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## Does It Pay To Pray? Costly Ritual and Cooperation

Bradley J. Ruffle\*

Richard Sosis†

\*Ben-Gurion University, [bradley@bgu.ac.il](mailto:bradley@bgu.ac.il)

†Hebrew University of Jerusalem and University of Connecticut, [richard.sosis@uconn.edu](mailto:richard.sosis@uconn.edu)

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# Does It Pay To Pray? Costly Ritual and Cooperation\*

Bradley J. Ruffle and Richard Sosis

## Abstract

Time-consuming and costly religious rituals pose a puzzle for economists committed to rational choice theories of human behavior. We propose that either through selection or a causal relationship, the performance of religious rituals is associated with higher levels of cooperation. 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.

**KEYWORDS:** economics of religion, experimental economics, religious ritual, cooperation, kibbutz

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## 1. Introduction

“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, p. 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. Expanding on Iannaccone's pioneering work, Berman (2000) presents a model in which groups provide mutual insurance and charity, and rituals serve to signal members' commitment to the group.<sup>1</sup> Levy and Razin (2006) show that costly and observable rituals allow religious individuals to identify and cooperate with one another.

Despite these hypothesized benefits associated with religious ritual, there exists a dearth of quantitative evidence. In this paper, we test for a relationship between religious ritual and the cooperative behavior of members of religious and secular communes, Israeli kibbutzim (the plural of kibbutz). 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. To measure religious ritual, we collect individual-level measures of the kibbutz member's participation in religious rituals.

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 compare the cooperativeness 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 ritual performance on religious kibbutzim, especially along gender lines, offers an opportunity to

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<sup>1</sup> Outside of economics, evolutionary anthropologists have similarly argued that religious practices serve to signal group commitment and help overcome free-rider dilemmas that humans have encountered throughout their evolutionary history (Irons 2001, Sosis 2003).

explore whether differences in individual cooperativeness in the experimental game can be explained by variation in the performance of costly observable ritual. The most costly ritual obligations fall disproportionately upon men in Judaism, namely the obligation to pray collectively thrice daily. We gather individual-level data on the performance of this collective ritual 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 costly rituals, as we will demonstrate, but are otherwise very similar to those of religious kibbutz members, they provide a natural comparative population to assess the relationship between costly ritual performance and cooperation.

We hypothesize that those kibbutz members who engage frequently in costly religious rituals will play our experimental game most cooperatively. Two possible explanations underlie this hypothesized relationship: i) *selection through signaling/screening*: a kibbutz that adopts a costly social norm, such as daily synagogue attendance for males, may make joining too costly for free-riders merely seeking to benefit from the kibbutz's egalitarian distribution of resources independent of effort; ii) *causality*: participation in costly religious rituals with other kibbutz members may inculcate the member with a sense of group solidarity, bonding and a desire to cooperate with fellow kibbutz members.

We find that religious men (the primary practitioners of Judaism's most costly public ritual, synagogue attendance) are more cooperative than religious women. What is more, religious men who attend synagogue daily 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 costly ritual for cooperative behavior. In a brief research note aimed at anthropologists, Sosis and Ruffle (2003) report preliminary evidence of these findings. Motivated by costly signaling theory, we extend these findings in the current paper and show their robustness to different regression methods and various specifications and controls.

In the next section, we provide some background on the economic structure of the kibbutz as well as the significance of the distinction between religious and secular kibbutzim. In section 3, we discuss the related literature on the economics of religion and develop a model that highlights our anticipated relationship between costly observable ritual performance and cooperative behavior. Section 4 describes our choice of sample kibbutzim, experimental design, procedures and hypotheses. Section 5 presents our results. In section 6, we use our results to explain the stylized fact that religious kibbutzim have been economically more successful than their secular counterparts. Section 7 concludes.

## 2. The Israeli Kibbutz

### 2.1 Background on the Kibbutz

The Israeli kibbutz is among the best known, most enduring and successful examples of a modern commune. 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 semiconductor 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>2</sup> such measures are impractical for the kibbutz without drastically altering its fundamental nature. Rather, 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

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<sup>2</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 et al. (1994) for a thorough theoretical, experimental and empirical treatment of common-pool resources.

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. Second, 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 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. The most radical change – and typically the last one implemented by the small minority of kibbutzim that have decided to privatize fully – is differential salaries according to which individual kibbutz members earn incomes that reflect, at least in part, their productivity.

Interestingly, religious kibbutzim emerged from the economic crisis of the 1980s relatively unscathed. For this reason, they were not pressured by the banks to privatize nor did they choose to adopt such measures.

## **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>3</sup> while the 16 religious kibbutzim belong to the Religious Kibbutz Federation.<sup>4</sup> The clean

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<sup>3</sup> Months after the completion of our experiments, the Kibbutz Ha’Artzi and the TAKAM federations announced their intentions to merge.

<sup>4</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

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, members of secular kibbutzim 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*), and thus ritual plays a central and defining role in their lives. However, unlike Ultra-Orthodox Jews, they do not shun modernity; for instance, they serve in the Israeli military, own televisions and read mainstream newspapers.

