



# Why churches need free-riders: Religious capital formation and religious group survival



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## ABSTRACT

Prevailing theory claims that churches thrive when they overcome the free-rider problem. However, this paper argues that religious organizations need free-riders in a dynamic setting. If individuals' contributions to congregations increase as their exposure to religion increases, then allowing potential members to free-ride temporarily may increase future membership and contribution levels. Free-riders thus comprise a risky but necessary investment by the church. Strict churches screen out riskier investments yet still allow some free-riding, while ultra-strict churches screen out all but members' children. This new theory yields predictions consistent with stylized empirical facts.

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## 1. Introduction

Economic theories of collective religious production derive primarily from [Iannaccone \(1992, 1994\)](#).<sup>1</sup> He observes that many religious goods are collectively produced and thus susceptible to free-riding. Because churches have difficulty identifying and excluding free-riders directly, they resort to an indirect method to obtain high contributions from their members: members may be required to undertake observable behaviors—such as wearing distinctive clothing or abstaining from certain forms of consumption—that generate costly stigmas but serve to signal commitment to the group. Those who would be free-riders are screened out of the religious group. This *stigma-screening theory* accurately predicts that strict churches with these requirements will have fewer free-riders, higher contributions,

and higher quality religious goods than non-strict churches.<sup>2</sup> The seemingly irrational behaviors required by strict churches can thus be understood as a way to screen out free-riders and thrive in the religious marketplace.

However, other evidence suggests that the stigma-screening theory is incomplete. Strict churches still have free-riders, which suggests that stigma-screening falls far short of eliminating free-riding. Moreover, many religious groups, contrary to the spirit of screening and exclusion implied by the stigma-screening theory, are very welcoming to individuals who contribute little or nothing to the group. Perhaps most puzzling of all is that these groups might expend costly resources reaching out to these individuals, resources that could be spent on the internal production of goods that could be consumed by contributing members. Why do churches—even strict ones—allow or even welcome free-riders? Does their presence undermine the stigma-screening theory?

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<sup>1</sup> The economic research on religious organization is one of many areas of the research on the economics of religions. E.g., an individual's utility may depend on actions related to afterlife benefits (e.g., [Azzi and Ehrenberg, 1975](#)) or be due to a rational addiction to religion (e.g., [Iannaccone, 1990](#)); religious suppliers may behave as rent-seeking monopolists (e.g., [Ekelund, 1996](#)) or as producers of club goods (e.g., [Iannaccone, 1992; 1994](#)); and regulations may inhibit both religious pluralism and religious participation. (e.g., [McBride, 2008](#)). Iannaccone's argument that the collective nature of religious production creates a religious free-riding problem is the primary one considered in the field. However, we note that there could be other factors that reinforce the problem. Notably, many religious services are not priced, and allowing open access to private religious goods can create an additional incentive to free-ride.

<sup>2</sup> The vitality of strict churches was first noted by [Kelley \(1972\)](#) and then developed theoretically by [Iannaccone \(1994\)](#). Empirical evidence confirms that members of strict churches donate more money on an average to their churches (e.g., [Hoge, 1996; Iannaccone, 1994; Olson and Perl, 2001](#)), and that donations are less skewed in strict churches than in other churches so that the higher average contributions in strict churches is due to everyone contributing more and not just a smaller proportion of very large contributors ([Iannaccone, 1994; Olson and Perl, 2005](#)). These two facts imply that strict churches have relatively fewer free-riders than other churches, which, in turn, provides an explanation for why strict churches grow faster than non-strict churches ([Iannaccone, Olson, and Stark, 1995](#)).

This paper argues that a church's optimal strategy in a dynamic setting is to manage but not eliminate all free-riding. The argument relies on the notion of religious capital, i.e., an individual's set of skills, experience, knowledge, and familiarity tied to a specific religious group's doctrine, structure, and norms (Iannaccone, 1990). As religious capital grows, so does an individual's marginal value of participation and their willingness and ability to contribute to the group. By allowing some individuals, who are not yet willing to contribute, to consume the religious goods today, the church makes an investment in their religious capital with the hope that they contribute in the future. Indeed, because contributors are not born but must be produced, a church *must* allow a degree of free-riding to survive over time; otherwise its stock of high capital contributors will eventually be depleted.

This logic reconceptualizes the prevailing stigma-screening theory by placing it in a dynamic context. A church's investment in members is risky because not all individuals who consume the good become contributors. The investment is also costly because the free-riders consume church resources and decrease average contributions, thereby decreasing the quality of the church's religious services. Hence, a church does not want just anyone to free-ride; it prefers to invest in individuals with higher expected returns on the investment. By increasing the cost of membership, the church screens out those less likely to form high religious capital. Whereas the original theory states that requiring members to undertake stigmatizing behavior screens out free-riders, the new theory developed here states that the behavioral requirements screen out those *more likely to remain* free-riders. Moreover, this new theory accounts for different kinds of strict church strategies by distinguishing strict churches like the Jehovah's Witnesses and Seventh-day Adventists that seek converts from the ultra-strict groups like the Amish and Hasidic Jews that focus on growth through internal fertility. This distinction between strict and ultra-strict is ignored in previous theory.

Earlier research using a "rational choice" or related approaches to religion<sup>3</sup> acknowledges that accommodating potential contributors serves a dynamic purpose, yet it has not constructed a general theory of free-riding and religious capital formation. Miller (2002) uses a "strategic management perspective" in claiming that "Reducing the demands placed upon potential customers eases them into a religious organization" thereby fostering membership growth (445). I draw inspiration from Miller's work but develop this key idea in a greater depth and in new directions. Specifically, I distinguish different types of free-riders of interest to the group (potential recruits and children), include the possibility of risky (probabilistic) religious capital formation, and examine growth strategies of both medium and high-strictness groups. McBride (2007) identifies many of the practices and policies of the Church of Jesus Christ of Latter-day Saints (Mormon) as investments in less-committed members' religious capital but does not generalize his idea. That free-riders play a role in the dynamic growth of megachurches has been noted and examined by Thumma and Travis (2007) and von der Ruhr and Daniels (2012). My argument here explicitly and formally combines *dynamic* religious capital formation with *static* stigma-screening in a more general church setting. It explains why churches need not eliminate free-riding so much as they must strategically manage it by maintaining a

certain type of heterogeneity in the membership. Stigma-screening, which homogenizes membership in a different dimensions, serves a complementary purpose.

After briefly reviewing the original theory and evidence on free-riding in churches in Section 2, Section 3 presents a verbal description of the new theory and how it relates to the original theory. Section 4 then presents a formal game-theoretic model of free-riding and religious capital formation. Similar to the original theory, the new theory predicts the empirical facts mentioned earlier, i.e., that strict churches will have a smaller proportion of free-riders than easy-going churches and that contributions in strict churches will be less skewed than in easy-going churches. Yet, it also makes a new prediction that both strict and non-strict churches will welcome certain types of free-riders, and that ultra-strict and strict groups will have different membership compositions. Section 5 concludes with a brief discussion of the key insights.

