Costly Requirements and Signaling in Religious Groups: The American Congregational Giving Study

Short Title: Costly Requirements and Signaling in Religious Groups

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ABSTRACT
The costly signaling theory of religion proposes that the costs associated with religious rituals and requirements bolster the commitment of group members and foster intragroup cooperation. Using data collected on religious practice and giving among American Christian congregations, this thesis provides an empirical test of this theory. Broad support was found for three hypotheses stemming from the costly signaling theory of religion and the related economic approach to religion: (1) the number of costly requirements imposed by a congregation had a significant effect on the amount of money donated by its members, (2) stricter congregations had more members of low socioeconomic status, and (3) the number of programs a congregation offered was significantly correlated with the number of costly requirements it imposed.

KEYWORDS
Signaling theory, evolution of religion, religion, ritual, cooperation, costly requirements, Christianity

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In recent years there has been a growing body of work exploring religious belief and practice from a broadly evolutionary perspective (Atran and Norenzayan 2004; Bulbulia 2004b; McNamara 2006; Sjöblom 2007; Slone 2008; Voland and Schiefenhövel 2009). Directing their attention to religious practice, a number of scholars have investigated the ways in which such practices can serve as signals of commitment and trustworthiness (Alcorta and Sosis 2005; Bulbulia 2004a, 2009; Cronk 1994; Henrich 2009; Irons 2001, 1996, 2002; Sosis 2003, 2005; Sosis and Alcorta 2003). This body of work grounds itself in signaling theory to explain the ways in which these signals of religious commitment are reliably conveyed (Akerlof 1970; Bliege Bird and Smith 2005; Cronk 2005; Grafen 1990; Lachmann, Szamado, and Bergstrom 2001; Spence 1973; Zahavi 1975). Using this theoretical framework, the many costly acts within religion are argued to be honest, hard-to-fake signals. Religiosity and commitment to the collective works of the group are necessarily abstract traits that would be hard for others to observe, making costly signals of those underlying traits a good venue for honest communication. Communication about each individual’s intentions towards the group is essential if the difficult task of overcoming collective action problems is to be achieved. Religious prescriptions and restrictions are also seen to help create and protect a more cohesive, dedicated religious group by weeding out free-riders and providing venues for signaling (Iannaccone 1992, 1994; Sosis 2003).

While there has been a good deal of theoretical exploration of the costly signaling theory of religion (Bulbulia 2009; Henrich 2009; Sosis 2003), empirical evaluations have been rather scant. What work has been done has largely been with
cross-cultural survey data or economic games (Bulbulia and Mahoney 2008; Soler 2008; Sosis 2000; Sosis and Bressler 2003; Sosis and Ruffle 2003). Here, I capitalize on a survey dataset of American Christian congregations to evaluate some of the predictions of the costly signaling theory of religion.

**DATASET**

The American Congregational Giving Study (ACGS) was a large survey project conducted from 1992 to 1995, and published as *Money Matters: Personal Giving in American Churches* (Hoge et al. 1995, 1996). The study aimed to elucidate church giving behaviors in American Christian congregations, with information gathered both on the opinions and practices of lay congregants and the strategies of the clergy to raise funds. 10,902 individuals from 625 congregations of five denominations are represented in the study. The five denominations are the Presbyterian Church (U.S.A.), the Evangelical Lutheran Church in America (ELCA), the Roman Catholic Church, the Southern Baptist Convention, and Assemblies of God. The 625 congregations are located in nine municipalities, one in each of the nine census regions of the United States to give a representative sample of the denominations. The five denominations included in the ACGS are some of the largest denominations in the United States, and represent a range of social and theological perspectives (Iannaccone 1994). For all of the analyses presented here, the Roman Catholic congregations have been excluded because of their uniqueness, as noted by Hoge et al (1996). Indeed, much of the book, and a large literature of work by others (e.g. Finke and Stark 2005), seeks to explain their aberrant
characteristics relative to other Christian denominations. The remaining four denominations cover the spectrum of American Christian religious conservatism, from the evangelical and Pentecostal Assemblies of God churches who preach the inerrancy of the Bible to the liberal ELCA churches choosing to ordain homosexual ministers.