All Modern Orthodox Jews are expected to keep the kosher dietary laws, dress modestly, and avoid work on the Sabbath, among many other requirements. In addition to these shared obligations, males and females also have their own distinctive ritual responsibilities. Here we focus on the unique nature of these differences, namely that male ritual requirements are primarily publicly oriented, whereas female requirements are generally performed privately or in the home. Of the three main ritual requirements exclusively imposed on women, none are performed publicly (namely, the laws of family purity such as attending a ritual bath (*mikveh*), separating a portion of dough when baking bread, and lighting Sabbath candles at home). By contrast, ritual requirements exclusively imposed on males are primarily collectively performed and publicly observable. The most notable collective ritual requirement among males is thrice-daily public prayer in a *minyan* (a quorum of at least 10 men). No similar requirement exists for women to attend communal prayer. In fact, women who choose to attend synagogue sit separately from, and are not seen by, the men, and are not counted as part of the *minyan*. In addition to its collective nature, males' obligation to pray thrice daily is costly, demanding an hour and a half to two hours daily during the week, and three to three-and-a-half hours on the Sabbath. Thus, while both males and females observe numerous costly and public ritual requirements, such as the dietary and Sabbath laws, here we exploit their differences in ritual obligations to assess whether these differences are related to cooperative behavior.

Our hypothesis that costly observable rituals predict group commitment and cooperative behavior thus 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 communal prayer, the more cooperatively

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Progressive (Reform) Judaism Movement that belong to the TAKAM. These kibbutzim have been excluded from our sample, although they would make interesting case studies.

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 relation between costly ritual and cooperation.

### **3. The Economic Benefits of Religious Ritual**

#### **3.1 Related Literature**

A growing literature associates religious observance with beneficial outcomes.<sup>5</sup> Orbell et al. (1992) 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. Johansson-Stenman et al. (2005) provide a more recent experimental study on the relationship between religiosity and in-group as well as out-group pro-social behavior. Although they do not collect measures of religious belief or observance, they find no significant evidence that religious affiliation affects the levels of trust or trustworthiness in a trust game conducted in rural Bangladesh among and between Hindus and Muslims.

According to Ensminger (1997), increased trust leading to improved trade opportunities may explain the vast number of African societies that have converted to Islam. By adopting Islam, Ensminger contends, the African converts earned the trust of North African and Middle Eastern traders, which allowed for the extension of credit to expand further trade possibilities. Additionally, 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 and permitted the screening of free-riders unwilling to undertake such demanding rituals and prohibitions.

The success of Ultra-Orthodox Jews in the diamond industry provides another example of the economic benefits achieved by close-knit religious

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<sup>5</sup> Iannaccone's (1998) comprehensive review of the economics of religion includes studies that associate religious observance with beneficial social behavior (e.g., lower rates of crime and drug and alcohol abuse), more stable marriages and improved mental and physical health.

communities. Multi-million dollar transactions are sealed by nothing more than a few words of Yiddish and a handshake in New York's diamond district (Shield, 2002, p. 2). Trust among diamond industry workers 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 through numerous costly requirements for entry into their community, such as particular dress, dietary restrictions, and thrice-daily prayer. This has enabled them to out-compete others unable to achieve such high levels of cooperation, resulting in their worldwide prominence in the industry (Richman, 2006).

Nowhere is cooperation more necessary than for communes whose survival and success hinge on it. In a 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. 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 religious 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.

In addition to these empirically observed benefits, several theoretical papers demonstrate the ability of religious individuals to form a restrictive group and exclude non-believers from group benefits. 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 tests his model's predictions using self-reported survey data from the General Social Survey, 1986-1990. 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.

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 government 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.

In a recent paper, Levy and Razin (2006) model a prisoners' dilemma played by a population with heterogeneous beliefs on post-game payoff shocks they receive. Individuals' beliefs differ in whether the shocks relate to their actions. A religion is an institution in which agents pay an observable signal. In equilibrium, those who pay the cost believe that, on average, they receive a negative shock if they defect. Thus, incurring the costly signal allows individuals to identify those who have the same beliefs and exclude those who don't. The result is that within the religion, a higher level of cooperation is attained. Moreover, society as a whole displays a higher level of cooperation toward the religion.

### **3.2 A Model of Religious Ritual and Cooperative Behavior**

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.

By design of the kibbutz, the government and the market have been excluded from providing a solution to these problems. Instead, kibbutz members must design their own internal mechanisms to encourage cooperation and discourage free riders. The kibbutz may wish to adopt any non-market activity that helps it to distinguish cooperative individuals from free riders. Employing a costly social norm like daily synagogue attendance for males may deter free-riders from joining who might otherwise wish to benefit from the kibbutz's egalitarian distribution of resources independent of effort. In addition to this selection argument for introducing costly rituals, a causal force may also be at work. The act of participating in regular costly public rituals with other male members of the kibbutz may imbue males with a sense of group solidarity, bonding or similar positive feelings toward fellow kibbutz members. Both the selection and causal forces suggest kibbutzim with costly public rituals will exhibit higher levels of cooperative behavior than their counterparts without such rituals. We develop below the argument that those individuals who partake in the ritual will behave more cooperatively than those who don't.