## 2. Assessing the stigma-screening theory

While some private religious goods, such as the communion with deity associated with prayer, meditation, and other personal devotional activities, are produced and consumed by an individual, many religious goods are produced collectively. The financial contributions of many people are needed to build and maintain a meetinghouse and fund various religious activities such as social events or proselytizing, clergy salaries, and more. Other contributions in time and emotional effort create shared religious fervor, build meaningful bonds among members, reinforce members' religious beliefs, and may even help reduce certain financial obligations (e.g., members can perform basic maintenance on the building to reduce operational costs) so that funds can be spent for other activities. But because of the positive externality present, it is rational for an individual to free-ride on others' contributions.<sup>4</sup> If this incentive exists for many members and if they all free-ride, then the church will receive relatively low contributions and, consequently, produce low quality religious goods and services.

Iannaccone (1992) and Iannaccone (1994) recognized that churches are limited in their ability to identify and exclude free-riders and argued that many churches have developed a second-best method to limit free-riding. The stigmatizing and often peculiar behaviors required by strict churches, such as wearing distinctive clothing, abstaining from certain foods or drinks, and moving to a commune, all raise an individual's cost of membership by raising the cost of secular activities. A classification of American denominations into six strictness levels is provided in Table 1. The stricter the church, the larger and more extensive the behavioral expectations for church members. Because these behaviors are easier to observe than other actions associated with religious effort, a church can condition membership and access to the church's goods on compliance with these observable behaviors. These behavioral requirements limit free-riding if the associated costs are relatively lower for religiously committed individuals than for free-riders. By sufficiently raising the cost of membership, the free-riders will screen themselves out of the group, and as long as the cost is not prohibitively high, the committed types will sort into the group. This solution leaves participating members better off than without the stigma-screening although they are suffering the stigma.

<sup>3</sup> Warner (1993) characterizes the rational choice approach to religion as a new paradigm. See (Chaves, 1995; Demerath, 1995; Ellison, 1995; Iannaccone, 1995), and the essays in Young (1997) for descriptions, defenses, and critiques of the rational choice approach. Iannaccone (1998) reviews the work by economists. Not all researchers fully agree with the new view. To some, the once dominant secularization hypothesis, exemplified by Berger's 1967 *Sacred Canopy* thesis which predicted a decline in religion with modernization, has transformed into a neo-secularization theory (Yamane, 1997), which, according to a popular undergraduate text, is less a predictive theory than a useful descriptive concept about the many ways religion changes in response to modernization (Roberts, 2004). Others hold fast to a traditional secularization hypothesis (e.g., Bruce, 2002).

<sup>4</sup> It is useful here to clarify what I mean by free-riding. One definition of free-riding is consuming while contributing zero to production – literally riding for free. Of course, many people, so-called *cheap-riders*, consume while contributing very small but non-zero amounts. Any definition assumes a threshold below which a contribution is considered free-riding. This threshold is not simply a one-to-one consumption-to-contribution ratio because even high contributors in the presence of positive externalities receive benefits that far exceed their individual contributions. In the model below, free-riding will be explicitly defined, but for the sake of discussion, I assume that such a meaningful threshold exists.

**Table 1**  
Classification of American denominations by strictness.

Ultra-strict	Amish Hare Krishnas Hasidic Jews
Strict	Assemblies of God Jehovah's Witnesses Latter-day Saints Nazarenes Orthodox Jews
Conservative	Conservative Jews Missouri Lutherans Seventh-day Adventists Southern Baptist Convention
Moderate	American Baptists Lutherans
Liberal	Episcopalians Methodists Presbyterians
Ultra-liberal	Reform Judaism Unitarian Universalists United Church of Christ

Notes: This classification is adapted from Ch. 8 of [Stark and Finke \(2000\)](#).

**Table 2**  
Financial contributions by religious group.

	(a) Avg. yearly contr. (\$)	(b) Skew	(c) Average percent income contr. (%)	(d) Skew	(e) Obs.
Strict					
Latter-day Saints	1713.05	1.19	6.2	1.96	79
Assemblies of God	913.64	2.69	5.0	3.19	33
Southern Baptist Convention	734.10	5.78	3.0	3.61	375
Nazarenes	631.63	2.02	3.4	1.12	16
Missouri Lutherans	567.59	1.39	1.5	0.88	49
Jehovah's Witnesses	303.79	3.48	2.0	3.69	29
Strict combined	839.07	4.76	3.4	3.29	581
Not strict					
Presbyterians	722.06	4.98	2.5	4.64	104
United Church of Christ	653.70	1.35	2.5	1.10	20
Lutherans	472.52	4.32	1.7	5.33	98
Episcopalians	412.72	3.38	3.5	7.94	76
United Methodist Church	379.97	5.46	1.9	5.89	251
Unitarian Universalists	309.09	2.33	0.8	1.90	11
Not strict combined	472.53	5.96	2.2	13.84	560
Other					
Catholic	290.50	6.83	1.2	13.20	878

Notes: Data from General Social Survey, 1987–1989. Only observations with the INCOME86 and TITHING variables were included. Income variables set to middle of income range reported, with those earning more than \$60,000 counted as earning \$70,000. Latter-day Saints includes those with OTHER variable 59, 60, 62, or 64 to reflect various labels of LDS Church. Presbyterian includes those with DENOM variable 40, 41, or 42 to reflect 1983 merger resulting in the Presbyterian Church (U.S.A.). Lutheran includes those observations with DENOM variable 30, 31, or 35 to reflect 1988 merger resulting in the Evangelical Lutheran Church in America.

This logic yields multiple hypotheses that are supported by empirical evidence. First, because strict churches should have proportionally fewer free-riders, they should receive higher average contributions (both monetary and non-monetary) from their members. Second, because the screening process should yield more homogeneous and highly committed memberships within strict churches, the skewness of the distribution of members' contributions should be lower in strict churches than in easygoing churches. These hypotheses have been tested in an extensive literature, and the general conclusion is that the predictions are verified ([Hoge, 1996](#); [Iannaccone, 1992](#); [1994](#); [Olson and Perl, 2001](#)). [Table 2](#) provides one snapshot of the evidence that uses financial contributions to proxy for religious

**Table 3**  
Members' self-reported grades of own religious group.

	(a) Average self- reported grade	(b) Obs.
Strict		
Latter-day Saints	3.81	22
Jehovah's Witnesses	3.80	10
Assemblies of God	3.50	6
Nazarenes	3.00	2
Southern Baptist Convention	2.99	85
Missouri Lutherans	2.95	19
Strict combined	3.19	144
Not strict		
United Church of Christ	3.11	9
Lutherans	2.97	31
United Methodist Church	2.86	65
Episcopalians	2.71	21
Presbyterians	2.60	30
Unitarian Universalists	2.33	3
Not strict combined	2.82	159
Other:		
Catholic	2.79	227

