pairs design guided our choice of sample religious and secular kibbutzim: each of the seven religious kibbutzim was matched with one or more secular kibbutzim. The latter were chosen for their similarity to religious kibbutzim along four measures that may potentially affect cooperation. In forming these matched sample pairs, we controlled for the kibbutz's population size, year of establishment, degree of economic success, and degree of privatization. Because religious kibbutzim are, on average, economically more successful (Fishman and Goldschmidt 1990) and much less privatized (i.e., more communal) than secular kibbutzim, our paired secular kibbutzim constitute some of the most successful and highly collectivized secular kibbutzim in a movement that is otherwise economically struggling and becoming much less

communal (Leviatan et al. 1998). In total, 558 kibbutz members from 18 kibbutzim throughout Israel participated in our research.<sup>7</sup>

Our data sources for the construction of our matched samples are the government census of the kibbutzim and their population (Israel Central Bureau of Statistics, 1998) for the kibbutz size and year of establishment data, Getz (1999) for the privatization data, and personal communication with the kibbutz research institute Yad Tabenkin for the economic strength data. Table 1 displays the means and standard deviations of these control variables for religious and secular kibbutzim in our sample. The number of members (“Kibbutz Size”) and the number of changes adopted by the kibbutz in the direction of privatization (out of a possible 23) are identical in the religious and secular kibbutz samples. As for the variables “Year of Establishment” and “Economic Strength”, the distributions of these variables are not significantly different across the religious and secular kibbutzim (the p-values from Wilcoxon-Mann-Whitney non-parametric tests are .42 and .54 for the respective variables). Whatever slight differences remain between the two samples follow from the impossibility of matching these kibbutzim along all four variables simultaneously. When we were unable to find a secular kibbutz that was similar to a particular religious kibbutz on all four variables, we opted to compromise on the need to match the two kibbutzim on the exact year of establishment. Where two or more candidate secular kibbutzim differed appreciably only in their degree of economic strength, we chose the more successful secular kibbutz, believing that this should favor higher in-group cooperation on the secular kibbutz – opposite to our hypothesis thereby making more difficult its validation. A fortuitous by-product of controlling for these four variables is that we have created two sample populations that are also very similar in terms of a number of demographic variables, such as the age composition of the kibbutz, educational attainment, and gender ratio (see Table 1).

[insert Table 1 here]

### **3.2 Experimental Design**

The logistics of our field experiments and the nature of our subject pool raise several essential considerations in the choice of an experimental game. For example, assuring

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<sup>7</sup> That some of the religious kibbutzim are quite similar with regard to the control variables means that we were able to match one secular kibbutz with three different religious kibbutzim and another with

subject anonymity is of prime importance since kibbutz members live together, and work and socialize with one another on a daily basis. For this reason, we chose to conduct these experiments in the privacy of the individual members' homes rather than in a public space.

We also require a symmetric game to allow us to compare kibbutz members' choices with one another. As for the particular nature of the experimental game, issues of cooperation and self-restraint confront kibbutz members on a daily basis. As discussed in section 2.1, almost all consumption goods on a kibbutz are common-pool resources in the sense that they are exhaustible and freely accessible to all kibbutz members. We therefore sought a game that captures an element of the common-pool resource dilemmas familiar to kibbutz members.

We select a one-shot game for two reasons. First, we want to capture participants' instinctive willingness to cooperate. A kibbutz member's instinct to cooperate is cultivated by his daily interactions with fellow members. Our question of interest is not whether one group is able to learn to be more cooperative than another. Second, the diversity of the subject pool in terms of education, age and occupation means that we have to choose a conceptually simple game – one that can be understood by all. A one-shot game contributes to this aim.

Indeed, simplicity was the overwhelming consideration in our choice of an experimental game. For this reason, we settled on the following two-player game. There are 100 shekels available in a joint envelope to which each pair member has access.<sup>8</sup> Each pair member independently decides how much of the available 100 shekels to remove from the envelope to keep for himself. If the sum of the amounts of money removed exceeds 100 shekels, then both players receive zero and the game is over. If the sum of the amounts removed is less than or equal to 100, then each player keeps the respective amount that he removed. In addition, whatever money is leftover in the envelope is multiplied by 1.5 and divided equally between the two players.<sup>9</sup> Appendix A contains the instructions.

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two religious kibbutzim.

<sup>8</sup> All of the experiments in this paper were conducted between January and May 2000. At this time, 4 Israeli shekels equaled approximately \$1 US.

<sup>9</sup> We tested three different variations of this experimental game on student subjects and members of three kibbutzim. The most familiar design we tested was a parameterization of the public goods game in which there are 100 shekels to be divided and each pair member may claim up to 50 shekels, that is, any amount between 0 and 50. The amounts that each player leaves in the envelope are summed together, multiplied by 1.5 and divided equally between the two players. Feedback from subjects indicated that they found this design difficult to understand. The main source of confusion for subjects

Note that any pair of amounts that sum to 100 is a Nash equilibrium of this game. For any amount,  $x_j$ , that player  $j$  removes from the envelope, player  $i$ 's best response is to remove 100 minus  $x_j$ . However, the Nash equilibria of this game are socially inefficient. That is, the sum of the pairs' payoffs is higher if together they remove less than 100. The socially optimal outcome is achieved when both players remove 0.<sup>10</sup>

The amount a player removes therefore provides a measure of his cooperative behavior. For every shekel a player leaves in the envelope, he adds three-quarters of a shekel to his opponent's payoff and three-quarters of a shekel to his own payoff, provided their claims sum to less than 100.

### **3.3 Experimental Procedures**

#### **3.3.1 Preliminaries to Conducting the Experiments**

Identical procedures were followed in recruiting subjects and conducting the experiments on the religious and secular kibbutzim. After receiving permission from the kibbutz general secretary, a letter of introduction describing the nature of the research, the sources of funding and a request to participate was sent to every household on the participating kibbutz. These letters were mailed out to all households on the kibbutz about a week before our planned visit. One or two days prior to our visit, we telephoned kibbutz members inviting them to participate in the research and, for those who agreed, arranged a specific time to meet.

#### **3.3.2 Upon Arrival at the Kibbutz**

To facilitate data collection and to minimize the chances that participants who completed the experiment could contact others who may be scheduled to participate, 20 Ben-Gurion University graduate and undergraduate students (who had completed a

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in standard public goods games is the existence of two accounts (as opposed to only one common pool from which money is drawn in our design). For this reason, we decided on the game presented above.

<sup>10</sup> Our game resembles the Nash demand game (Nash 1953). The difference is that whatever money is leftover in our game gets multiplied by 1.5 (rather than disappears) and divided equally between the two players. This distinction encourages players to remove less money so that more is available for the pair. In the Nash demand game, the Nash equilibria and socially optimal outcomes coincide.

class in experimental economics) were trained and employed. Between 8 and 14 subjects (i.e., between 4 and 7 pairs) participated simultaneously at any given time.

Upon arrival at the kibbutz, each experimenter searched for the home of his first subject. Once an experimenter found his subject's home, he called the other experimenter by cellular phone to let him know that he had arrived. He waited outside until the other experimenter had also found his participant's home, at which point they entered their respective subjects' homes simultaneously. This ensured that the paired subjects began the experiment at the same time.

Upon entering the subject's home, the experimenter introduced himself and requested a quiet place where they could sit undisturbed for the next 30 minutes. Once seated, the experimenter conveyed some preliminary details concerning the experiment (see the "Introduction" in Appendix A). The subject was then given the instruction sheet and told to take his time to read the instructions carefully. Once finished, the experimenter read the instructions aloud.