We illustrate the selection argument with a variation on Iannaccone's (1992) and Berman's (2000) models, adapted to our environment in which cooperative kibbutz members seek to keep out uncooperative types. Suppose there

are a large number of potential members,  $N$ . Each individual,  $i$ , chooses how to allocate his time  $T$  between selfish pursuits,  $s_i$ , that benefit the individual only and cooperative activities,  $c_i$ , that benefit others at a cost to oneself. Thus,  $s_i + c_i = T$ ,  $\forall i$ . Cooperative activities include volunteer work, refraining from the consumption of a common-pool resource, involvement in group activities or organizations and contributing to the quorum of ten men required for group prayer in Judaism.

An individual derives utility from both types of activities,  $s_i$  and  $c_i$ , as well as the degree to which others with whom the individual interacts cooperate. That is,

$$U_i(s_i, c_i, \sum_{j \neq i} \frac{c_j}{n}), U^3 > 0,$$

where  $n \leq N$ , meaning the individual may interact with all  $N$  individuals outside of the kibbutz or some strict subset of individuals ( $n < N$ ) on a kibbutz that restricts entry.

While in Berman's (2000) model the source of unobserved heterogeneity is individuals' outside option (i.e. their market wage), here individuals are distinguished by their inherent preferences for cooperation. There are two types of potential members that differ in their innate preference for selfish versus cooperative activities. Cooperative types (labeled "*coop*") prefer relatively more cooperative activities and less selfish activities compared to uncooperative types (labeled "*uncoop*"). Thus, *uncoop* wish to join the kibbutz to benefit from the positive externality provided by *coop*. In forming a kibbutz, *coop* prefer to exclude *uncoop* to raise the average level of cooperation to match their own. Figure 1 displays how *coop* achieve this goal.

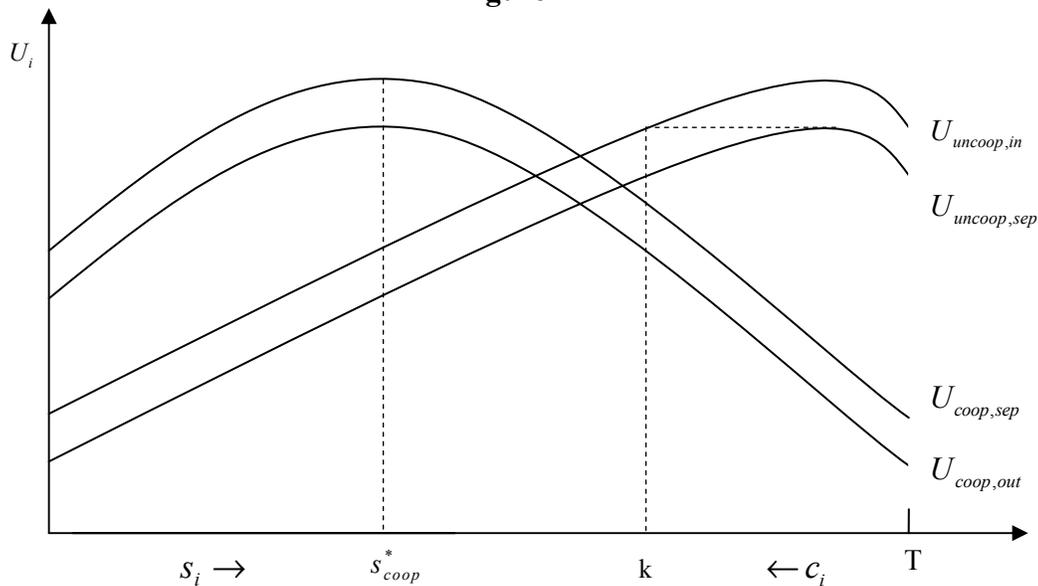
$U_{coop,out}$  indicates *coop*'s utility function in the event that they remain outside the kibbutz and interact with *uncoop*. Cooperative types maximize their utility by choosing  $s_i = s_{coop}^*$  and  $c_i = T - s_{coop}^*$ . *Coop* wish to exclude *uncoop* and form a kibbutz of their own to benefit from higher average cooperation. To achieve this separating equilibrium, they display a signal that an *uncoop* finds too costly to undertake. Daily synagogue attendance provides one such highly visible, and thus verifiable, signal. Because communal prayer participation is itself a type of cooperative activity, it substitutes for other cooperative activities in potential members' time allocation.<sup>6</sup> Figure 1 displays the minimum signal,  $k$ , required to

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<sup>6</sup> Our model departs from standard signaling models in that the signal is productive. An analogous model where the costly signal is purely wasteful yields identical results. We prefer our modeling choice for our environment since it leads to the interpretation that cooperative religious males willingly participate in religious rituals as part of their typical range of cooperative activities, whereas uncooperative religious males find the required signal in excess of the time they would willingly devote to cooperative activities.

discourage *uncoop* from joining the kibbutz. If an uncooperative individual incurs the cost of the signal  $k$ , his resultant net utility (given by the point  $U_{uncoop,in}(k)$ ) from joining a kibbutz made up entirely of *coop* is no higher than his maximum utility from remaining outside of the kibbutz (given by the peak of his utility function  $U_{uncoop,sep}$ ). As a result, he prefers not to join. *Coop* willingly display the signal, join the kibbutz, benefit from higher average cooperation, earn utility  $U_{coop,sep}(s_{coop}^*)$  and devote additional time,  $k - s_{coop}^*$ , to cooperative activities. As a result, upon observing the signal  $k$ , the kibbutz assigns probability one to the individual being *coop*.