Notes: Data from General Social Survey, 1988. The question asked, "Using the school grading system of A, B, C, D, and F for Fail, how do you rate your church or religious group in meeting your spiritual needs?" A is counted as 4, B as 3, C as 2, D as 1, and F as 0. Latter-day Saints includes those with OTHER variable 59, 60, 62, or 64 to reflect various labels of LDS Church. Presbyterian includes those with DENOM variable 40, 41, or 42 to reflect 1983 merger resulting in the Presbyterian Church (U.S.A.). Lutheran includes those observations with DENOM variable 30, 31, or 35 to reflect 1988 merger resulting in the Evangelical Lutheran Church in America.

effort. Members of strict churches tend to donate a higher level and a higher percentage of their income to their churches than members of non-strict churches, and those contributions are less skewed in strict churches.<sup>5</sup> A third prediction is that strict churches should provide larger benefits to their members than other churches. Though such benefits are difficult to measure because many of them are psychic in nature, some insight can be gleaned from the 1988 General Social Survey, which includes a question asking the respondent to grade how well her church meets her spiritual needs. As shown in [Table 3](#), members of strict churches generally report higher self-reported grades than members of easygoing churches. Because these data do not constitute a random sample (i.e., people can select themselves into religious groups) and we have a small number of observations for many denominations, they are only suggestive. Nonetheless, they indicate that members of strict churches are more satisfied with their churches, which, in turn, suggests that they believe their churches provide them meaningful benefits.

However, other evidence suggests a rethinking of the theory. Although the distribution of contributions is less skewed in strict churches than in non-strict churches, contributions are still skewed in strict churches. [Iannaccone \(1997\)](#) explains that skewness should be expected given natural variation in percentage giving rates, variation in income levels, and a weak correlation between income and contribution rates, but the skewness is also likely related to the existence of free-riders that are not being screened out of the group. Some members are high contributors with strong religious convictions, while others are free-riders to varying degrees. Indeed, the presence of even a large portion of non or low-contributing members is evident in very successful groups. For example, while there are nearly 8 million Jehovah's Witnesses worldwide who actively preach door-to-door each month, a similar number of individuals attend Jehovah's Witnesses

<sup>5</sup> [Olson and Perl \(2005\)](#) explain that comparing skewness between strict and easygoing churches is more appropriately done at the congregation, not denomination, level. That level, of course, cannot be analyzed with GSS data. But because I am interested in only illustrating the facts, the denomination level data are sufficient for my purposes.

meetings but do not actively contribute.<sup>6</sup> Any stigma-screening, if at work as all, clearly falls far short of eliminating free-riding.

It is also true that religious groups are generally very welcoming to individuals who contribute little to the group. Many churches keep their facilities open for strangers to enter and use without expecting anything in return. Churches also happily welcome large crowds of infrequent attendees during holiday services even when those individuals commonly known to contribute little to the church. For example, a large portion of weekly attendance at American megachurches (congregations which 2000 + average weekly attendance) consists of individuals that do not contribute large amounts of time or money to the church's activities. Only 46% of megachurch attendees participate in the small midweek groups considered to be the central focus of worship (Bird and Thumma, 2011). The remaining majority enjoy the benefits of the large-scale services without contributing the time and effort of the more dedicated members. Providing this service for the free-riding majority, rather than screening the majority's access, is a key part of the megachurch operations.

McBride's (2007) detailed examination of free-riding in the Church of Jesus Christ of Latter-day Saints (LDS) is particularly instructive. The LDS Church is strict: members are to abstain from alcohol, tobacco, coffee, tea, and pre- or extra-marital sexual relations. Consistent with the stigma-screening theory, LDS contribute, on an average, a very high percent of their income to the Church in tithes and in time and energy in official and unofficial Church activities, and these contributions fuel the LDS Church's fast membership growth. Yet, the LDS Church has free-riders, too. Many members attend and receive various goods and services, while not contributing much money, time, or effort. In fact, local Church leaders are instructed to direct many efforts and easy-to-exclude services to those very members who they know are not contributing much. For example, a local LDS bishop (congregational leader) knowing perfectly well that an individual is contributing little to the Church will channel to that individual formal home visits, informal friendship, and other services that are costly in time and effort for other members. Reaching out and courting free-riders, rather than fully excluding them, is a fundamental aspect of the LDS Church's operations, a fact that is inconsistent with the prevailing stigma-screening theory.

Other religious groups do distance themselves from outsiders and do not engage in outward-oriented missionary efforts. Yet even those groups devote large resources towards the socialization of children. Such is true of the ultra-strict Amish and Hasidic Jews. Their strategy is to effectively screen out all outsiders, focusing their efforts on retention of their own youth. The original stigma-screening theory cannot account for these different survival strategies, but as will be seen below these two strategies can both exist as equilibria.

### 3. A theory of stigma-screening with religious capital

It is instructive to recognize that free-riders can be meaningfully partitioned into different categories. One category is those individuals who exemplify the spirit of the term free-rider, such as adult members who attend church meetings and consume church services, yet contribute little financially or otherwise to the production of religious goods. Another category is new adult members and potential members who are the beneficiaries of tremendous amounts of fellowshiping and proselytizing efforts, but who have not yet developed the skills necessary to contribute in various ways. For example, their religious knowledge is too limited to lead youth groups and

religious lessons. A third category is children who contribute no money and very little time and effort. They are the beneficiaries of others' efforts on their behalf.

In each of these cases, the free-rider is not contributing to today's production of collective goods and services, but the distinctions are instructive. Religious seekers and children of church members are welcomed at churches even though their contributions today are small. Long-standing adult members may enjoy their presence in the congregations, as they add a type of vitality to church meetings. However, more important to the group itself is that these individuals have the potential to become large contributors in the future. As they experience and consume religious services, they build ties with other church members and learn church doctrines and norms. In other words, they form religious capital (Iannaccone, 1990).

Religious capital is a type of human and social capital that increases an individual's productivity and consumption value of religious goods. On the production (supply) side, an individual's experience and knowledge tied to a particular church increase her ability to produce religious goods associated with that church. A churchgoer who knows the hymns improves the quality of the hymn singing more than a churchgoer who does not know the hymns, and an individual who has extensive knowledge of church doctrines and practices should, all else equal, provide better instruction as a teacher of youth than someone who does not. Religious capital also influences consumption (demand) in that it directly increases the consumption value of the religious goods for the holder of the religious capital. Familiarity with doctrines and practices improves the symbolic quality of religious services, social bonds strengthen the feeling of community within the group, and increased religious conviction increases the sense of purpose associated with all of the above.<sup>7</sup> A further distinction is between group-specific religious capital that is not transferable across groups and more general religious capital that is transferable. Knowledge of the Bible, for example, transfers across Christian groups, but knowledge of Catholic rites does not transfer to Protestant groups that do not use those rites.