The ACGS is composed of two parts, a congregational profile and lay questionnaires. The congregation profile, completed by a church leader with the help of a researcher, asks questions regarding: characteristics of the congregation and its members (such as age and race profiles), the types of amenities offered (such as prayer groups and parochial schools), congregational expenditures, the financial decision making process, and theological teachings. The lay questionnaire, mailed to 30 members’ homes (with a return rate of 58%), asks questions regarding: socioeconomic background (such as age, sex, education level, income, etc.), attitudes towards the congregation and the denomination, theological beliefs, and details of the amount of time and money given to the church. Together, these surveys provide detailed information about each congregation and the practices and attitudes of its members. Most importantly for this study, the congregational profile asks a question about church-based restrictions: “Does your congregation teach that Christian life should be safe-guarded through abstinence from: Certain kinds of food, Alcohol and/or tobacco, Gambling, Certain kinds of entertainment such as movies, night clubs, or dancing, Other.” This question gives clear information on the number and type of costly requirements each member is obligated to follow. For the analyses below, this question was used to generate a “strictness scale” for each
congregation (Olson and Perl 2001; Sosis and Bressler 2003), ranging from zero to five (Figure 1). The data from this question coupled with the detailed information on the giving habits and attitudes of the laity, provides an opportunity to evaluate the predictions of the costly signaling theory of religion.

This dataset has already been used to test the closely related economic theory of religion as put forth by Iannaccone (1992, 1994, 1998). Iannaccone focuses specifically on the type of costly requirements that the ACGS asks about, and argues that they can help to establish particularly strong, attractive churches with loyal members. Iannaccone views religion as a “club good,” meaning that its value is determined by the contributions of its members, and so highlights the difficulty that religious groups have in eliciting substantial contributions from their members. Iannaccone argues that costly prohibitions raise the cost of membership, thereby deterring free-riders hoping to reap the benefits of membership without contributing anything to the community. Prohibitions against activities such as gambling and dancing make partaking in social activities outside of religious life more costly, thereby making social activities with the religious community less costly and more attractive.

Olson and Perl (2001) used the ACGS to evaluate Iannaccone’s prediction that stricter congregations would have more committed members. When looking across all five denominations they found that a congregation’s strictness was positively correlated with the amount of money donated to and time spent in the church, but when looking within each denomination the correlations were almost all non-significant. Olson and Perl (2005) also tested Iannaccone’s (1994) prediction
that strict churches have fewer free- and cheap-riders. They constructed measures of the skewness of congregational giving, meaning the asymmetry of individual giving around the mean. Positive skewness would indicate that many congregants were giving little relative to a few large donators, meaning that there were many free- and cheap-riders. Olson and Perl found that the skewness of giving was significantly lower within congregations that prohibited alcohol and/or tobacco than in those that did not. They found that theological conservatism was also a significant predictor of skewness of giving, but stressed that theology and strictness were highly correlated with each other. As with their previous study, when denomination variables were added to the model, the effect of strictness (and conservative theology) dropped below a significant level.

While these studies by Olson and Perl (2001, 2005) and the original work by Hoge et al (1996) have already used the ACGS data to evaluate hypotheses similar to those proposed by signaling theory, their methodology can be improved to address questions explicitly formed to test the costly signaling theory of religion. Iannaccone’s work, though similar, is not equivalent to it. Importantly, the economic approach does not acknowledge the communication and signaling that is so central to the human behavioral ecology approach. As a result, the work of Olson and Perl does not recognize the potential effect of religious signaling on their variables of interest. For example, their use of time spent in church activities as a dependent variable overlooks the fact that it is an easily observable signal of individual commitment, not just a consequence of internalized belief. Additionally, the methodology of these three studies is surprisingly basic, and statistical analyses
more suited to the dataset are clearly called for. This study will aim to correct some of these shortcomings, and provide a better test of the costly signaling theory of religious practice.