To ensure full comprehension of the game, two numerical examples were performed. In each example, a pair of numbers was randomly drawn from a bag containing numerical values between 0 and 100. The numbers were meant to be the amounts chosen by two hypothetical participants in the experimental game. Thus, for instance, if the numbers 20 and 60 were drawn from the bag, the participant was shown step-by-step that the first player would receive 35 shekels and the second player would receive 75 shekels, since the 20 shekels left over would increase to 30 and be split evenly between them.

After any clarifying questions were answered, a decision was elicited regarding the amount the subject wished to remove from the envelope as well as the amount the subject believed the other person would remove from the envelope. The experimenter of the subject who decided first telephoned the other experimenter by cellular phone and informed him that a decision had been reached.<sup>11</sup> The experimenter did not convey the amount of the decision in this conversation in order to avoid any reaction or facial expression on the part of the second experimenter, which could influence the second participant's decision. Further, immediately revealing the subject's decision might raise his suspicions that his decision was being conveyed to the other subject who could then use this information to make a decision. After the

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<sup>11</sup> Cellular phones were used instead of the kibbutz member's home phone to prevent the subject from discovering the identity of his paired partner.



second subject reached a decision, her experimenter telephoned the first experimenter to exchange their decisions. Each experimenter then communicated to his subject the other player's decision, the amount remaining in the envelope, and the amount that he will receive after the amount leftover in the envelope (if anything) is multiplied by 1.5 and divided equally between both players.

The subject was then asked to complete a short questionnaire (see Appendix A). Upon completion of the questionnaire, the subject was paid his earnings from the experiment. The experimenter then left the subject's home and proceeded to his next scheduled subject. At each kibbutz visited we sampled between 24 (at smaller kibbutzim) and 48 members (at larger ones).

#### **4. Experimental Hypotheses**

In light of the background provided on ritual obligations in Judaism and on the centrality of cooperation for the kibbutz, we derive three testable hypotheses in the context of our experimental game.

*1. Religious males are more cooperative than religious females.*

As already noted, while men and women share many religious responsibilities, collective ritual obligations fall disproportionately on males in Judaism. If collective rituals indeed promote group commitment and cooperation, then religious males' additional collective rituals (most notably public prayer) lead us to hypothesize that religious men will play our experimental game more cooperatively than religious women.

*2. The more frequently religious males attend synagogue, the more cooperative they are.*

In the follow-up questionnaire (question 4b), we asked subjects to report the frequency with which they visit the synagogue. If synagogue attendance really does signal one's commitment to the community and its values, then we would expect those males who most frequently attend to exhibit most abundantly one of the kibbutz's fundamental values, cooperation.

3. *Religious males are more cooperative than secular male and secular female kibbutz members.*

In the absence of comparably costly communal rituals on secular kibbutzim, we expect religious males to be the most cooperative of the four subpopulations.

## 5. Results

**Result 1** Religious males are more cooperative toward fellow kibbutz members than religious females.

[insert Figure 1 here]

Religious males removed on average 29.9 shekels (median=32.0, n=108) compared to 33.7 (median=35.0, n=108) for religious females ( $t=1.68$ ,  $p=.048$ ,  $df=211$ , one-tailed test of means, equal variances not assumed). The histograms in Figure 1 offer visual support for this result. Closer inspection of the histograms reveals that the most striking difference between the two distributions appears in the proportions of males and females that claimed amounts between 0 and 9 shekels. Twenty-eight of the 216 participants from the religious kibbutzim claimed between 0 and 9. Among these 28 subjects, 20 were males ( $\chi^2=5.66$ ,  $p=.017$ ,  $df=1$ ). Moreover, 22 of these 28 subjects claimed 0, 18 of whom were males ( $\chi^2=9.63$ ,  $p=.002$ ,  $df=1$ ).<sup>12</sup>

Regression equations (1)-(5) in Table 2 provide further support for the relative cooperativeness of religious males. If we take subjects claims at face value, then the OLS estimates in (1), (2) and (4) are appropriate. The “male” dummy variable indicates that, controlling for other explanatory variables, religious male kibbutz members claim above four shekels less than their female cohorts. On the other hand, the presence of 28 observations at 0, the left extreme value of the decision space, suggests that some subjects may have claimed negative amounts (i.e. to contribute money from their pockets to the envelope) had the option been available.<sup>13</sup> However, the censored decision space at zero renders such intentions unobservable. The left-censored Tobit reported in (3) accounts for the censoring problem at 0 and confirms

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<sup>12</sup> We can reject the explanation that religious males are better educated, understand the game better and thus claim lower amounts. The years of education among religious females (14.0 on average) and religious males (13.8 on average) are nearly identical and this variable is not significant in any of the Tobit regressions reported below.

that males remove significantly less than females<sup>14</sup>: converting the coefficient on “male” to a marginal effect yields an estimate of –4.88 shekels.

The other highly significant variable in these regressions is the amount the subject believes his opponent will remove from the envelope (“predict”).<sup>15</sup> The positive coefficient ( $p < .001$ ) on the “predict” variable in (2) and (3) suggests that subjects’ behavior is on the whole motivated by reciprocity: the more cooperative the subject believes his opponent is (i.e., the less he believes his opponent will remove from the envelope), the more he is willing to cooperate, and vice-versa.<sup>16</sup> Along these same lines, religious women predict that their fellow kibbutz members will remove larger amounts (mean=41.0, median=45.0) than those predicted by men (mean=38.6, median=43.0); although the difference is not significant,  $t=1.21$ ,  $p=.23$ ,  $df=200$ , two-tailed.

The “frackib” variable expresses the fraction of one’s life spent on the kibbutz. It is calculated as the year the experiments were conducted (2000) minus the year the member arrived on the kibbutz, divided by the member’s age. The regression coefficient of 8.00 in (2) suggests that for every additional 10% of one’s life spent on the kibbutz, one can be expected to claim 0.8 NIS more from the envelope. Someone born on the kibbutz can be expected to remove almost eight shekels more than a new arrival.<sup>17</sup> We return to this variable below.

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<sup>13</sup> The decision to claim an amount less than zero has a natural interpretation: the subject is willing to contribute money from his own pocket to the envelope, which means that for each shekel he contributes he gets back only 0.75 NIS and gives his paired partner 0.75 NIS.

<sup>14</sup> We use a one-sided Tobit regression model because there is only one observation in our entire database at the right limit value of 100. Thus, the left-censored and double-censored Tobit estimates are identical.

<sup>15</sup> We also tested a host of other potential explanatory variables. Since none of them were significant in this or any other regression we conducted on this sample of kibbutzim, we have omitted them from the table. These variables include the kibbutz member’s age, years of education, number of children, percentage of children living on the kibbutz and the number of kin on the kibbutz. We also tested for several kibbutz-level variables such as the number of members, year of establishment, economic success, degree of privatization and the number of holidays celebrated communally by the kibbutz. None of these variables were significant.

<sup>16</sup> Our model of a subject’s decision to remove a specified amount from the envelope includes the amount he believes his opponent will remove (“predict”). Nonetheless, to demonstrate the robustness of our results, in each regression table we also include one specification without the “predict” variable. Notice that there are ten fewer observations in the regressions that include “predict”. Ten subjects were unable to specify a point estimate for their opponent’s behavior. In regression (4), we include a term for the amount predicted squared (“predict<sup>2</sup>”) to allow for a non-linear, and possibly non-monotonic, relationship between the amount predicted and the amount removed by the kibbutz member. This variable however is not significant in this or any of the other regressions performed on religious kibbutz members. We will return to “predict<sup>2</sup>” in reporting the results from the secular kibbutzim.