I claim that religious capital influences the incentive to free-ride. Because religious capital increases a churchgoer's consumption value of religious services (the demand side), it also increases that churchgoer's individual marginal benefit of donating time, money, and effort towards the production of those services. An increase in religious capital decreases the incentive to free-ride, so an individual's incentive to free-ride diminishes over time as her religious capital grows. Children form religious capital as they experience the religious goods, as do new members as they are socialized into the new religion.<sup>8</sup> Thus, although these individuals contribute little to the production of religious goods and services today, they might very well become significant contributors in future months or years. Even the long-term member free-riders can also form religious capital as they continue their religious participation. Though not contributors today, they could become contributors in the future.

From an organization's viewpoint, allowing individuals to free-ride while developing religious capital may be necessary because individuals are not born with high religious capital. Individuals must develop the capital as they participate in various group related activities. This necessity puts the church in a paradoxical position: to produce high quality religious goods and services, it must limit

<sup>7</sup> I here argue that religious capital increases both religious supply and religious demand. Others have depicted religious capital as influencing religious supply not demand (e.g., Sherkat and Ellison, 1999), yet a careful reading of Iannaccone (1990) article reveals that Iannaccone envisioned demand side effects of religious capital. For example, he wrote, "Religious capital ... enhances the satisfaction one receives from participation in that religion..." (299).

<sup>8</sup> Religious capital should be distinguished from other types of human and social capital that enhance secular opportunities, such as literacy or business connections, that might also form as a result of religious participation but that do not directly serve to tie the person to the religious group (see Fan, 2008).

<sup>6</sup> The 2014 Yearbook of Jehovah's Witnesses (Watch Tower Bible and Tract Society of Pennsylvania, 2014) lists 7.97 million members. Other official statistics can be obtained from the annual Yearbook of Jehovah's Witnesses Statistics. According to Stark and Iannaccone (1997), the official statistics undercount by nearly a half the number of individuals who self-identify as Jehovah's Witnesses. Membership statistics only count those, denoted "publishers," who actively preach a certain number of hours a week.

free-riding, but to develop the high contributors necessary for a high quality product, it must also allow some individuals to free-ride while they develop religious capital. Indeed, the church must continually replenish its stock of high religious capital members over time to maintain its production of high-quality products. If the group fails to produce high capital individuals, contributions will decline, and the quality of its product will decline.

A church can partially avoid this difficulty by recruiting individuals from churches with easily transferable religious capital, yet with easily transferable religious capital, it might be hard to retain members. I suggest here that actual churches instead survive over time by producing the religious capital themselves. They do this by retaining both high- and low-capital individuals in their membership, or, to put differently, by maintaining memberships with both contributors and free-riders. High-capital individuals provide core strength and valuable resources, while free-riders provide a pool of future contributors. As free-riders form their religious capital, they become high-contributing members in the future. Because of population movement, eventual mortality, and other forces, the congregation will eventually lose its high capital members. To survive, the group must replace them with newly-formed high-capital individuals, and to do this, the group must maintain a pool of potential future contributors.

Free-riders thus comprise a costly investment by the church. The very presence of the free-riders places a drain on resources, thereby decreasing the quality of the religious goods. Yet, if religious capital formation is necessary to produce contributors, then even if the church can identify free-riders, it may still have to let them remain in the group. Indeed, the more important it is to have religious capital to be willing to contribute resources to the group, the more exposure to the religious goods is required for that person to form sufficient capital to be willing to contribute.

The logic can be extended further. A church's investment in free-riders is not only costly; it is also risky because not all individuals who participate religiously will form high religious capital. A religious group does not want just anyone to join. Instead, it would prefer to have join only those individuals who are more likely to form high religious capital. If the group could identify these individuals, then it could actively recruit them, thereby improving the return on its investment. The children of contributing members, for example, should have a higher chance of forming high capital than other children because families consume many religious goods together and religious ideals and norms can be reinforced at home. This explains why churches actively recruit the children of adult members and devote resources towards the production of their religious capital. Adult friends of current members are also viable because they already have capital tied to the church in the form of their friendship ties with church members.

Stigma-screening still plays a valuable role. If there was no cost to membership, then too many individuals would join and free-ride on others' contributions. With some high-capital types, the group would survive, but it would have a lower quality religious good than it would without those free-riders. While some of the free-riders would form high capital and become contributors, many would not form high capital and thus continue to free-ride. If by requiring all members to observe strict behavioral requirements the cost of membership becomes too high for some free-riders but not for those who are more likely to form high capital, then stigma-screening can increase the expected return on the group's investment. If an individual knows that there is a good chance she will form high religious capital and thereby greatly value her membership, then she will be willing to pay the cost of membership. The behavioral requirements allow individuals to sort themselves into and out of the religious group. Those more likely to form high religious capital will join or stay, while others will leave.

As will be shown formally below, the size of the stigma determines the equilibrium. No stigma results in an open membership but

pervasive free-riding. A stigma that is too high will drive away seekers, leaving only the adult members' children who remain because of their parents' influence on their choice. A stigma that is in a medium range will screen out some free-riders but still allow in some of those potential contributors. The types of individuals in the group will vary according based on this stigma. The first corresponds to a non-strict church, the second to an ultra-strict church, and the third to a strict (but not ultra-strict) church.

A religious group allowing an individual to free-ride while she forms religious capital is akin to the group subsidizing her religious capital formation, but it differs from paying individuals to join without asking anything in return. If a church offered free religious goods but did not ask anything in return, then everyone, including those who will never form religious capital, would join because there were benefits without costs. Instead of offering only free benefits, strict churches also require all members to pay a cost associated with the stigmatizing behavior, and it is this cost that screens out those individuals less likely to form religious capital. Thus, a religious group that wants to increase the quality of its religious goods must still require all members to pay a cost, even if that cost is not directly productive.

Understanding how free-riding relates to religious capital implies a dynamic revision of Iannaccone's stigma-screening theory. Contributors are not born; they are instead produced through an investment by the church. Because they are a costly and risky investment, stigma-screening allows a church to screen out those individuals for whom the investment has a lower and less risky expected return. Stigma-screening thus increases the return on the church's investment in religious capital formation. Various specific predictions follow.