**HYPOTHESES**

This dataset allows for the testing of three interrelated hypotheses. The primary hypothesis to be tested is that congregations with more costly requirements will evince greater group commitment, as seen through relatively larger monetary donations by members and statements of loyalty to the congregation. Focusing on the level of the individual rather than that of the group, I predict that the number of costly requirements will be a significant predictor of congregants’ financial donations and stated commitment (Hypothesis 1). This hypothesis follows from signaling theory (Sosis and Bressler 2003) and the economic work of Iannaccone (1992, 1994), which argue that bans on secular activities simultaneously raise the cost of membership and inculcate greater commitment in those who are willing to pay the cost. This greater dedication in members of strict churches should translate to larger donations to and greater satisfaction with the church by its members.

Signaling theory and an economic view of religion both lead to further testable hypotheses regarding the ability of the individual to shoulder the costs of these restrictions. Iannaccone (1992, 1994) predicts that stricter congregations will have more members from lower socioeconomic backgrounds, since the costs of membership will be lower for those giving up less in the secular world: “The costs
[of joining a ‘sectarian’ group with many prohibitions] are substantially less, and hence the odds of joining substantially higher, for people with limited secular opportunities, such as those with low wage rates, limited education, or minimal job experience” (Iannaccone 1994:1201). This premise is at the core of signaling theory, which asserts that costs are relative, not absolute, and depend on the condition of the signaler (Johnstone 1997). Following this, I predict that congregations with more costly requirements will have (1) a higher percentage of low-income congregants, and (2) a lower percentage of congregants with a university degree (Hypothesis 2).

Finally, I predict that the number of programs offered by a congregation will be positively correlated with the number of costly requirements it teaches (Hypothesis 3). These programs can be seen as a measure of the congregation’s ability to overcome collective action problems. Successfully run programs such as youth groups, Bible studies, outreach programs, etc. all require coordination and cooperation among those involved. Given the argument above that stricter churches will have more dedicated, committed members, it follows that they should be more adept at coordinating their action toward a public good.

**METHODS**

The ACGS survey databases can be accessed online through the Association of Religion Data Archives (http://www.thearda.com/). The main explanatory variable, the level of strictness of each congregation, was determined by tallying the number of costly requirements advocated by each congregation (Olson and Perl
The dependent variable of annual donations to the congregation was square root transformed to account for the substantial positive skew of the data. In the presentation of the results below, however, the values for donations are presented as untransformed to reflect actual monetary value for ease of interpretation.

I use linear mixed models (LMM) in SPSS to analyze the data. Linear mixed models, also known as hierarchical linear models or multilevel models, are used when the data are hierarchical, such that subjects are nested within groups and observations are consequently not independent of each other (Gelman and Hill 2007; Snijders and Bosker 1999). The ACGS data are certainly hierarchical in nature: individuals are nested in congregations, which are nested in denominations. Standard statistical methods assume independence of observations and therefore obtain artificially small estimates of standard errors, leading to spurious significant results. Linear mixed models do not assume independence of observations, and so give more accurate results while also using all of the data instead of improperly aggregating or disaggregating it. Furthermore, LMMs can simultaneously analyze variables operating at different hierarchical levels, letting the researcher easily create one inclusive model. Additionally, by specifying the hierarchical levels as random factors, the results are made generalizable to the entire population from which these groups were sampled. In this case, that means that the results are applicable to the larger population of American Christian denominations, not just the four analyzed here.
**Results**

*Hypothesis 1:* The number of costly requirements was found to be a significant predictor of individual monetary donations to the church. The congregation-level strictness score was found to have a significant positive effect on money donated ($F = 2.485, p = .031$) (Table 1). Relative to a null model including congregation and denomination as random effects, the final model including congregation strictness and individual income (obviously strongly tied to one’s ability to donate to the church) as fixed factors reduced the between-congregation variation from 35.71 to 18.90, meaning that those two factors explain about 47% of the variance in donations between congregations and resulting in an improved goodness-of-fit measure. For the six levels of strictness (0 to 5 costly requirements), only two were significantly different from 0 costly requirements (the reference category): 1 costly requirement ($t = 2.471, p = .014$) and 2 costly requirements ($t = 2.243, p = .026$) (Table 2). The estimated marginal means of donations for the strictness scale are displayed in Figure 2. Income, as expected, was also highly significant ($F = 643.886, p = .000$), and all levels were highly significantly different from the reference category (income less than $20,000 a year). The model was also run with each individual costly requirement as a fixed effect instead of the strictness scale. None of the models resulted in significant effects for the particular costly requirement.