<sup>17</sup> This same finding (that the larger the fraction of one’s life spent on the kibbutz, the less cooperative one behaves toward fellow kibbutz members) was previously noted in Ruffle and Sosis (2003) on a

[insert Table 2 here]

**Result 2** The more frequently religious males attend synagogue, the more cooperatively they behave on average toward other kibbutz members in the game; whereas, the cooperative behavior of religious females is unrelated to their synagogue attendance.

The difference in cooperative behavior between religious males and females appears to be attributable to the ritual participation of males. The right-hand (darkly shaded) bars of Figures 2a and 2b display the mean amounts claimed by religious males and females, respectively, as a function of their frequency of synagogue attendance. The figures draw attention to the fact that daily prayer is required of Orthodox males, while no such requirement exists for Orthodox females. Sixty-eight out of 102 males who responded indicated daily synagogue attendance. The remaining 34 male respondents attend at least weekly (on the Sabbath) plus on holidays. By contrast, only five of the 102 female respondents attend synagogue several times a week or more.

[insert Figures 2a and 2b here]

More importantly, the figures point to a negative relation between the frequency of synagogue attendance and the amount males removed from the envelope. That is, the more frequently religious males participate in synagogue services, the more cooperative they are. For example, men who attend synagogue daily remove 27.2 shekels compared to men who do not attend daily who claim 33.1 shekels on average. No such relation exists among females. Table 3 provides descriptive statistics for the amount claimed as well as other variables, according to subpopulation.

[insert Table 3 here]

Regressions (5) – (11) in Table 4 lend additional support to the positive relation between the cooperative behavior of religious males and their synagogue attendance. We replace the “male” dummy variable with two interaction dummies, “religious male\*daily synagogue” and “religious male\*not daily synagogue”. The former variable assumes the value of one for religious males who attend synagogue daily and zero otherwise. The negative and highly significant coefficients of  $-6.99$  and  $-5.76$  in (5) and (6), respectively, as well as the estimated mean marginal effect of

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different sample of four kibbutzim. See that paper for an in-depth discussion of the role of self-selection versus socialization in the cooperative behavior of kibbutz members.

-6.47 from Tobit (7), indicate that religious males who attend synagogue daily remove six or seven shekels less than religious females; whereas, the latter variable is not significantly different from zero suggesting that religious males who don't attend synagogue daily are no more cooperative than religious females. Regressions (8) and (9) include a dummy variable "religious female\*weekly", which equals one for religious females who attend synagogue at least once a week (i.e., on Sabbath and holidays, several times a week or daily) and zero otherwise. The statistically insignificant coefficients in both regressions reveal that these women are no more cooperative than women who attend synagogue less frequently. Other regression specifications not included here confirm that female synagogue attendance is unrelated to their cooperative behavior in the game.

[insert Table 3 here]

The left-hand (lightly shaded) bars of Figures 2a and 2b display the mean amounts that religious male and religious female kibbutz members predicted their opponents would remove from the envelope. The data show that the more frequently males attend synagogue, the less they believe their opponents will claim in the game. Together with the positive relation between cooperative behavior and synagogue attendance, this again suggests that the desire to cooperate and to reciprocate motivate male kibbutz members who claim small amounts. Among religious females, no relation between synagogue attendance and "predict" exists.

The observation that the longer one spends on the kibbutz, the less cooperative one becomes is curious when coupled with our central finding that frequent, collective ritual performance correlates positively with cooperative behavior for males. A closer look at the data reveals that men who do not attend synagogue regularly and women account for the significance of the "frackib" variable. In regression (10), we interact "frackib" with gender and, in the case of males, frequency of synagogue attendance. The "male\*daily synagogue\*frackib" variable is not significantly different from zero; whereas the other two interaction variables, "male\*not daily synagogue\*frackib" and "female\*frackib", have significant coefficients of 8.78 and 11.37, respectively. Those who join the kibbutz are initially enthusiastic about the kibbutz ideals of community and cooperation. Over time, however, there is a natural tendency for this idealism to give way to the challenges of living communally. One interpretation of the results from (10) is that collective ritual counteracts this tendency.

Having examined in depth the cooperative behavior of religious men and women, we turn now to our secular sample.

**Result 3** Secular male and secular female kibbutz members exhibit similar levels of cooperation toward fellow kibbutz members.

This result indicates that inherent sex differences cannot account for the observed disparity in the way religious males and females play the game. Males from secular kibbutzim remove on average 30.1 shekels (median=32.5, n=170), while females from secular kibbutzim removed on average 30.5 shekels (median=30.0, n=172),  $t=.21$ ,  $p=.83$ ,  $df=327$ . Furthermore, regressing the amount claimed by secular kibbutz members only on a host of explanatory variables, including a dummy variable for sex, shows that secular males and secular females claim similar amounts (the coefficient on “male” is *positive*, but not significant in any of regressions (12) – (15) in Table 5)). The positive and highly significant coefficient on the “predict” variable in (13) again suggests that, by and large, secular kibbutz members’ decisions are motivated by reciprocity. Yet the inclusion of “predict<sup>2</sup>”, the fact that it is negative and highly significant and its magnitude imply that the positive relation between “predict” and the amount removed from the envelope holds as long as “predict” is less than 72.6 shekels. This relationship is consistent with the reciprocity motive. For values of “predict” greater than 72.6, on the other hand, an increase in the amount predicted accompanies a decrease in the amount removed from the envelope. This relationship is consistent with the fear of exceeding the available 100 shekels. In our sample, only 9/342 secular kibbutz members predicted that their opponents would remove more than 72.6 shekels.

[insert Table 5 here]

Recall from the regressions in Table 2 that this non-monotonic relationship between the amount removed from the envelope and the amount predicted was not observed among religious kibbutz members. Along similar lines, religious males predict the lowest amounts of the four subpopulations (mean=38.6, median=45), while secular females predict the highest amounts (mean=43.0, median=50). The rank-order, non-parametric Kruskal-Wallis test indicates that the four subpopulations predict significantly different amounts ( $\chi^2=6.41$ ,  $p=.093$ ,  $df=3$ ). The amount a participant believes his opponent will claim can be interpreted as his degree of trust in

his opponent.<sup>18</sup> By this measure, religious males are the most trusting (i.e. predict less) of their fellow kibbutz members of any of the four subpopulations. What is more, those religious males who pray daily at the synagogue are even more trusting, predicting only 36.1 on average, significantly less than any other subgroup (see Table 3 for the details.) As we will now show, a controlled comparison of the amounts claimed reveals that they are also the most cooperative.

**Result 4** Religious male kibbutz members are the most cooperative subpopulation in the religious and secular kibbutzim. They remove significantly less money from the envelope than secular males, secular females and religious females, controlling for a number of explanatory variables. Religious males who attend synagogue daily are the source of this relatively cooperative behavior.