**Proposition 1.** *Strict and ultra-strict churches will have fewer free-riders than non-strict churches.*

**Proposition 2.** *The distribution of contributions will be skewed in ultra-strict, strict, and non-strict churches, but it will be less-skewed the stricter the church.*

**Proposition 3.** *All churches will have free-riders who are welcomed.*

**Proposition 4.** *Ultra-strict churches will rely primarily on fertility for survival.*

This first proposition follows from logic similar to the earlier stigma-screening theory. Behavioral requirements screen out some free-riders in the new theory just as they did in the original theory. Although the second proposition was implied by the original theory, it was not a key component of the theory. It now forms a key part of the new theory because having some free-riders implies skewness in contributions, and having fewer free-riders in strict churches implies less skewness in strict churches. The original stigma-screening theory did not have a specific prediction about the presence of free-riders in strict churches, yet this is a direct implication of the new theory in Proposition 3. The last prediction, also novel to this economics of religion literature, follows from recognizing that ultra-strict groups screen out far more potential recruits than strict groups. It is also consistent with growth rates of Amish and Hasidic Jewish groups that grow almost entirely from internal fertility.

A few additional points deserve mention. First, depending on the nature of the religious good, an individual's religious capital formation may only be possible if the individual contributes towards the good's production. Passively listening to a sermon or choir while others exert the effort, for example, increases an individual's appreciation for the group's teachings and services and therefore increases an individual's religious capital. The returns from studying a sacred text, on the other hand, may require hours of personal study. The distinction centers on the cost of participation that must be paid to produce the capital. The theory presented here focuses on the former type in which others' efforts enhance one's religious capital.

Another point is that the investment explanation proposed here differs in an important way from the investments undertaken by other organizations. Firms producing secular goods, for example, undertake various forms of investment, such as purchasing equipment or training new employees. A religious group’s investment is different in that it takes place in the context of collectively produced club goods with free-rider problems. The investment is not a direct cost but is instead an indirect result of allowing larger-than-desirable (in a static sense) free-riding which in turn reduces the actual quality and quantity of the club good.

A final note is that religious capital formation can—but does not have to—be understood in the framework of *rational addiction*. Becker and Murphy (1988), for example, examine a model in which an individual’s consumption of a good increases her “consumption capital” and thereby increases her consumption value of that good in the future. In their rational addiction setting, the individual may rationally choose to consume the good knowing full well the addictive effects it has on future utility. Addiction could instead be irrational (Tomer, 2001) due to, for example, defective mental performance in evaluating consequences. Religious capital formation could also be coerced, as in the little child who prefers to not attend the religious meetings but succumbs to parental pressure and still forms the religious capital. The primary theory developed in this paper is amenable to each of these circumstances because it is in the group’s interest to strategically allow free-riding whether or not the free-riders are rational choosers, boundedly rational, or coerced, etc. For concreteness, the model in the next section will first depict rational addiction in the form of actors choosing with full awareness of how their tastes may change. Iannaccone (1990) originally framed religious capital in those terms. The model will later consider when the choice is restricted by parents.

4. Formal model

The following model demonstrates the logical consistency of the argument above and also demonstrates for future researchers how a model that combines stigma-screening and religious capital formation can be constructed.

4.1. Basic model

In each period  $t$ ,  $n \gg 0$  identical individuals are born (the identical assumption will be relaxed in Section 4.4).<sup>9</sup> Thus, in every period, there are  $2n$  individuals—the  $n$  born in  $t$  and the  $n$  born in  $t - 1$ . Each individual lives two periods, denoted *childhood* and *adulthood*. These labels are for expositional ease and should not be interpreted literally. I will later discuss how the children in the model may be understood as actual children or as adult potential converts, the distinction being whether or not the individual makes her join decision herself or the decision is made by an adult.

There is only one religious group and its religious goods cannot be produced outside this group. The first assumption simplifies the analysis,<sup>10</sup> while the second reflects the collective nature of religious good production.

In each period, each individual chooses whether or not to join the religious group and then, conditional on joining, whether or not to contribute to the production of the religious good. Let  $c_{i,t}^{b_i} \in \{0, 1\}$  denote the contribution level chosen in period  $t$  by individual  $i$  who was born in period  $b_i$ . Then,  $c_{i,t}^{b_i} = 1$  signifies that individual  $i$  born

in period  $b_i$  contributes in period  $t$ , while  $c_{i,t}^{b_i} = 0$  signifies  $i$  born in  $b_i$  does not contribute in  $t$ . Restricting to binary contributions simplifies the analysis; the key results can be obtained with continuous contributions.

Let  $M_t$ ,  $0 \leq |M_t| \leq 2n$ , be the set of individuals alive at time  $t$  that join in time  $t$ , and suppose their profile of contributions in time  $t$  is  $\{c_{j,t}^{b_j}\}_{j \in M_t}$ . Then the religious good has a *base value* in time  $t$  of

$$f\left(\frac{1}{|M_t|} \sum_{j \in M_t} c_{j,t}^{b_j}\right)$$

if  $|M_t| \geq 2$  and 0 otherwise. The  $\frac{1}{|M_t|} \sum_{j \in M_t} c_{j,t}^{b_j}$  term is the average of all members’ contributions in period  $t$ . Assume that religious goods are increasing in average contributions,  $f'(\cdot) > 0$ .

Each individual  $i$  born in  $b_i$  maximizes her lifetime utility,

$$U_{it} = u_{i,b_i}^{b_i} + u_{i,b_i+1}^{b_i},$$

where  $u_{i,b_i}^{b_i}$  and  $u_{i,b_i+1}^{b_i}$  are the single period utilities from childhood and adulthood.

The single period utility is a function of the good’s base value,  $i$ ’s religious capital  $k_{i,t}^{b_i}$  in  $t$ , and the contribution choices of the various individuals. Specifically,

$$u_{i,t}^{b_i} = \begin{cases} k_{i,t}^{b_i} f\left(\frac{1}{|M_t|} \sum_{j \in M_t} c_{j,t}^{b_j}\right) - c_{i,t}^{b_i}, & \text{if } |M_t| \geq 2, \\ -c_{i,t}^{b_i}, & \text{otherwise.} \end{cases}$$

Note that  $i$ ’s religious capital only influences the value of her religious consumption and not the quality of the club good for others. A richer model would consider the impact of  $i$ ’s capital on religious production as well as consumption (e.g., an increase in  $i$ ’s religious capital could increase her ability to produce goods for others to consume). This addition would not substantively alter the main results because it would not fundamentally alter the decision making incentives of an individual who cares only about the costs and benefits of her own contribution decision. I leave it out to simplify the model.

Assume that every individual is born with the same religious capital  $k_1 \geq 0$ . Also assume that the religious capital of each child who consumes the religious good in time  $t$  will increase to  $k_2 \geq k_1$  in time  $t + 1$ .<sup>11</sup> This increase in capital depends on consumption of the religious good and not the contribution. An increase in capital from  $k_1$  to  $k_2$  is what we call religious capital formation in this model. The religious capital of those children who did not consume the religious good in time  $t$  remains at  $k_1$ . I later relax the assumption that all religious good consumers become high religious capital adults.

4.2. Religious production and religious capital formation

Let us first consider a scenario in which the religious good cannot be excluded from the general membership and in which there is no membership cost to joining the religious group. This scenario is the simplest case that illustrates how free-riding exists in equilibrium.