To test if there was greater satisfaction with and commitment to the congregation with greater strictness, I also ran models with the dependent variable as the degree to which an individual agreed with the statement, “If I had to change
the congregation I attend, I would feel a great sense of loss.” Strictness level did not have a significant effect on this stated measure of commitment ($F = 1.22, p = .304$).

**Hypothesis 2:** As expected, a congregation’s strictness scale was found to be negatively correlated with education and income levels. Other fixed factors were included that also accounted for some of the variance in the education levels of congregants: the total receipts of the congregation, its location (ranging from urban city to rural), the number of programs offered by the congregation, and a variable getting at theological conservatism and evangelism. Even with these variables included, congregations with more costly requirements had significantly fewer members with college degrees ($F = 5.047, p = .000$). The three highest levels (3 to 5 costly requirements) were significantly different from the reference category (0 costly requirements) (Table 3, Figure 3). Similarly, congregations with more costly requirements had significantly more members with a yearly income of less than $20,000 ($F = 3.533, p = .005$). All fixed factors were again included, and again, the three highest levels of strictness (3 to 5 costly requirements) were significantly different from the reference category (0 costly requirements) (Table 4, Figure 4). These models show that the strictness of a congregation has a significant effect on its socioeconomic profile, with greater requirements associated with a higher percentage of members with low socioeconomic status.

**Hypothesis 3:** In a simple correlation, the number of programs a congregation offers and the number of costly requirements it advocates were shown
to be significantly positively related in a straight bivariate analysis \((r = .231, p < .001)\). As the number of programs a church offers will depend both on its membership and its monetary resources, I additionally controlled for membership and total receipts, as well as denomination, and still found there to be a highly significant correlation \((r = .142, p < .001)\). These correlations demonstrate a significant relationship between the number of programs a congregation offers and its strictness.

**DISCUSSION**

General support was found for the main hypothesis that individuals in stricter congregations give larger sums of money to the congregation, suggesting that congregations that call for more sacrifices have members who show greater commitment to the group. The strictness scale variable did have a significant effect on the amount of money given by individuals, and a general trend of increasing donations with increasing strictness was observed for the three lower levels of strictness.

The lack of a clear significant difference between the least strict and the strictest congregations (those with 3-5 costly requirements), though, does not seem to fit the predictions. Looking at the previous research using the ACGS, though, it is surprising that any positive evidence for the effect of costly requirements on donations was found at all. The vast majority of the variance in strictness can be attributed to between-denomination differences: in a variance component model, variance between denominations accounted for 78% of the variance (variance
component = 2.35, $SE = 1.925$, Wald $Z = 1.222$, $p = .222$). Even if the between-denomination variance component was actually at the lower bound of its 95% confidence interval and the within-denomination variance component at its upper bound, between-denomination differences would still account for 40% of the variability in strictness. It is this characteristic of strictness that made Olson and Perl's (2001) OLS regressions of strictness insignificant when looking within each denomination, but significant when pooling all five denominations together. The linear mixed models used in this study were better equipped to deal with this pattern of variance, and so resulted in significant results for the strictness scale even when denomination had been taken into account. Still, the substantial between-denomination differences are not simply erased in linear mixed models. The vast majority of congregations with 3-5 costly requirements are Assemblies of God and Southern Baptist. These two denominations have very similar profiles, so the between-congregation differences are quite slight once denomination is essentially controlled for in the LMM model. Without sufficient variation between congregations, the overall pattern of a significant relationship between strictness and donations was not found in the stricter congregations. Again, that a significant relationship was found in spite of this is telling both of the utility of linear mixed models and also of the weight of this result.

The lack of any significant effect of strictness on stated loyalty to the congregation does not pose a great threat to the costly signaling theory of religion. There is a general issue of biases with survey data, and this is especially acute when dealing with questions regarding people's stated beliefs. Answers to opinion
questions are pushed towards positive affirmation by the subtle pressure respondents may feel to give the socially or theologically ‘correct’ answer (Burris and Navara 2002). In keeping with this, the distribution of responses to the “great sense of loss” question was highly skewed towards affirmative answers: 70.6% said they either strongly or moderately agreed with the statement, while only 12.5% disagreed (the rest were undecided). This lack of variation makes finding any effect of strictness highly unlikely. Monetary donations, as a more concrete measure of commitment to the church and one less open to external pressure, is a much more appropriate measure.