Figure 1



Cooperative individuals (*coop*) reveal their type by choosing a signal between  $k$  and  $s_{coop}^*$  such that uncooperative individuals (*uncoop*) prefer not to imitate.

We can extend our model to more than two types differentiated by their optimal time allocation between cooperative and selfish pursuits. Suppose there exists a third type (to be referred to as *medium*) that prefers more cooperative activities than *uncoop* but less than *coop*. Also suppose that the required signal,  $k'$ , is such that both *coop* and *medium* find it profitable to display the signal, while *uncoop* does not. Then outcomes in which *coop* and *medium* display different as well as the same signal are both possible depending on  $k'$ . If  $k'$  is set at or above *coop*'s optimal amount of cooperative activity,  $s_{coop}^*$ , then both *coop* and *medium* pool on  $k'$ . However, if  $s_{coop}^* > k' > k$ , then *medium* will display  $k'$ , while *coop*

may prefer a higher level of the signal. This separating outcome demonstrates that even the kibbutz that adopts a costly social norm like regular synagogue attendance may consist of members who display differential amounts of the signal. What is more, the extent to which an individual displays the signal predicts his cooperativeness.

#### **4. Experimental Methodology**

##### **4.1 Choice of Sample**

To control for between-kibbutz differences unrelated to behavior, we employed a matched-pairs design to select our sample of 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 observable measures that may potentially affect cooperation: the kibbutz's population size, year of establishment, degree of economic success, and degree of privatization.<sup>7</sup> 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). Moreover, 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. In total, 558 kibbutz members from 18 kibbutzim throughout Israel participated in this study.

Table 1 displays the means and standard deviations of the above control variables for the religious and secular kibbutzim in our sample. For instance, the average kibbutz in both samples maintains about 650 members, while kibbutzim in both samples adopted 2.1 (out of a possible 23) changes toward privatization. Non-parametric Wilcoxon-Mann-Whitney tests reveal that the distributions of these four variables are not significantly different across the religious and secular kibbutz samples (p-values range from .42 to .86). A fortuitous by-product of controlling for these 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).

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<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**  
**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 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.

## 4.2 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.<sup>8</sup> For example, assuring 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 require a symmetric game to allow us to compare kibbutz members’ choices with one another. The game should resemble the nature of the cooperation and self-restraint issues that 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

<sup>8</sup> Our non-standard subject pool playing controlled laboratory games best fit the artefactual field experiments category of Harrison and List's (2004) classification.

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, this is not a study in the differential abilities to learn to play repeated games. Rather, 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. 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. One hundred shekels are available in a joint envelope to which each pair member has access.<sup>9</sup> Each pair member simultaneously and 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 left over in the envelope is multiplied by 1.5 and divided equally between the two players.<sup>10</sup> Appendix A contains the instructions.

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>11</sup>

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<sup>9</sup> At the time these experiments were conducted 4 Israeli shekels equaled approximately \$1 US. Kibbutz members in our sample receive monthly stipends between 600 and 800 shekels from their respective kibbutzim.

<sup>10</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 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>11</sup> Our game resembles the Nash demand game (Nash, 1953). The difference is that whatever money is left over in our game gets multiplied by 1.5 (rather than disappearing) 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.

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.

In order to understand better the motive behind a player's decision to remove a particular amount, each player was also asked to indicate the amount he believes his opponent will remove from the envelope. This amount reflects the player's degree of trust in his opponent. For example, a player who removes 0 and believes his opponent will do the same is fully cooperative and fully trusts that his opponent will behave fully cooperatively, whereas a player who makes the same claim of 0, but believes his opponent will remove 100 displays no trust at all in his opponent and can be said to be motivated by fear rather than cooperativeness or reciprocity.

### **4.3 Experimental Procedures**

#### **4.3.1 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 about a week before our planned visit. To minimize the chances that participants might anticipate with whom they are paired, we waited one or two days prior to our visit before telephoning kibbutz members to invite them to participate in the research. For those who agreed (greater than 75% of those contacted), we arranged a specific time to meet. Again to maintain subject anonymity and prevent subjects from anticipating the identity of their paired partners or learning it after the experiment, between 8 and 14 subjects (i.e., between 4 and 7 pairs) participated simultaneously at any given time. For this purpose, we trained and employed 20 Ben-Gurion University graduate and undergraduate students (who had completed a class in experimental economics) to help conduct the experiments.