Because no individual has a cost to join the group, every individual has a weakly dominant strategy to join, and we can focus solely on the contribution decision. I now show that there exists an equilibrium in which everyone joins the group, the high capital adults contribute, and the low capital children do not contribute. We derive the conditions for this equilibrium by looking at an adult’s contribution decision assuming all others act according to the proposed equilibrium

<sup>9</sup> The  $n \gg 0$  assumption avoids corner solutions in which only 0 or 1 members join.

<sup>10</sup> If the number of groups was endogenous to the model, then groups would concern themselves with optimal group size. However, the main logic about religious capital formation and the necessity of free-riders would remain intact. The simplifying assumption of one groups allows for a focus on that key logic.

<sup>11</sup> This depiction of religious capital formation is weakly monotonic in the level of consumption, i.e., there is no formation if there is no consumption, but there is formation if there is consumption. A more realistic depiction might have formation be strictly monotonic in the level of consumption. The simpler form has been assumed here for analytic simplicity.

and then looking at a child's contribution decision again assuming others act according to the proposed equilibrium.

Note that if everyone abides this equilibrium then in each period  $t$  there will be exactly half of the membership contributing; with  $n$  adults and  $n$  children, the proposed equilibrium has  $n$  contributors and  $2n$  members of the group. When making her decision, the adult considers only the present period (her childhood decision is sunk). Given this behavior by the others, each adult joined as a child in period  $t - 1$  and so has high religious capital in time  $t$ . The high-capital adult  $i$  will contribute if the expected payoff of joining and contributing is greater than the expected payoff of not contributing:

$$k_2 f\left(\frac{1}{2}\right) - 1 \geq k_2 f\left(\frac{n-1}{2n}\right) \Rightarrow k_2 \geq \frac{1}{f\left(\frac{1}{2}\right) - f\left(\frac{n-1}{2n}\right)}. \tag{1}$$

This expression states that the adult only contributes if her capital  $k_2$  is sufficiently high.

With this condition satisfied and assuming all others' abide the equilibrium, the child will contribute as an adult whether or not she contributes as a child. Thus, the child, when deciding whether or not to contribute, will only consider the relevant expected payoffs of her childhood period. Low-capital child  $i$  will not contribute if

$$k_1 f\left(\frac{n+1}{2n}\right) - 1 < k_1 f\left(\frac{1}{2}\right) \Rightarrow k_1 < \frac{1}{f\left(\frac{n+1}{2n}\right) - f\left(\frac{1}{2}\right)}. \tag{2}$$

Conditions (1) and (2) are, together, necessary and sufficient for the equilibrium to exist.

**Claim 1.** Suppose exclusion is not possible. If  $k_1 < \frac{1}{f\left(\frac{n+1}{2n}\right) - f\left(\frac{1}{2}\right)}$  and  $k_2 \geq \frac{1}{f\left(\frac{1}{2}\right) - f\left(\frac{n-1}{2n}\right)}$ , then the partial free-rider equilibrium exists in which all children and adults join, all children have low religious capital and do not contribute, and all adults have high religious capital and contribute.

In words, if each child's religious capital is sufficiently small and each adult's religious capital is sufficiently large, then there exists an equilibrium in which children will free-ride on the adults' contributions, and the adults will, consequentially, generate via their contributions the religious capital in the children necessary for the group to provide religious goods in the next period. Conditions (1) and (2) correspond directly to basic facts about religious capital formation. An individual's initial religious capital  $k_1$  will be small before exposure to the club good, whereas individuals with high religious capital will highly value the religious goods. If the children have sufficiently low capital, then their marginal returns to contributing are very low, and they will not contribute. If adults have sufficiently high capital, then they are willing to contribute. The children (either potential adult converts or members' children) are allowed to free-ride while they form religious capital.

The denominator terms in the right hand sides of conditions (1) and (2) measure the equilibrium marginal productivities of the good's base value for adults and children, respectively. As this marginal productivity increases,  $i$  is willing to contribute at more levels of religious capital. As  $n$  approaches  $\infty$ ,  $i$ 's marginal productivity (the denominator) approaches 0, thus driving the entire term towards  $\infty$ . This relationship is consistent with the idea that an individual's marginal productivity is smaller in larger groups.

Notice what happens if the children are forbidden from joining. If in period  $t$  the group decides to not allow the children to join because they are free-riders, then it might be possible to obtain contributions from all members. This yields a very high quality religious good in that period, but in the next period there are no high-capital adults. Nobody will be willing to contribute, the good's base value will be 0,

and there would be no reason for individuals to join. The group would cease to exist. Allowing the children to free-ride is necessary for the group's survival.

### 4.3. Exclusion of free-riders and religious capital formation

We now examine whether the partial free-rider equilibrium exists when non-contributors could be costlessly identified and excluded from the religious group. Iannaccone (1992; 1994) original work explains why religious groups have difficulty identifying and excluding free-riders, yet the costless exclusion case is an interesting theoretical one because, according to the spirit of the original stigma-screening logic, in it we might expect to see the least amount of free-riding. However, as will now be shown, the dynamic process of religious capital formation can be so important for a religious group to survive that it might allow free-riding even when it can costlessly identify and exclude free-riders.

To make the highest possible sanction, suppose that non-contributing children and non-contributing adults cannot consume the good, and also that any child who does not contribute as a child cannot consume the good as an adult even if she contributes as an adult. In this equilibrium, each adult has high capital and the base value of the good is  $f(1)$  because everyone contributes. A high-capital adult receives payoff 0 if she deviates by not contributing, while she receives  $k_2 f(1) - 1$  by contributing. Thus, she will contribute if

$$k_2 \geq \frac{1}{f(1)}.$$

The child's payoff to not contributing is 0 today but also 0 tomorrow because she would not be allowed to join. Thus, her payoff to contributing must now consider both periods. If  $k_2 \geq \frac{1}{f(1)}$ , then she will contribute as an adult only if she contributes as a child. Thus, the payoff she considers when making her contribution choice is  $k_1 f(1) - 1 + k_2 f(1) - 1$ . This payoff is greater than 0 when

$$k_1 \geq \frac{2}{f(1)} - k_2.$$

If  $k_2$  is sufficiently large, then the right hand side will be less than  $k_1$ , and the full contribution equilibrium will exist. However, if  $k_2$  is large but not too large and  $k_1$  is small, then this equilibrium will not exist. In effect, because the utility of consumption is due in part to religious capital and not just contributions, exclusion will not work if the capital is too small.