The models testing the relationship between strictness and socioeconomic status also found strong support. Congregations with more costly requirements did indeed have higher percentages of low-income members and lower percentages of university-educated members. The socioeconomic profiles of particularly strict congregations (3 to 5 costly requirements) were highly significantly different from those of congregations with no costly requirements. So, stricter congregations are more attractive to individuals of lower socioeconomic status. This may well be because of the heightened opportunity costs associated with costly requirements that Iannaccone highlights (1992, 1994). People who are successful in their professional and social lives would have a high opportunity cost associated with the costly prohibitions of religious groups. Not being able to socialize freely with others could have a dramatic impact on one’s professional and private life. For those of lower socioeconomic status, those costs may be slightly smaller and the potential benefit from membership to the religious group greater. These findings hint at the
actual material costs associated with the costly requirements imposed by religious groups, and the effects they have on group membership.

The number of programs a congregation provides and the number of costly requirements it imposes were also found to be highly significantly correlated. Being able to maintain many church programs requires the work of many dedicated individuals. In this light, churches that are able to sponsor many groups are most likely also those that foster powerful, moving religious experiences for their members. Furthermore, each program offered demonstrates a congregation’s ability to overcome the collective action problems that make such organizations challenging. Churches that can offer more programs are therefore showing the concrete benefits attained from their cooperative, cohesive community. As the resources and size of each congregation were controlled for, the significance of the relationship between strictness and the number of programs implies that stricter congregations are better able to overcome collective action problems. This then shows the true benefits of the costly constraints group members follow – such immediate costs do seem to translate into trusting, cooperative groups.

**Conclusions**

Overall, the results testing these three hypotheses provide broad support for the costly signaling theory of religion. Members of more demanding congregations are generally more committed to those congregations than members of more lenient ones. It seems that individuals are signaling their commitment to the group both by adhering to the costly requirements and by conspicuously spending time in church
activities. Additionally, the more demanding congregations have a greater proportion of members of low socioeconomic status, reflecting the lower costs and greater perceived benefits of membership for those individuals. Finally, the costs of membership do seem to have a substantial reward: congregations with higher membership costs are better able to overcome collective action problems, as seen through the greater number of organizations they can maintain. These findings have implications for the costly signaling theory of religion and raise particular issues that deserve further discussion.

Given the relationship between a congregation’s costly requirements and the characteristics and behaviors of its members, a broad exploration of costly requirements is in order. The requirements recorded in the ACGS study are all costly restrictions, fulfilling Sosis and Bressler’s (2003:219) definition of one type of costly requirement:

Behaviors that might have entailed somatic or reproductive benefits that are restricted by a [religious group] or restrictions that limit an individual’s ability to achieve these benefits from nongroup members. Behaviors or behavioral restrictions are thus costly if they stigmatize members or entail individual sacrifice. This definition highlights two of the ways in which costly requirements can be costly: (1) there can be a direct cost associated with forgoing opportunities (such as not eating available prohibited food or not having sexual relations outside of marriage), and (2) there can be an indirect cost associated with restrictions that impact social interactions and limit potentially beneficial relationships (such as not being able to go for a drink with coworkers). While we cannot easily quantify
exactly how costly the restrictions in the ACGS are, it should be clear that there are real costs associated with them.

There is a third way in which costly restrictions become costly and serve as honest signals: (3) there can be cost associated with faking commitment and breaking the prohibition (Lachmann et al. 2001). For these social constraints, much of the cost associated with the rules may actually come not from the immediate costs of forgone opportunities, but from the consequences for not abiding by the rule. Infractions, if exposed, can result in punishment, ranging from social ridicule to expulsion from the group. This threat of punishment can be a strong motivator to follow the required constraints (Sosis 2005). As Iannaccone (1992, 1994) stresses, this threat of punishment for transgressions makes participation in activities outside of the group more costly, thereby making those inside the group more attractive. Though we have information on the costly requirements placed on members of each congregation, we have no information on how such requirements were enforced, if at all. Without knowledge of how each congregation enforces its costly constraints, we cannot grasp exactly how costly each is. For this study, though, identifying the actual costs is not as important as identifying the relative costs from congregation to congregation, which is possible using the total number of constraints. There does seem to be some evidence that costly restrictions make church activities more attractive: there is a significant positive correlation between the average amount of time congregants spends in church activities and its strictness scale ($r = .162$, $p<.001$, controlling for denomination), as well as between the average frequency with which congregants attends worship and strictness ($r =$
These results suggest that some combination of the direct costs of the constraints and the threat of punishment for violating them help to ensure that members of strict congregations are committed and actively involved in church life.