Regressions (16) – (22) in Table 6 involving all kibbutz members (religious and secular) provide controlled comparisons of the cooperative behavior of religious and secular kibbutz members on the whole as well as categorized according to gender and frequency of synagogue attendance. The coefficient of  $-10.11$  on the dummy variable “religious” in (16) of Table 6 indicates that religious kibbutz members claim on average 10 shekels less than their secular counterparts. However, the inclusion of “predict” and “predict<sup>2</sup>” in (17) renders the “religious” dummy non-significant. These regressions along with Result 2 suggest that the extent to which religious kibbutz members are more cooperative can be attributed to the religious males in general and those who attend synagogue daily in particular. Along these lines, regressions (18) – (20) represent three of the four subpopulations with dummy variables in regressions, with religious males as the base category. From (19), for instance, we see that religious males remove four shekels less than religious females. Both the sign and the magnitude of this coefficient on the “religious female” variable are reassuring since they confirm Result 1 and match the coefficient estimates in Table 2. What is new is that religious males remove about 11 shekels less than secular males and eight shekels less than secular females. Similarly, computing the mean marginal effects from the Tobit estimates in (20) indicates that religious males claim 4.86 shekels less than

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<sup>18</sup> Thus, for instance, the religious woman who claimed 100 shekels (see Figure 1) and predicted that her opponent would remove 0 is very trusting, but uncooperative in that she chooses to exploit what she believes to be her very cooperative opponent.

religious females ( $p=.038$ ), 11.32 shekels less than secular males ( $p=.038$ ) and 9.03 shekels less than secular females ( $p=.080$ ).<sup>19</sup> A closer look at the religious males highlights the primary source of these differences: according to (21) or the transformed estimates of (22), respectively, religious males who attend synagogue daily claim 10.07 or 10.46 shekels less than secular kibbutz members, whereas, the amounts claimed by religious males who do not attend daily and by religious females are not significantly different from secular members.

[insert Table 6 here]

These results control for the amount a kibbutz member believes his opponent will remove from the envelope (“predict”), “predict<sup>2</sup>” and the fraction of a member’s life spent on the kibbutz (“frackib”). This last variable is significant on the religious kibbutzim only.

Another significant interaction variable is “work off kibbutz\*secular”. This dummy variable equals one for secular kibbutz members who work off the kibbutz, and zero otherwise. The negative and highly significant coefficient of  $-6.18$  implies that secular kibbutz members who work outside the kibbutz claim on average about six shekels less than all other groups. To understand this, note that those individuals who work outside the kibbutz are typically professionals and earn salaries well above the Israeli average. As kibbutz members they are required to contribute these high salaries to the kibbutz. Their choice to remain on the kibbutz rather than join mainstream, capitalist society therefore signals their commitment to the kibbutz values of egalitarianism, community and cooperation. The significance of this “work off kibbutz” variable is limited to the secular kibbutzim: it is not significant in any of the three regressions involving religious kibbutz members only (shown in regression (5) only), even though the fractions of members who work outside the kibbutz are very similar on the religious (23%) and secular (25%) kibbutzim.

We also asked all participants to indicate the number of meals they eat in the communal dining hall during an average week (question 11 of the Questionnaire in Appendix A). The frequency with which a kibbutz member eats in the dining hall (rather than in the privacy of his home or outside the kibbutz) may serve as a

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<sup>19</sup> Nonetheless, all of these groups play this experimental game more cooperatively than Israeli city residents. Using the same experimental game, Ruffle and Sosis (2003) find that city residents remove 35.63 shekels on average (median=40,  $n=61$ ), even though the sample of city residents chosen is similar in age, education and standard of living to the kibbutz sample. However, when kibbutz



solidarity-promoting ritual signaling the member's involvement in the kibbutz and commitment to its ideals. The distributions of frequencies of eating in the communal dining hall are very similar among religious and secular kibbutz members (e.g. religious members eat an average of 8.9 meals a week in the dining hall ( $\sigma = 5.74$ ) compared to an average of 8.5 meals a week for secular members ( $\sigma = 5.48$ ),  $t=0.84$ ,  $p=.40$ ,  $df=425$ ). Nonetheless, in the secular kibbutzim only, the frequency with which one eats in the dining hall is negatively correlated with the amounts members removed from the envelope. The regression coefficient of  $-.276$  in (13) in Table 5 indicates that for every additional meal a secular kibbutz member eats in the dining hall, he removes 0.276 NIS less from the envelope. Returning to regression (17) on all kibbutz members, we see that the coefficient on "meals" is significant (and negative) on the secular kibbutzim only. One interpretation of this result is that the secular kibbutz members who are most committed to the cooperative ideal of the kibbutz engage in this ritual most frequently.

While religious kibbutz members work outside the kibbutz and eat in the communal dining hall with the same frequency as their secular counterparts, these actions do not convey the same information as they do on secular kibbutzim. Religious kibbutz members, male members in particular, appear to have their own forms of religious collective ritual and costly signals. Because Judaism does not oblige women to attend the synagogue regularly, the action ceases to be a community-wide ritual or signal for women, even for those who do attend regularly. Likewise, the very rare secular kibbutz member who may attend the synagogue infrequently conveys no meaningful message about his willingness to cooperate since synagogue attendance is not required in the secular community. The point is that for a collective ritual to be meaningful as a signal of intention in a particular community, it must be valued by members of that community, or by outsiders.<sup>20</sup>

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members play this game against city residents (outsiders), they behave identically to the city residents (average=35.2, median=40, n=61).

<sup>20</sup> That outsiders can attribute meaning to the collective ritual practice of others is exemplified by a phenomenon described in Frank (1988): affluent New York City families place advertisements in the newspapers of Salt Lake City for Mormon governesses for their children. Apparently, "persons raised in the Mormon tradition are trustworthy to a degree that the average New Yorker is not" (p. 111).

## **6. Discussion**

### **6.1 The Necessity of Frequent Costly Collective Ritual**

The question arises, what is it about religious observance or religious ritual that is associated with higher levels of cooperation among group participants? Costly signaling theory suggests the importance of observable collective rituals. Mere faith or belief in God not accompanied by costly actions may be less effective at promoting cooperation among fellow believers. Here we have shown the relation between frequent costly collective ritual (i.e., regular synagogue attendance) and cooperative behavior. Religious females and religious males who attend synagogue less frequently are less cooperative than males who attend daily. Research by Orbell et al. (1992) supports the importance of regular ritual in cooperative behavior. They conduct a repeated  $n$ -person prisoner's dilemma game on university students in Logan, Utah (a largely church-going Mormon population) and Eugene-Springfield, Oregon (a mixed population with one of the lowest church attendance rates in the U.S.). Their results show that whether a person considers himself to be religious is unrelated to his cooperative behavior. However, the frequency of church attendance of the Mormon participants in Logan is positively correlated with cooperative behavior, while no correlation between cooperation and church attendance was observed among non-Mormons in Logan and church frequenters in Eugene-Springfield.

Our results on religious ritual and cooperative behavior do not, of course, establish causality. While theory suggests that frequent, collective ritual promotes cooperation, one could argue that the decisions to remove small amounts in our experimental game and to attend synagogue regularly are behaviors befitting an inherently cooperative individual. And thus the correlation we have established may result from self-selection. Regardless, both explanations point to the desirability of requiring frequent, collective rituals of all members to screen out non-cooperators.

Of course, one need not belong to a religion to engage in costly collective rituals. Rituals are characteristic of groups that perform collective tasks, such as sports teams, armies, volunteer groups, and fraternities and sororities, the success of which hinge upon group solidarity and cooperation. However, using historical data, Sosis and Bressler (2003) show that in a sample of 19<sup>th</sup> century U.S. communes, the costliness of rituals is a significant predictor of cooperative success among religious

communes only. They suggest that religious rituals are more effective than secular rituals in promoting cooperation because the supernatural beliefs that surround religious rituals are not subject to verification or falsification and are therefore more stable than the secular beliefs that motivate secular rituals (also see Rappaport 1999, Sosis and Alcorta 2003). In the case of secular kibbutzim, communal dining may serve as a group-level ritual. Consistent with Sosis and Bressler's findings, it is only a weakly significant predictor of cooperative behavior. Moreover, the costliness of communal dining remains in question since the alternative to communal dining is to eat at one's own expense at home or outside the kibbutz.