Yet, the partial free-rider equilibrium will exist in this scenario. Because excluding the good from non-contributing high-capital adults may help foster contributions, assume the group does so. Now, the adult will be willing to contribute if

$$k_2 f\left(\frac{1}{2}\right) - 1 \geq 0 \Rightarrow k_2 \geq \frac{1}{f\left(\frac{1}{2}\right)}.$$

The child will join but not contribute if

$$k_1 f\left(\frac{n+1}{2n}\right) - 1 < k_1 f\left(\frac{1}{2}\right) \Rightarrow k_1 < \frac{1}{f\left(\frac{n+1}{2n}\right) - f\left(\frac{1}{2}\right)}.$$

**Claim 2.** Suppose exclusion is costless. The partial free-rider equilibrium exists if  $k_1 < \frac{1}{f\left(\frac{n+1}{2n}\right) - f\left(\frac{1}{2}\right)}$  and  $k_2 \geq \frac{1}{f\left(\frac{1}{2}\right)}$ .

A simple example demonstrates when the PFR equilibrium exists at the same time the full contribution equilibrium does not. Suppose  $k_1 = 0$ . From the above, the full contribution equilibrium exists if  $k_2 \geq \frac{2}{f(1)}$ , and the PFR equilibrium exists if  $k_2 \geq \frac{1}{f\left(\frac{1}{2}\right)}$ . If  $\frac{1}{f\left(\frac{1}{2}\right)} < \frac{2}{f(1)}$ ,

which is true if  $f$  is concave from  $\frac{1}{2}$  to 1, then  $(\frac{1}{f(\frac{1}{2})}, \frac{2}{f(1)})$  is a range of  $k_2$  such that the PFR equilibrium exists but the full contribution equilibrium does not—even when full exclusion is possible. Hence, in this dynamic setting with religious capital, allowing free-riding is necessary in some conditions even if exclusion is costless.

Comparing the conditions in Claims 1 and 2, we see that exclusion makes it easier to induce contributions from high-capital adults than without exclusion as in the first claim because  $\frac{1}{f(\frac{1}{2})} < \frac{1}{f(\frac{1}{2}) - f(\frac{n-1}{2n})}$ . However, in equilibrium, the ability to exclude does not impact the child's decision to contribute. Thus, if the partial free-rider equilibrium exists in the case with no exclusion (Section 4.2), it will also exist in the case with exclusion (this subsection), though the opposite is not necessarily true. More importantly, we see the same logic from Section 4.2 at work. If children have low capital then they will not contribute, while the high capital adults will contribute. Again, the children must be allowed to free-ride in order for the group to continue through time.

We also learn a deeper point about religious capital formation. Claim 2 establishes that even if full exclusion is possible, so long as some potential contributors (i.e., the children) have sufficiently low capital, then the religious group will still have to allow some free-riding in order for those individuals with very low religious capital to form higher religious capital.

This finding demonstrates the fundamental role of religious capital formation and strategic management of free-riding in religious group survival. Free-riding is crucial for the group to continue even if free-riders could be perfectly excluded. If nobody ever forms high capital so that all adults have capital  $k_1$ , then no adults will contribute, no religious good will be produced, and the group will not continue into future periods. Allowing some members to free-ride is necessary for the group to survive over time, but having some contributors is necessary for the group to exist at all at a given point in time.

#### 4.4. Stigma-screening with religious capital formation

I now show how the idea that successful groups must allow free-riding reconceptualizes Iannaccone (1992; 1994) stigma-screening theory. To examine stigma-screening in a context of religious capital formation, we need to again assume that free-riders are not easily identified and excluded (else there is no need to impose a stigmatizing cost). In the basic model above, all children who consume the religious good become high-capital adults, so that allowing the free-riders to ride for free was a riskless investment from the group's point of view. In real life, however, not all individuals exposed to the religious good end up becoming high capital adults. Instead, any given individual  $i$ , conditional on exposure to the religious good, might only form high religious capital with some probability  $\alpha_i$ ,  $0 \leq \alpha_i \leq 1$ . Moreover, individuals might differ in their capital formation probabilities, e.g.,  $\alpha_i \neq \alpha_j$  for some  $i$  and  $j$ . Some individuals have stronger family religious ties, more friends within the religious group, or a personality conducive to the social nature of religion. These differences create a role for stigma-screening because now the free-riders are a risky investment, and the group may want to screen out those free-riders who are less likely to form high capital. By screening out the unwanted types, the base value of the religious good will increase, and by allowing the preferred free-riders to join, the group will survive through time.

To account for these considerations, I extend the basic model in three ways. First, suppose that the group can choose a stigmatizing behavior. By assumption, this behavior does not contribute to production of the religious good, but it does impose a direct cost  $b \geq 0$  on an individual who joins the group because, as described by Iannaccone (1992; 1994), it decreases the utility from secular activities. This fixed cost  $b$  simplifies the more subtle stigma process modeled by Iannac-

cone, but has the same effect. Second, and consistent with the original theory, assume that the group excludes based only on compliance with the observable stigmatizing behavior and not on contribution levels, which are assumed to be unobservable due to excessive monitoring costs. Third, assume that there are two types of children born each period. While all  $n$  children born in  $t$  begin with capital  $k_1$ , only  $y$ ,  $0 \leq y \leq n$ , of them can form high religious capital if exposed to the religious good. Each of these  $y$  children have  $a_i = a$ ,  $0 < a < 1$ . The other  $n - y$  children have  $a_i = 0$ . As is common in Bayesian games in keeping with the rational addiction setting, each child knows her own type, but the group does not observe the child's type.

To keep the specification simple, assume that if  $y'$  of the  $y$   $a$ -type children join, then exactly  $x$ ,  $0 \leq x \leq y'$  of them form high capital, where  $x$  is the integer nearest  $ay'$ . In other words, an  $a$ -type child who joins knows that there is a  $a$  probability that she is one of the  $x$  individuals who will have high capital in the next period. Although the exact number of individuals who form high capital is known after the decision to join is made, the acquisition of religious capital is probabilistic in the sense that the identities of which children form high capital are not known a priori by the individual or group.

We are interested in the conditions under which the following separating equilibrium<sup>12</sup> exists: all high-capital adults join and contribute, all low-capital adults do not join and do not contribute, all  $a$ -type children join and do not contribute, and all 0-type children do not join and do not contribute.