Costly requirements are one part of a larger system of signals operating within religious groups. Because of the nature of the dataset, this study could only focus on this single aspect of the system, but it is likely that the strictness scale is indicative of a larger system of costly and honest signals of commitment. The strictness scale, for example, is significantly positively correlated with congregational responses to a question asking how “typical” their teachings are relative to other churches in the denomination ($r = .156, p < .001$, controlling for denomination). Congregations with more costly constraints are more likely to have responded, “We tend to be stricter in interpreting Christian teachings than are most churches in our denomination.” This combination of theological and social strictness means that those congregations that impose many costly requirements are likely those that are generally demanding and conservative.

In addition to costly requirements, participation in religious rituals serves as a primary venue for signaling to co-members (Alcorta and Sosis 2005; Bulbulia 2009; Rappaport 1994, 1999; Sosis 2003). First, many rituals involve substantial physical costs and risk serious bodily harm or even death. More commonplace rituals, such as the Sunday worship services practiced in all of the ACGS congregations, involve a general cost of time and energy, which could have been invested in some other beneficial activity. As with the other costly requirements,
such ritual costs will dissuade skeptical individuals who are not fully committed to the group, making those that participate much more likely to be honestly communicating their loyalty and belief. Whereas costly requirements are only observable when transgressed, ritual participation lets others easily observe commitment through the regularity and intensity of worship. Collective rituals provide ample opportunity to give and observe signals of belief, group commitment, and adherence to the group's moral norms (Alcorta and Sosis 2005; Rappaport 1999; Sosis and Bressler 2003).

Especially important is the content of the rituals, namely their emotionally rich affirmations of belief in the supernatural. As Rappaport (1999) argues, the empirically unverifiable nature of the supernatural means that religious individuals must verify their belief in the supernatural emotionally. The intense emotions experienced during collective rituals become the proof justifying the belief and all the concomitant behaviors associated with that belief, including the costs of membership to a religious group (Alcorta and Sosis 2005; Bulbulia 2004a). As ritual participation inculcates belief, one's perception of the benefits and costs of membership change, increasing commitment (Sosis 2003). Beyond this personal verification and reinforcement of belief, the emotions evoked in rituals communicate that belief to others. Emotions are particularly hard-to-fake signals (Frank 1988), and their easy observance by others makes rituals particularly good venues to evaluate the commitment of others and police for free-riders (Bulbulia 2004a; Schloss 2008). While the ACGS did not provide information on signaling in worship services, the positive correlation between frequency of worship attendance
and strictness ($r = .191, p<.001$, controlling for denomination) does suggest that congregations with members who are signaling commitment through adherence to costly requirements are also signaling commitment through frequent participation in ritual activities.

The signaling theory of religion is a young field, and many fruitful avenues for expanding our understanding of it still remain unexplored (Sosis 2003). Much of the “adaptationist” work done so far has relied on tapping pre-existing data sources (Johnson 2005; Roes and Raymond 2003; Sosis 2000; Sosis and Bressler 2003; Wilson 2005), and this study is no exception. Such work is clearly necessary to establish the merit of the approach and refine its conceptions. As the field matures, however, more effort should be placed on collecting data tailored to test particular questions of signalling theory, and that work has begun (Bulbulia and Mahoney 2008; Ruffle and Sosis 2006; Soler 2008; Sosis and Ruffle 2003). In addition to the game-theoretic studies, other methods of experimentation and observation should be used. In-depth fieldwork would be particularly beneficial, as the particular behaviors of individuals could be observed, allowing for greater refinement of a theory that is essentially focused on the individual. Additionally, longitudinal studies would provide information in changes in religious practice over time, and the consequences such changes have on intragroup cooperation.