What is more, our data show that aside from communal dining, no ritual on the secular kibbutzim is as widespread or as frequent as daily synagogue attendance among Orthodox men on religious kibbutzim. We asked all participants (question 6 in the Questionnaire) to indicate "how many times a month on average [they] participate in events open to all kibbutz members, such as song and dance evenings, movies, kibbutz meetings, sporting events, concerts, plays, lectures, study groups, etc." Secular kibbutz members attend only two communal events a month on average, with no significant differences between the sexes ( $t=1.65$ ,  $p=.23$ ,  $df=258$ ). Intuitively, this seems too infrequent to promote trust or bonding between individuals in the way that daily synagogue attendance does. Indeed, the attendance of communal events by a secular kibbutz member is uncorrelated with the amount he or she claims in our experimental game ( $\sigma = -.045$ ,  $p=.45$ ,  $n=278$ ).

## **6.2 The Economic Success of Religious Kibbutzim**

Religious kibbutzim have been more economically successful than their secular counterparts and this disparity has increased over time. Fishman and Goldschmidt (1990) find that the per capita net production of the religious kibbutzim has been higher than that of the secular kibbutzim in every decade of their 70-year existence (see also Fishman 1983). They construct an economic performance measure and estimate that the economic success differential in favor of the religious kibbutzim increased consistently over the 1958-1982 period.<sup>21</sup> Moreover, the religious kibbutzim

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<sup>21</sup> Along similar lines, Barro and McCleary (2003) also demonstrate a positive relation between religiosity and economic growth. Based on a panel-data analysis of 41 countries, Barro and McCleary show that economic growth responds positively to the extent of a nation's religious beliefs, particularly

appear to have emerged relatively unscathed from the economic crises of the 1980s, not requiring the government subsidies or debt forgiveness from Israeli banks that assisted the economic recovery of the secular kibbutzim. Indeed, the Religious Kibbutz Movement claims that “the economic position of the religious kibbutzim is sound, and they remain uninvolved in the economic crisis which is affecting so many of the settlement sector”.

Explanations for the economic well being of kibbutzim are undoubtedly multi-faceted, including sound investment practices, the differential political influence of the kibbutz federations and historical circumstances. Fishman (1983) speculates that the economic success of the religious kibbutzim is due to low levels of consumption stemming from adherence to Jewish religious law, which demands restraint and limitations. Consistent with this explanation, religious kibbutz members in our game are better able to refrain from consuming the common-pool resource than their secular counterparts. What our results offer beyond Fishman is a mechanism by which religious kibbutz members achieve mutual cooperation. Not all religious requirements are equally effective, rather publicly observable rituals most successfully encourage self-control.

### **6.3 An Application to the Developing World**

In the minds of many Westerners, those who engage in religious rituals are primitive and superstitious. Our results suggest that, certainly in the case of the developing world, religious observance might be more accurately understood as a sophisticated response to underdeveloped legal and economic institutions. Religious rituals promote cooperation. For most Westerners, this benefit alone cannot justify the cost of partaking regularly in time-consuming rituals. Hayek (1988) makes the point that cooperation requires the mutual pursuit of an agreed upon goal among members of the society, whereas capitalism involves individuals “pursuing thousands of different ends of their own choosing in collaboration with thousands of persons whom they will never know” (p. 113). Individuals in advanced capitalist economies face collective-action problems irregularly, anonymously (e.g. fund-raising campaigns for public goods, like public radio and television stations) and with different individuals each

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belief in heaven and hell. They conjecture that church attendance affects religious beliefs, which affect individual traits like thrift, work effort, honesty and trust, which affect economic outcomes.

time. What is more, the existence of well-defined property rights, enforceable contracts and an advanced legal system obviate the need for cooperative, trusting behavior. However, these guarantees and substitute institutions for cooperation are unavailable in developing countries. Ill-defined property rights and a backlogged, bureaucratic and corrupt legal system create favorable conditions for the adoption of publicly observable religious rituals as a mechanism to promote group solidarity, trust and cooperation and to avoid disputes.

These religious groups are then able to offer members mutual insurance and (local) public goods like health care, education and defense where the government and marketplace fail. For example, Berman (2003) explains the use of extremely costly practices by religious militias as a means to exclude free riders from the benefit of the club good that they provide to members.

It follows that multinational corporations and foreign institutions investing in the developing world and dependent on collaboration with the indigenous people may profit from preserving indigenous ritual practices and the environment in which they take place. The well-documented water temple system of Bali represents a case in point (see Lansing 1991, for the authoritative study, as well as Wilson 2002, pp. 126-133). A lake in a volcanic crater on the island as well as the rains that run off of the volcano irrigate Bali's rice fields. The Balinese have developed what has proven to be an ingenious cooperative system of aqueducts to supply water in equitable amounts to the surrounding farmers. At the heart of this coordinated effort lies an indigenous religion that worships, among other deities, Dewi Danu, the goddess of the waters emanating from the volcano in whose honor an immense temple stands at the volcano's summit. Smaller temples for worship are located at every branch of the irrigation system and at the fields onto which the aqueducts empty. The wisdom and success of the Balinese water temple system became clear when the Asian Development Bank imposed a farming alternative on the Balinese in the 1980s. The Asian Development Bank concluded in 1988 that,

The substitution of the 'high technology and bureaucratic' solution ... proved counter-productive and was the major factor behind the yield and cropped areas declines experienced between 1982 and 1985 ... The cost of the lack of appreciation of the merits of the traditional regime has been high. Project experience highlights the fact that the irrigated rice terraces of Bali form a

complex artificial ecosystem which has been recognized locally over centuries (Lansing 1991, p. 124, from Wilson 2002, p. 130).

## **7. Conclusions**

The predominant rational choice theory of religious behavior suggests that costly prohibitions serve to screen out less committed members and increase the religious participation of remaining members (Iannaccone 1992). Through this screening mechanism, religions are able to overcome free-riding problems associated with the collective production of “religious goods”.

We posit that the benefits of religious ritual extend beyond the production of religious goods to include beneficial economic behavior and proceed to estimate this economic benefit. The Israeli kibbutz presents a host of opportunities for free riding and exploitative behavior. Regularly performed collective religious rituals may enhance the participant’s sense of group commitment, solidarity and trust, which ultimately translate into increased cooperation toward group members. At the same time, these costly rituals may screen out potential members motivated purely by economic opportunism. Instead, only those truly committed to the kibbutz ideology of cooperation would be willing to undertake the significant collective ritual obligations imposed upon men in Orthodox Judaism.

In this paper, we design a test to determine whether the performance of collective religious ritual indeed increases the cooperation of its performers. We take advantage of the natural distinction between religious and secular kibbutzim to compare the cooperative behavior of their members. Even with the careful controls in the choice of sample kibbutzim, we find differences in the levels of cooperation of kibbutz members. These differences can be characterized by the regularity of collective religious ritual performance. Those who most regularly engage in collective religious ritual are the most cooperative. This attests to the effectiveness of costly collective ritual in fostering cooperation.

In contradiction to the quote with which we began this paper, religion appears to offer a significant advantage in dealing with day-to-day economic problems. For individuals in capitalist economies who face collective-action problems irregularly, anonymously or with different individuals each time and who have economic and reputational incentives to ensure a minimal degree of cooperation and legal recourse

in case these incentives fail, devout religious observance on purely economic grounds seems unwarranted. However, for communes whose survival depends on solving collective-action problems with the same set of people daily and for individuals in developing countries who lack the economic and legal institutions to assure cooperation, religious ritual may be imperative.