#### **4.3.2 Upon Arrival at the Kibbutz**

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. If the numbers drawn were 20 and 60, for instance, 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>12</sup> The experimenter did not convey the decision in this conversation in order to avoid any reaction or facial expression on the part of the second experimenter that might 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 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 total payment.

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).

#### **4.4 Experimental Hypotheses**

In light of the background provided on ritual obligations in Judaism, the centrality of cooperation for the kibbutz and the selection and causal arguments derived in

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<sup>12</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.

Section 3.2, we present three testable hypotheses in the context of our experimental game.

*1. On religious kibbutzim, males are more cooperative than females.*

As already noted, while men and women share many religious responsibilities, public ritual obligations fall chiefly on males in Judaism. If, either through selection or causality, public rituals are indeed associated with increased group commitment and cooperation, then we expect religious males to claim smaller amounts from the envelope on average than religious females.

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

In the post-experiment questionnaire (question 4b), we asked subjects to report the frequency with which they attend synagogue services. We expect those males who most frequently attend to claim the smallest amounts from the envelope.

*3. Males on religious kibbutzim are more cooperative than males and females on secular kibbutzim.*

In the absence of comparably costly communal or otherwise observable rituals on secular kibbutzim (to be discussed following Result 4 of Section 5), we expect religious males to claim smaller amounts from the envelope on average than secular males and females.

## **5. Results**

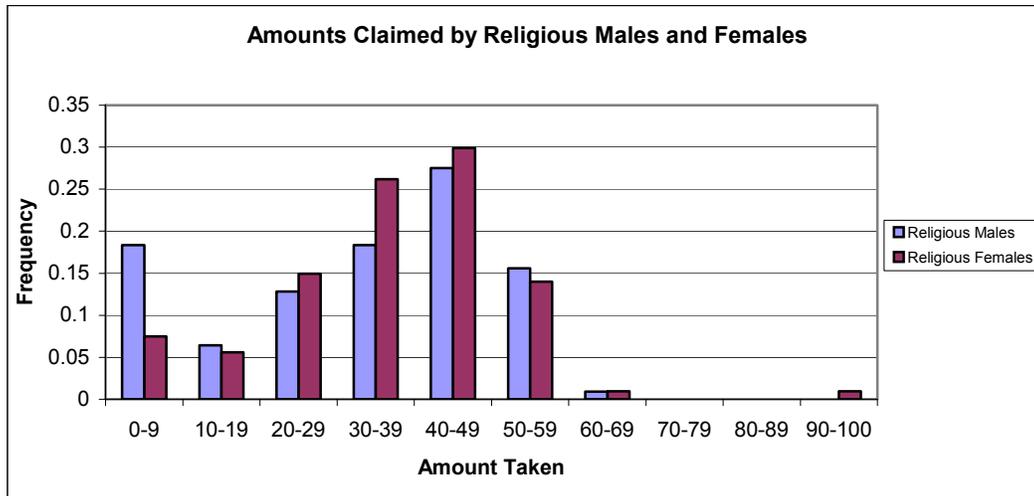
**Result 1** On religious kibbutzim, males are more cooperative toward fellow kibbutz members than females.

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 2 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 who 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 ( $\chi^2=5.66$ ,  $p=.017$ ,  $df=1$ ). Furthermore, 22 of these 28 subjects claimed 0, 18 of whom were males ( $\chi^2=9.63$ ,  $p=.002$ ,  $df=1$ ).<sup>13</sup>

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<sup>13</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

Figure 2



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

Regression equations (1) – (4) 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 about 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>14</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 that males remove significantly less than females:<sup>15</sup> converting the coefficient on “male” to a marginal effect yields an estimate of  $-4.88$  shekels.

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average) and religious males (13.8 on average) are nearly identical and education is not a significant predictor of the amount claimed in any of the regressions reported below.

<sup>14</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 shekels and gives his paired partner 0.75 shekels.

<sup>15</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. We also estimated Probit regressions for the decision to remove zero: religious males are significantly more likely to claim zero than religious females. Our remaining results reported below are also qualitatively similar for the Probit specification.

**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 std. errors in parentheses) from religious kibbutz sample only. The amount claimed 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").

The amount the subject believes his opponent will remove from the envelope ("predict") is another highly significant variable in these regressions. 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 more trusting the subject is or the less he believes his opponent will remove from the envelope), the more he is willing to cooperate, and vice-versa.<sup>16</sup> Regressions (2) – (4) indicate that even controlling for trust, religious males are more cooperative than religious females.

<sup>16</sup> 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 in any of the other regressions performed on religious kibbutz members. We will discuss "predict<sup>2</sup>" when reporting the results from the secular kibbutzim.