Beyond these methodological goals, some particular topics within the signaling theory of religion deserve greater attention. Establishing the relative costs associated with costly signals is a pressing task: celibacy clearly has a different cost associated with it than wearing hijab, though is it not immediately clear how either
cost could be measured for a single individual, let alone generalized to the wider population. As highlighted in the discussion above, punishment for defecting may be a particularly important way in which costly requirements are actually costly. Quantifying not only the immediate costs of particular behaviors, but also such additional potential costs is necessary. Similarly, a better understanding of the interaction between the different types of signals would be beneficial. For example, knowing how the costly requirements under study here relate to and differ from signaling in ritual behavior would have revealed much more about the larger system of signals. Finally, signals are not communicating a presence or absence of any trait, but rather are communicating its relative quality. Researchers should attempt to observe the strength and intensity of signals, not just their presence. While the research presented here has not been able to provide a complete evaluation of the costly signaling theory of religion, it should be clear that this approach (and the larger body of evolutionary approaches to religion) has substantial analytical purchase. Hopefully, further theoretical and empirical work will continue to expand and refine our understanding of religious practice and belief.
BIBLIOGRAPHY


http://dx.doi.org/10.1007/978-3-642-00128-4.


**Figures**

**Figure 1:** Chart and graphs showing the number of costly requirements imposed by congregations. The top graph shows the number of costly requirements divided into denominations. The bottom graph (displayed upside down) shows the same data summed for all denominations.

<table>
<thead>
<tr>
<th>Number of Congregations</th>
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<tbody>
<tr>
<td>0 costly req.</td>
</tr>
<tr>
<td>Assemblies of God</td>
</tr>
<tr>
<td>Southern Baptist</td>
</tr>
<tr>
<td>Catholic</td>
</tr>
<tr>
<td>ELCA</td>
</tr>
<tr>
<td>Presbyterian (USA)</td>
</tr>
<tr>
<td>Total</td>
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**Table 1:** Type III Tests of Fixed Effects, the dependent variable is monetary donation

<table>
<thead>
<tr>
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<th>Estimate</th>
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<th>p</th>
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</thead>
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<td>4.338</td>
<td>5.621</td>
<td>.010</td>
</tr>
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<td>5 costly requirements</td>
<td>1.407</td>
<td>2.758</td>
<td>0.510</td>
<td>.610</td>
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<td>4 costly requirements</td>
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<td>1.591</td>
<td>-0.142</td>
<td>.887</td>
</tr>
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<td>3 costly requirements</td>
<td>1.773</td>
<td>1.314</td>
<td>1.349</td>
<td>.178</td>
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<td>3.368</td>
<td>1.502</td>
<td>2.243</td>
<td>.026</td>
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<td>1 costly requirements</td>
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<td>.014</td>
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<tr>
<td>0 costly requirements</td>
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<tr>
<td>Income $80,000+</td>
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<td>Income $20,000-$49,999</td>
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<tr>
<td>Income &lt;$20,000</td>
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<td>0</td>
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</tbody>
</table>

**Table 2:** Parameter Estimates of Fixed Effects, the dependent variable is monetary donation (sqrtgivmon1). Note: All estimates are square-root transformed, representing estimates for the square root of donations. References categories (low income and 0 costly requirements) are set to zero, with all other estimates showing the difference from that reference category.
Figure 2: Estimated Marginal Means (squared to give actual monetary amount) of donations for the six levels of strictness. The error bars represent the standard error.

Table 3: Parameter Estimates of strictness (other fixed effects not shown), the dependent variable is the percentage of congregation with a university degree. References category (0 costly requirements) is set to zero, with all other estimates showing the difference from that reference category.
Figure 3: Estimated Marginal Means for the percentage of college-educated members for the six levels of strictness. The error bars represent the standard error.

Table 4: Parameter Estimates of strictness (other fixed effects not shown), the dependent variable is the percentage of congregation with an income under $20,000. References category (0 costly requirements) is set to zero, with all other estimates showing the difference from that reference category.
Figure 4: Estimated Marginal Means for the percentage of low-income members for the six levels of strictness. The error bars represent the standard error.