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## **Appendix A: Subjects' Forms** (translated from Hebrew)

### **Instructions**

#### **Introduction** (read aloud by the experimenter)

We thank you for willingness to participate in this research conducted by Ben-Gurion University and the University of Connecticut. The exercise in which you have agreed to participate relates to decision-making and requires less than 30 minutes of your time. We assure you that during the exercise as well as after its completion and on the short questionnaire that follows the exercise, your identity will remain anonymous. The information collected by the researcher in your home will be used for research purposes only. Under no circumstance will your identity be revealed to anyone or published anywhere.

This exercise in decision-making will take place in pairs. The person with whom you are paired for the purpose of this exercise is another member from your kibbutz. Another researcher from our team is currently at the home of this person. Under no circumstance will you learn the identity of the person with whom you are paired; nor will s/he learn your identity. During the decision-making exercise, you will be asked to make a number of decisions. At the end of the exercise, the researcher will pay you an amount of money. The precise amount of money to be paid to you will be determined by the decisions you make in the exercise as well as the decisions of the anonymous person with whom you have been paired. This research is funded by a number of grants from various research foundations.

## Participants' Instructions

(read first by the subject and then read aloud by the experimenter)

### Exercise

In this exercise, you and the person from your kibbutz with whom you are paired have access to the same envelope that contains 100 shekels. You must choose an amount of money you wish to remove from the envelope to keep. You may choose any amount between 0 shekels and 100 shekels, inclusive. At the same time, the member of your kibbutz with whom you are paired for this exercise must decide an amount of money (between 0 and 100 shekels inclusive) that he or she wishes to remove from the same envelope. After you have decided how much to keep from the envelope, the researcher will convey your decision by cellular phone to the other researcher who is presently at the home of the person with whom you are paired. You and the person with whom you are paired will learn of the other's decision only after each of you has made your decision.

If the sum of the amounts you and your paired partner choose to remove from the envelope (the total amount removed) exceeds 100 shekels, then you both receive no payment and the exercise ends. If you and the person whom you are paired choose to remove from the envelope an amount that together is less than 100 shekels, then you each keep the amount you removed from the envelope; in addition, the sum of money left over increases by 50% (in other words, is multiplied by 1.5) and is divided equally between you and your paired partner.

This completes the instructions. Before you make a decision in the exercise, the researcher in front of you will read aloud the instructions an additional time and answer any questions you may have. Also, you will be shown two numerical examples in order to illustrate the exercise and to avoid any unintended loss in earnings.

Thank you – The Research Team.

## Questionnaire<sup>22</sup>

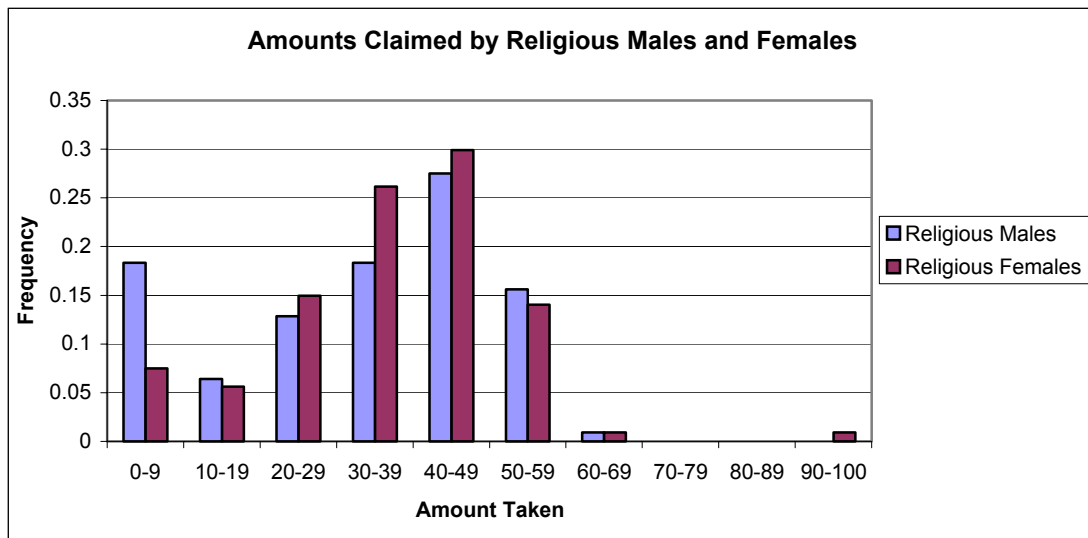
1. What is your age?
2. Where were you born? 1. this kibbutz 2. another kibbutz 3. in Israel 4. country \_\_\_\_\_
3. (If participant was not born on the kibbutz) In what year did you arrive at this kibbutz?
- 4a. Did you grow up in an observant household? Yes No
- 4b. How frequently do you visit the synagogue?  

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
never	seldom	primarily on holidays	primarily on Sabbath and on holidays	several times a week	every day
5. How many years of study have you completed?
6. How many times a month on average do you participate in events open to all kibbutz members such as song and dance evenings, movies, kibbutz meetings, sporting events, concerts, plays, lectures, study groups, etc.?
7. What is your marital status?  
1. Single 2. Married 3. Divorced 4. Widowed 5. Divorced/Remarried 6. Widowed/Remarried
8. How many children do you have and what are the ages of each child?


<sup>22</sup> The questions below are a subset of the full questionnaire. We have included only those questions related to this paper. Questions 4a and 4b were asked of participants on religious kibbutzim only. The secular and religious questionnaires were otherwise identical.

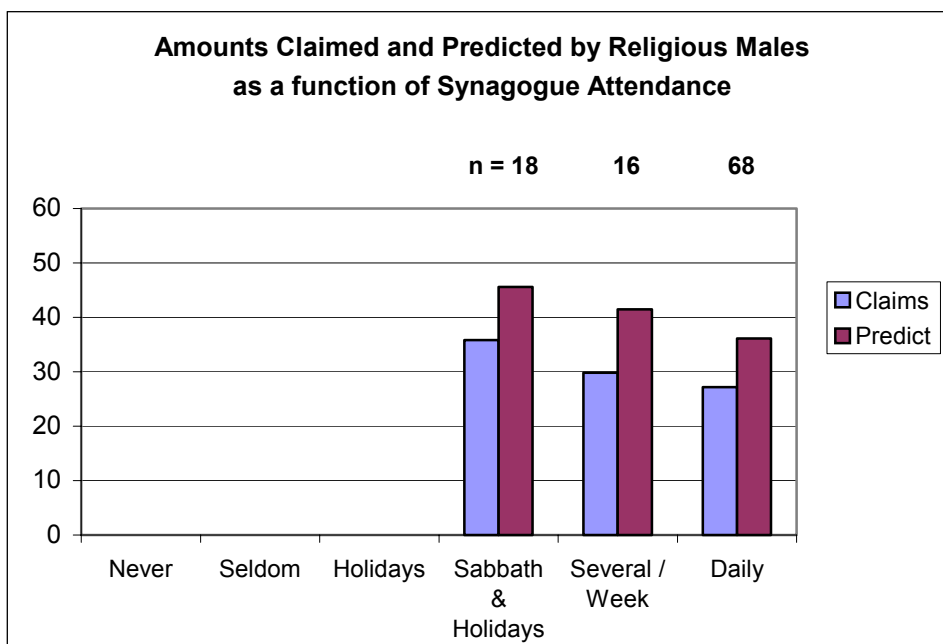
- 8b. Of your children that have reached the age at which they have had to decide whether to become a member of the kibbutz or to leave the kibbutz,  
 how many decided to become kibbutz members? \_\_\_\_\_  
 how many have left the kibbutz? \_\_\_\_\_
9. How many people live in your home **including yourself**?
10. In how many other households on this kibbutz do you or your spouse have family members?
11. On average, how many meals a week do you eat in the dining hall? \_\_\_\_\_
12. Where do you currently work?  
 What is your position?  
 How long have you worked at this position?  
 Are you (also) employed outside of the kibbutz?