The “frackib” variable expresses the fraction of one’s life spent on the kibbutz. It is calculated as the year the experiments were conducted 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 shekels more from the envelope. Someone born on the kibbutz can be expected to remove eight shekels more than a new arrival.<sup>17</sup> This result would seem to favor the selection argument in understanding the observed positive relationship between religion and religious ritual and cooperative behavior. We return to the “frackib” variable below.<sup>18</sup>

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

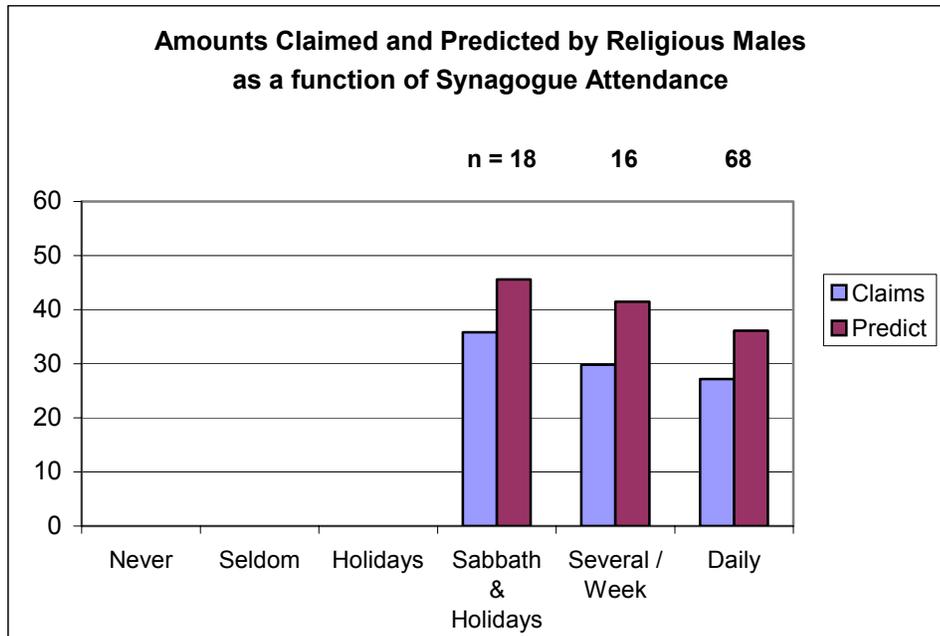
The difference in cooperative behavior between religious males and females appears to be attributable to the ritual participation of males. The right-hand (darkly shaded) bars of Figures 3a and 3b display the mean amounts claimed by religious males and females, respectively, as a function of their frequency 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.

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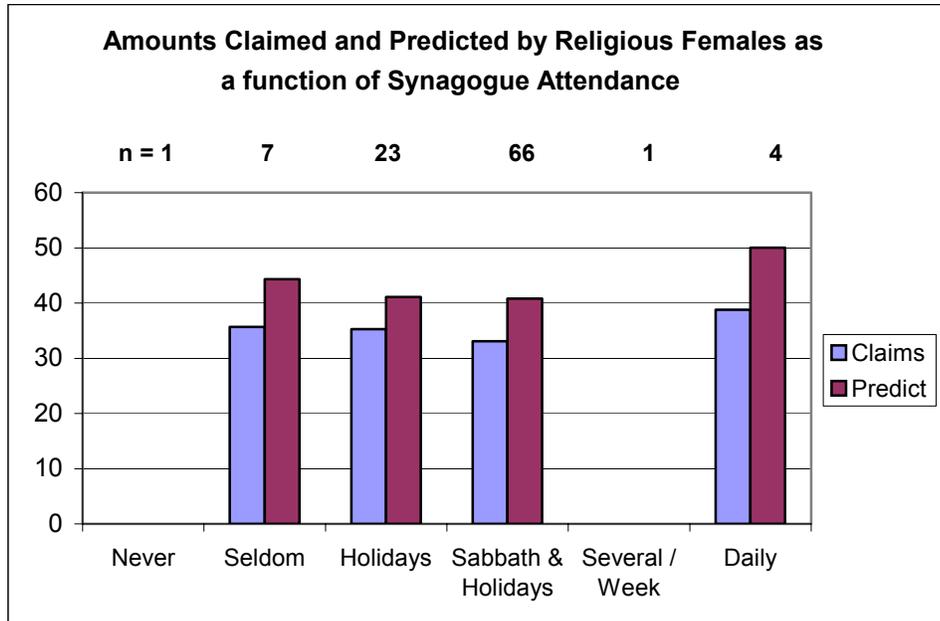
<sup>17</sup> This same finding (that the larger the fraction of one’s life spent on the kibbutz, the less cooperative one behaves toward fellow kibbutz members) was previously noted in Ruffle and Sosis (2006) on a different sample of four kibbutzim. See that paper for an in-depth discussion of the role of self-selection versus socialization in the cooperative behavior of kibbutz members.

<sup>18</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 two numerical examples, 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 in this sample.

**Figure 3a**



**Figure 3b**



Bar graphs indicating the mean amounts religious males claimed (left-hand bar of 3a), religious females claimed (left-hand bar of 3b) and the mean amount they believed their paired partner would claim (right-hand bar of 3a and 3b respectively) as a function of frequency of synagogue attendance. Sample sizes for each category of synagogue attendance appear above the bar graphs.