**Figure 1**



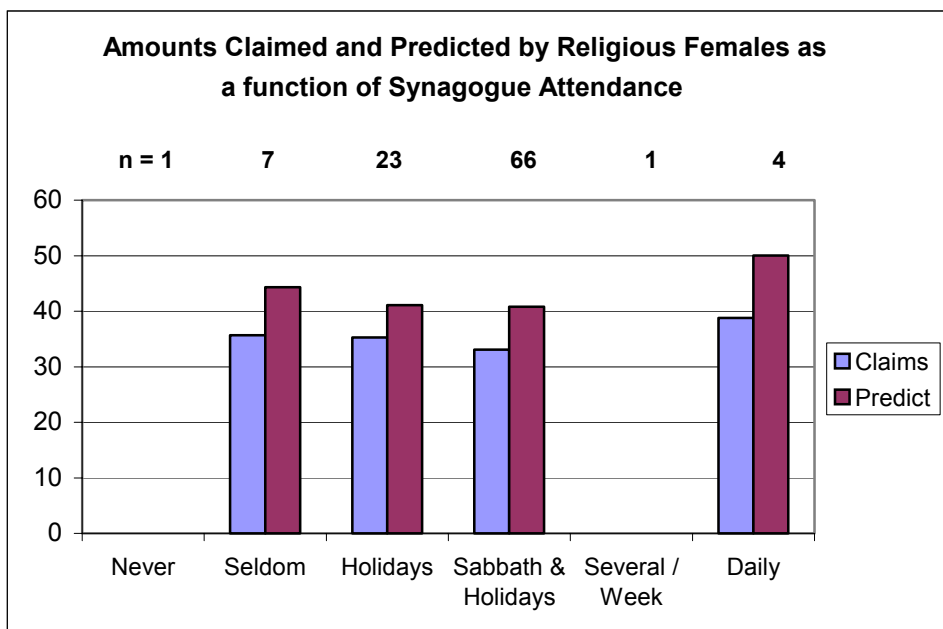
Histograms displaying the distributions of the amounts taken from the envelope (in shekels) by male and female members of religious kibbutzim.

**Figure 2a**



Bar graphs indicating the mean amount claimed by religious males (left-hand bar) and the mean amount religious males believed their paired partner would claim (right-hand bar) as a function of the frequency of the religious male's synagogue attendance. The sample sizes for each category of synagogue attendance appear above the bar graphs.

**Figure 2b**



Bar graphs indicating the mean amount claimed by religious females (left-hand bar) and the mean amount religious females believed their paired partner would claim (right-hand bar) as a function of the frequency of the religious female's synagogue attendance. The sample sizes for each category of synagogue attendance appear above the bar graphs.

**Table 1**  
**Comparison of Religious and Secular Kibbutz Samples**

Variable	Religious kibbutzim		Secular kibbutzim	
	Mean	Std. Deviation	Mean	Std. Deviation
Kibbutz size	658.3	185.1	652.8	209.3
Year of establishment	1946.9	7.6	1937.1	14.8
Economic Strength 1=Very Strong 2=Strong 3=Fair 4=Weak 5=Very Weak	2.21	0.74	1.84	0.86
Number of Privatization changes adopted by kibbutz	2.10	1.56	2.11	1.42
Age (years)	49.96	18.07	47.32	15.86
Education (years)	13.89	3.03	14.06	2.64
Sex 0=female 1=male	0.500	0.500	0.497	0.503

Means and standard deviations for a number of kibbutz-level and demographic variables reported separately for the religious and secular kibbutzim in our sample. The “Kibbutz Size” variable refers to the number of members on the kibbutz. The “Economic Strength” variable is a weighted index constructed by the kibbutz research institute Yad Tabenken. This measure is composed of the kibbutz’s assets and level of debt. The “number of Privatization changes adopted by kibbutz” variable reflects the degree to which the kibbutz remains a traditional, collectivized kibbutz. Each kibbutz received a score between 0 and 23 according to the number of changes it had implemented at the time the research was conducted.

**Table 2**  
**Cooperation and Gender on the Religious Kibbutzim**

estimation method	OLS	OLS	Tobit	OLS
variable\equation	(1)	(2)	(3)	(4)
constant	26.56 (3.13)	9.89 (4.44)	6.92 (4.85)	4.95 (7.31)
predict	---	0.48*** (0.11)	0.54*** (.123)	0.88** (.420)
predict <sup>2</sup>	---	---	---	-.006 (.006)
male	-4.45** (2.26)	-4.14* (2.23)	-5.11** (2.42)	-4.02* (2.31)
frackib	11.18** (4.57)	8.00* (4.65)	8.13* (5.07)	8.42* (4.58)
n	214	204	204	204
adjusted R <sup>2</sup>	.034	.205	.192	.212

The dependent variable is the amount removed from the envelope by the subject (in shekels).

- \*\*\* The coefficient is significant at the 1% level.
- \*\* The coefficient is significant at the 5% level.
- \* The coefficient is significant at the 10% level.

OLS and left-censored Tobit regression coefficients (heteroskedasticity-consistent standard errors in parentheses) from religious kibbutzim sample only. The amount removed from the envelope is regressed on the subject's estimate of how much his opponent will remove ("predict"), "predict<sup>2</sup>", a dummy variable for the subject's sex and the fraction of one's life spent on the kibbutz ("frackib").

**Table 3**  
**Descriptive Statistics of Key Variables by Subpopulation**

variable	Religious Kibbutzim			Secular Kibbutzim	
	Males who Attend Synagogue Daily	Males who Do Not Attend Synagogue Daily	Females	Males	Females
amount removed	27.21	33.06	33.71	30.13	30.53
predict	36.12	42.58	41.0	39.24	43.02
frackib	.676	.678	.639	.688	.648
% work off kibbutz	22.7%	25.0%	15.0%	24.1%	25.6%
meals	10.1	10.3	7.8	9.4	7.7
age	51.0	54.4	48.1	48.0	46.6
education	13.4	14.3	14.0	14.1	14.0
n	68	34	108	170	172

Descriptive statistics for key variables by subpopulation. Means are indicated for the amount removed from the envelope, the amount that the subject predicted his opponent would remove, the fraction of one's life spent on the kibbutz ("frackib"), the number of meals per week eaten in the communal dining hall, age, and years of education. For the "work off kibbutz" variable, the percentage of kibbutz members who work off the kibbutz is reported.

**Table 4**  
**Cooperation and Synagogue Attendance on the Religious Kibbutzim**

estimation method	OLS	OLS	Tobit	OLS	Tobit	OLS	OLS
variable\equation	(5)	(6)	(7)	(8)	(9)	(10)	(11)
constant	26.18 (3.18)	4.91 (7.31)	-0.97 (8.76)	6.01 (8.47)	0.24 (9.83)	3.04 (6.71)	5.04 (7.62)
predict	---	0.87** (.427)	1.15** (.496)	0.89** (.402)	1.17** (.478)	0.87** (.412)	0.87** (.419)
predict <sup>2</sup>	---	-0.006 (.006)	-0.010 (.007)	-0.007 (.006)	-0.010 (.006)	-0.006 (.006)	-0.006 (.006)
male* daily synagogue	-6.99*** (2.63)	-5.76** (2.63)	-6.84** (2.85)	-7.81* (4.44)	-9.20** (4.69)	---	-5.29** (2.73)
male* not daily synagogue	-1.21 (3.25)	-2.20 (3.07)	-3.24 (3.35)	-4.17 (4.52)	-5.54 (4.81)	---	-1.74 (3.20)
female* weekly synagogue	---	---	---	-2.91 (4.00)	-3.34 (4.14)	---	---
frackib	11.78** (4.67)	9.14** (4.69)	9.46* (5.15)	10.43** (5.17)	10.87** (5.67)	---	10.23** (4.81)
male*daily synagogue* frackib	---	---	---	---	---	3.81 (4.66)	---
male*not daily synagogue*frackib	---	---	---	---	---	8.78* (5.28)	---
female*frackib	---	---	---	---	---	11.37** (5.40)	---
work off kibbutz	---	---	---	---	---	---	-0.62 (2.55)
meals	---	---	---	---	---	---	-0.11 (.562)
n	208	198	198	193	193	198	192
adjusted R <sup>2</sup>	.050	.225	.214	.223	.211	.222	.221

The dependent variable is the amount removed from the envelope by the subject (in shekels).

\*\*\* The coefficient is significant at the 1% level.

\*\* The coefficient is significant at the 5% level.

\* The coefficient is significant at the 10% level.

OLS and left-censored Tobit regression coefficients (heteroskedasticity-consistent standard errors in parentheses) from religious kibbutzim sample only. The amount removed from the envelope is regressed on, among other variables, the subject's estimate of how much his opponent will remove ("predict"), "predict<sup>2</sup>", interaction dummies between religious males, religious females and the frequency of their synagogue attendance, the fraction of one's life spent on the kibbutz ("frackib"), "frackib" interacted with gender and synagogue attendance, a dummy variable for whether the kibbutz member works outside of the kibbutz ("work off kibbutz") and the number of meals a week the kibbutz member eats in the communal dining hall ("meals").

**Table 5**  
**Cooperation on the Secular Kibbutzim**

estimation method	OLS	OLS	Tobit	OLS
variable/equation	(12)	(13)	(14)	(15)
constant	34.87 (2.14)	5.88 (2.92)	0.92 (3.46)	5.88 (3.46)
predict	---	0.98*** (.144)	1.18*** (.143)	0.97*** (.114)
predict <sup>2</sup>	---	-0.007*** (.002)	-0.008*** (.002)	-0.007*** (.002)
male	0.65 (2.06)	2.84 (1.78)	2.38 (1.90)	2.99 (1.81)
frackib	---	---	---	-0.02 (3.21)
work off kibbutz	-6.07*** (2.24)	-5.88*** (2.16)	-6.95*** (2.42)	-6.18*** (2.17)
meals	-.440** (.183)	-.276* (.166)	-.287* (.176)	-.277 (.169)
n	299	293	293	291
adjusted R <sup>2</sup>	.025	.292	.282	.287

The dependent variable is the amount removed from the envelope by the subject (in shekels).

\*\*\* The coefficient is significant at the 1% level.

\*\* The coefficient is significant at the 5% level.

\* The coefficient is significant at the 10% level.

OLS and left-censored Tobit regression coefficients (heteroskedasticity-consistent standard errors in parentheses) for secular kibbutz members only. The amount removed from the envelope is regressed on, among other variables, the subject's estimate of how much his opponent will remove ("predict"), "predict<sup>2</sup>", a dummy variable for the subject's sex, the fraction of one's life spent on the kibbutz ("frackib"), a dummy variable for whether the kibbutz member works outside of the kibbutz ("work off kibbutz"), and the number of meals a week the kibbutz member eats in the communal dining hall ("meals").



**Table 6**  
**Cooperation on all Kibbutzim**

estimation method	OLS	OLS	OLS	OLS	Tobit	OLS	Tobit
variable\equation	(16)	(17)	(18)	(19)	(20)	(21)	(22)
constant	25.61 (3.76)	8.14 (4.02)	21.63 (4.41)	-0.94 (3.89)	-7.69 (4.69)	8.57 (4.05)	3.02 (4.71)
predict	---	0.92*** (.136)	---	0.92*** (.135)	1.14*** (.163)	0.91*** (.137)	1.13*** (.165)
predict <sup>2</sup>	---	-.006*** (.002)	---	-.006*** (.002)	-.008*** (.002)	-.006*** (.002)	-.008*** (.002)
religious	-10.11** (5.07)	-5.59 (4.42)	---	---	---	---	---
religious male* daily synagogue	---	---	---	---	---	-10.07** (5.09)	-11.22** (5.68)
religious male* not daily synagogue	---	---	---	---	---	-7.08 (5.26)	-8.39 (5.96)
frackib* religious	12.39*** (4.67)	9.30** (5.15)	12.95*** (4.71)	9.86** (4.67)	10.10** (5.15)	9.72** (4.66)	9.92* (5.15)
frackib* secular	-0.74 (3.73)	0.38 (3.20)	-0.88 (3.76)	-0.09 (3.22)	0.28 (3.52)	0.35 (3.20)	0.67 (3.48)
work off kibbutz* religious	-1.64 (2.71)	-1.74 (2.40)	-0.34 (2.73)	-0.64 (2.40)	-0.47 (2.62)	-0.96 (2.40)	-0.78 (2.63)
work off kibbutz* secular	-6.20*** (2.25)	-6.05*** (2.13)	-6.22*** (2.26)	-6.18*** (2.16)	-6.91*** (2.40)	-6.05*** (2.13)	-7.17*** (2.40)
meals* religious	-.235 (.208)	-.242 (.190)	-.125 (.214)	-.146 (.194)	-.129 (.204)	-.126 (.196)	-.111 (.207)
meals* secular	-.445** (.183)	-.245 (.165)	-.457** (.185)	-.285* (.168)	-.288 (.180)	-.247 (.165)	-.258 (.177)
religious female	---	---	4.65* (2.41)	4.00* (2.28)	5.20** (2.50)	-5.12 (4.37)	-5.12 (4.84)
secular male	---	---	14.67** (5.84)	11.19** (5.20)	12.13** (5.84)	---	---
secular female	---	---	13.91** (5.58)	8.30* (4.93)	9.68* (5.52)	---	---
n	485	485	501	485	497	485	485
adjusted R <sup>2</sup>	.024	.257	.027	.262	.256	.260	.251

The dependent variable is the amount removed from the envelope by the subject (in shekels).

- \*\*\* The coefficient is significant at the 1% level.
- \*\* The coefficient is significant at the 5% level.
- \* The coefficient is significant at the 10% level.

OLS and left-censored Tobit regression coefficients (heteroskedasticity-consistent standard errors in parentheses) for all (religious and secular) kibbutz members. The amount removed from the envelope is regressed on, among other variables, the subject's estimate of how much his opponent will remove ("predict"), "predict<sup>2</sup>", interaction variables between religious males and the frequency of their synagogue attendance, the fraction of religious and secular kibbutz members' lives spent on the kibbutz, interaction dummies between religious and secular kibbutz members and whether they work outside of the kibbutz, and the number of meals a week they eat in the communal dining hall. Categorical variables by kibbutz type and sex ("religious female", "secular male", "secular female") are also included.