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, while men who do not attend daily 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 by subpopulation.

**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 (17.98)	33.06 (17.03)	33.71 (15.33)	30.13 (19.09)	30.53 (15.80)
predict	36.12 (15.5)	42.58 (14.3)	41.0 (13.1)	39.24 (18.6)	43.02 (16.5)
frackib	.676 (.22)	.678 (.28)	.639 (.27)	.688 (.28)	.648 (.29)
% work off kibbutz	22.7%	25.0%	15.0%	24.1%	25.6%
meals	10.1 (6.0)	10.3 (5.3)	7.8 (5.3)	9.4 (5.3)	7.7 (5.5)
age	51.0 (16.7)	54.4 (18.2)	48.1 (18.5)	48.0 (15.6)	46.6 (16.1)
education	13.4 (3.4)	14.3 (2.4)	14.0 (3.0)	14.1 (2.9)	14.0 (2.4)
n	68	34	108	170	172

Means and standard deviations for the amount removed, the amount that the subject predicted his opponent would remove, the fraction of one’s life spent on the kibbutz, 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.

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  $-6.47$  from Tobit (7), indicate that religious males who attend synagogue daily remove six or seven shekels less than religious females; whereas, the latter interaction 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. Additional classifications of female synagogue attendance are all non-significant, indicating that female attendance is unrelated to their cooperative behavior in the game.

The right-hand (darkly shaded) bars of Figures 3a and 3b 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 causal interpretation of the results from (10) is that costly public ritual counteracts this tendency.

**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>	---	-.006 (.006)	-.010 (.007)	-.007 (.006)	-.010 (.006)	-.006 (.006)	-.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 synagog* 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 regressions (heteroskedasticity-consistent std. errors in parentheses) from religious sample only. The amount claimed is regressed on 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").

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

**Result 3** On secular kibbutzim, male and female 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 remove on average 30.5 shekels (median=30.0, n=172),  $t=0.21$ ,  $p=.83$ ,  $df=327$ . 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 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 when combined with the negative and highly significant coefficient on “predict<sup>2</sup>”, the positive relation between “predict” and the amount claimed 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.

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. Similarly, 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 ( $\chi^2=6.41$ ,  $p=.093$ ,  $df=3$ ). Since the amount a participant believes his opponent will claim can be interpreted as his degree of trust in his opponent,<sup>19</sup> religious males can be seen as the most trusting 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, substantially 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.

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<sup>19</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.

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

estimation method	OLS	OLS	Tobit	OLS
variable/equation	(12)	(13)	(14)	(15)
constant	35.64 (2.45)	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>	---	-.007*** (.002)	-.008*** (.002)	-.007*** (.002)
male	1.23 (2.13)	2.84 (1.78)	2.38 (1.90)	2.99 (1.81)
frackib	---	---	---	-0.02 (3.21)
work off kibbutz	-6.67*** (2.35)	-5.88*** (2.16)	-6.95*** (2.42)	-6.18*** (2.17)
communal events	-.265 (.571)	---	---	---
meals	-.481** (.199)	-.276* (.166)	-.287* (.176)	-.277 (.169)
n	278	293	293	291
adjusted R <sup>2</sup>	.030	.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.

**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) – (21) 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 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. Regression (17) divides the religious and secular populations into four subpopulations with

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

estimation method	OLS	OLS	OLS	Tobit	OLS	Tobit
variable/equation	(16)	(17)	(18)	(19)	(20)	(21)
constant	25.61 (3.76)	21.63 (4.41)	-0.94 (3.89)	-7.69 (4.69)	8.57 (4.05)	3.02 (4.71)
predict	---	---	0.92*** (.135)	1.14*** (.163)	0.91*** (.137)	1.13*** (.165)
predict <sup>2</sup>	---	---	-.006*** (.002)	-.008*** (.002)	-.006*** (.002)	-.008*** (.002)
religious	-10.11** (5.07)	---	---	---	---	---
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)	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)	-0.88 (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)	-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)	-6.22*** (2.26)	-6.18*** (2.16)	-6.91*** (2.40)	-6.05*** (2.13)	-7.17*** (2.40)
meals* religious	-.235 (.208)	-.125 (.214)	-.146 (.194)	-.129 (.204)	-.126 (.196)	-.111 (.207)
meals* secular	-.445** (.183)	-.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	501	501	485	485	485	485
adjusted R <sup>2</sup>	.024	.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.

religious males as the omitted category and reveals that the latter account disproportionately for the relatively cooperative behavior of religious kibbutz members. From (17) and (18), we see that religious males remove four shekels less than religious females. Both the sign and the magnitude of this “religious female” coefficient are reassuring since they confirm Result 1 and match the coefficient estimates in Table 2. What is new is that these regressions indicate that religious males are the most cooperative subpopulation, both when we control for kibbutz members' trust (18) and when we don't (17). For instance, controlling for trust, 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 (19) indicates that religious males claim 4.86 shekels less than religious females ( $p=.038$ ), 11.32 shekels less than secular males ( $p=.038$ ) and 9.03 shekels less than secular females ( $p=.080$ ).<sup>20</sup> A closer look at the religious males highlights the primary source of these differences: according to (20) or the transformed marginal estimates from (21), respectively, religious males who attend synagogue daily claim 10.07 or 10.46 shekels less than secular kibbutz members, whereas, the claims by religious males who do not attend daily and by religious females are not significantly different from secular members.<sup>21</sup>

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 testifies to their commitment to the kibbutz values of egalitarianism, community and

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<sup>20</sup> Nonetheless, all of these groups play this experimental game more cooperatively than Israeli city residents. Using the same experimental game, Ruffle and Sosis (2006) find that city residents remove 35.6 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 members play this game against city residents (outsiders), they behave identically to the city residents (average=35.2, median=40,  $n=61$ ).

<sup>21</sup> To ensure that these results are not driven by particular kibbutzim, we reran OLS regression (20), each time excluding one of the seven matched religious-secular pairs. Our qualitative results are robust to this sample sensitivity analysis: for instance, the coefficient on the “religious male\*daily synagogue” variable ranges from  $-14.22$  to  $-6.49$  (mean coefficient=10.16,  $n=7$ ). All but the coefficient of  $-6.49$  ( $p=.25$ ) (for which a religious kibbutz and its two paired secular kibbutzim were excluded) are significant.

cooperation.<sup>22</sup> 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.

In an effort to determine whether secular kibbutzim have their own observable rituals that might be associated with cooperative behavior, we included several questions on the post-experiment questionnaire (see Appendix A). We asked all participants (question 6) 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 bonding or cooperation between individuals. Indeed, the number of communal events attended by a secular kibbutz member is uncorrelated with the amount he claims in our experimental game ( $\sigma = -.045$ ,  $p=.45$ ,  $n=278$ ) and is not a significant predictor of his cooperative play in our game in any of our regressions on secular members (shown in (12) of Table 5 only).

We also asked all participants to indicate the number of meals they eat in the communal dining hall during an average week (question 11). 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 solidarity-promoting ritual or may simply signal 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 ( $\sigma = 5.7$ ) compared to an average of 8.5 meals a week for secular members ( $\sigma = 5.4$ ),  $t=0.84$ ,  $p=.40$ ,  $df=425$ ). Yet, in the secular kibbutzim only, the frequency with which one eats in the dining hall is negatively correlated with the amounts members claim. The regression coefficient of  $-.276$  ( $p\text{-value}=.097$ ) in (13) in Table 5 indicates that for every additional meal a secular member eats in the dining hall, he claims 0.276 shekels less in the game. In regression (17) on all kibbutz members, we see that the coefficient on “meals” is significant (and negative) on the secular kibbutzim only. One explanation for the finding that “meals” is only a weakly significant predictor of cooperative behavior in most regression specifications in Tables 5 and 6 is that the costliness of communal

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<sup>22</sup> Indeed, Abramitzky (2005) documents a positive selection effect among kibbutz members who leave: members with high-skill occupations are nine percentage points more likely to leave and a high school education increases the departure rate by 50%.

dining remains in question since the alternative is to eat at one's own expense at home or outside the kibbutz.

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, especially males, appear to have their own forms of collective religious 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 synagogue infrequently conveys no meaningful message about his willingness to cooperate, since synagogue attendance is not expected in the secular community. The point is that for a ritual to be meaningful as a signal of intention in a particular community, it must be valued by members of that community (Rappaport, 1999).

## **6. Understanding 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. 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>23</sup> In addition, the religious kibbutzim 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

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<sup>23</sup> Barro and McCleary (2003) also demonstrate a positive relation between religiosity and economic growth. Based on a panel-data analysis of 41 countries, they show that economic growth responds positively to the extent of a nation's religious beliefs, particularly 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.

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: publicly observable rituals, either through selection or a causal effect, most successfully produce self-control.

## **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 adopting religious ritual extend beyond the production of religious goods to include beneficial economic behavior and we proceed to estimate this economic benefit. The Israeli kibbutz presents a host of opportunities for free riding and exploitative behavior. Regularly performed public religious rituals may enhance the participant’s sense of group commitment, solidarity and trust, which ultimately translate into increased cooperation toward group members. Alternatively, performance of these costly rituals may signal a member's commitment to his kibbutz and a predisposition to cooperative behavior. Only those truly committed to the kibbutz ideology of cooperation would willingly undertake these costly ritual obligations.

In this paper, we design a test to determine whether the performance of collective religious ritual is indeed associated with increased cooperation among 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 across and within kibbutzim. These differences can be characterized by the frequency of public religious ritual performance. Those who most regularly engage in collective religious ritual are the most cooperative. No matter its source, both the selection and causal mechanisms point to the benefits of requiring frequent costly rituals of group members to limit the consumption of communal resources. Contrary to the quote with which this paper began, religious ritual appears to offer a distinct advantage in dealing with economic problems of cooperation.

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

### **Instructions**

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

We thank you for your 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

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?  
**1**                      **2**                      **3**                      **4**                      **5**                      **6**  
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?  

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- 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?

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