Consider a high-capital adult's decision. Joining at cost  $b$  and contributing is better for a high-capital adult  $i$  than joining and not contributing in time period  $t$  if

$$k_2 f\left(\frac{x}{x+y}\right) - 1 - b \geq k_2 f\left(\frac{x-1}{x+y}\right) - b \Rightarrow k_2 \geq \frac{1}{f\left(\frac{x}{x+y}\right) - f\left(\frac{x-1}{x+y}\right)}. \tag{3}$$

The  $\frac{x}{x+y}$  term comes from  $x$  high-capital contributing adults and  $y$  low capital non-contributing children. The high-capital adult must also prefer joining and contributing to not joining at all:

$$k_2 f\left(\frac{x}{x+y}\right) - 1 - b \geq 0 \Rightarrow k_2 f\left(\frac{x}{x+y}\right) - 1 \geq b. \tag{4}$$

The low-capital adult must prefer not joining to joining and contributing:

$$0 > k_1 f\left(\frac{x+1}{x+y}\right) - 1 - b \Rightarrow b > k_1 f\left(\frac{x+1}{x+y}\right) - 1. \tag{5}$$

The low-capital adult must also prefer not joining to joining and not contributing:

$$0 > k_1 f\left(\frac{x}{x+y}\right) - b \Rightarrow b > k_1 f\left(\frac{x}{x+y}\right). \tag{6}$$

The  $a$ -type child will join and contribute as an adult if she forms high capital but not join or contribute as an adult if she does not form high capital. Her expected payoff of joining and not contributing must be greater than joining and contributing:

<sup>12</sup> A separating equilibrium is a game-theoretic equilibrium in which players of one type choose a different strategy than players of another type, thereby allowing the types to be distinguished by their actions. The equilibrium of interest here is appropriately called separating because the children choose different actions depending on their types. The  $a$ -type children choose to join, and the 0-type children do not join.

$$\begin{aligned}
 & k_1 f\left(\frac{x}{x+y}\right) - b + a\left(k_2 f\left(\frac{x}{x+y}\right) - 1 - b\right) \\
 & \geq k_1 f\left(\frac{x+1}{x+y}\right) - 1 - b + a\left(k_2 f\left(\frac{x}{x+y}\right) - 1 - b\right) \Rightarrow \\
 k_1 & \leq \frac{1}{f\left(\frac{x+1}{x+y}\right) - f\left(\frac{x}{x+y}\right)}. \tag{7}
 \end{aligned}$$

Joining and not contributing must also be better than not joining:

$$\begin{aligned}
 & k_1 f\left(\frac{x}{x+y}\right) - b + a\left(k_2 f\left(\frac{x}{x+y}\right) - 1 - b\right) \geq 0 \Rightarrow \\
 & k_1 f\left(\frac{x}{x+y}\right) + a\left(k_2 f\left(\frac{x}{x+y}\right) - 1\right) \geq b(1+a) \Rightarrow \\
 & k_1 f\left(\frac{x}{x+y}\right) + ak_2 f\left(\frac{x}{x+y}\right) - a \geq b(1+a) \Rightarrow \\
 \frac{k_1}{1+a} f\left(\frac{x}{x+y}\right) + \frac{a}{1+a} k_2 f\left(\frac{x}{x+y}\right) - \frac{a}{1+a} & \geq b \tag{8}
 \end{aligned}$$

Finally, the 0-type child in this equilibrium will not join or contribute as an adult. Her expected payoff to not joining must be greater than joining and not contributing:

$$\begin{aligned}
 0 & > k_1 f\left(\frac{x}{x+1+y}\right) - b \Rightarrow \\
 b & > k_1 f\left(\frac{x}{x+1+y}\right). \tag{9}
 \end{aligned}$$

This expected payoff must also be greater than that of joining and contributing:

$$\begin{aligned}
 0 & > k_1 f\left(\frac{x+1}{x+1+y}\right) - 1 - b \Rightarrow \\
 b & > k_1 f\left(\frac{x+1}{x+1+y}\right) - 1. \tag{10}
 \end{aligned}$$

Conditions (3)–(10) are necessary and sufficient for the equilibrium to exist in  $t$ . They have natural interpretations. Condition (3) says that for high-capital adults to contribute, their religious capital must be sufficiently large, while according to condition (7)  $a$ -type children must have sufficiently low capital to not contribute. Conditions (4) and (8) say that the strictness cost must be sufficiently small so that the high-capital adults and the  $a$ -type children are willing to join. Conditions (5), (6), (9), and (10) say that the strictness cost must also be sufficiently large so that low-capital adults and 0-type children will not join. As in other screening scenarios, the screening cost must be large enough to screen out the unwanted types but not too large to screen out the wanted types.<sup>13</sup>

To show that this equilibrium exists, we need only show that these conditions can be simultaneously met. This is easily accomplished by example. Suppose  $k_1 = 0$  so that each child is born with no capital. Then (7) is trivially met for any increasing  $f(\cdot)$ , and (5), (6), (9), and (10) are met for any  $b > 0$ . (3), (4), and (8) will now hold if  $k_2$  is large and  $b > 0$  sufficiently small. Of course, there are many parameter combinations that will satisfy the conditions. As long as  $k_1$  is sufficiently small,  $k_2$  is sufficiently large, and  $b$  is in the appropriate medium range, this separating equilibrium will exist.

**Claim 3.** A separating equilibrium with partial free-riding exists when conditions (3)–(10) are met.

From conditions (5), (6), (9), and (10) it is clear that the separating equilibrium does not exist without the group’s rules that generate the behavioral cost  $b$  of membership. Without such rules (i.e.,  $b = 0$ ), the partial free-rider equilibrium in the multi-type setting is a “pooling” one akin to that in Section 4.2 in which both children types join but where only  $ay$  of the  $n$  children form high religious capital.

This separating equilibrium corresponds to a strict (not ultra-strict) church. The statements about strict churches in the propositions of Section 3 arise from comparing this separating with a pooling equilibria. With  $ay$  children expected to form high religious capital in any given period, we expect to observe  $ay$  contributions and  $ay + y$  members in any period of the separating equilibrium. This yields average contributions of  $\frac{ay}{ay+y} = \frac{a}{a+1}$ . In the “non-strict” pooling equilibrium, the average contribution is  $\frac{ay}{2n}$ , which is less than  $\frac{a}{a+1}$  because  $y \leq n$ . Thus, consistent with Proposition 1, the model predicts that strict churches with costly behavioral requirements will have higher average contributions than non-strict churches.

The model also predicts a lower degree of skewness in strict churches’ contributions than in non-strict churches as predicted by Proposition 2. One manifestation of skewness is when there are fewer people contributing above the average contribution than there are contributing below the average contribution. The more positively skewed the distribution, the more members are contributing less than the mean contribution level than are contributing above the mean. In the separating equilibrium with average contribution  $\frac{ay}{ay+y}$ , there are  $ay + y$  non-contributors (below the mean) and  $ay$  contributors (above the mean). In the pooling ( $b = 0$ ) equilibrium with average  $\frac{ay}{2n}$ , there are the same number of contributors but a much larger number of non-contributors. Thus, the pooling equilibrium’s distribution of contributions is more skewed than the separating equilibrium. The model predicts that the distribution of contributions in non-strict churches will be more skewed than in strict churches.

Finally, consistent with Proposition 3, the model predicts that free-riders of a certain kind are welcomed in strict churches. For the equilibrium to exist, the strictness cost is set so that the  $a$ -type children are screened into the group, and the 0-type children are screened out of the group. The  $a$ -type children are screened into the group because they play a crucial role in facilitating the continuance of the church.

#### 4.5. Ultra-strict churches

There are two distinctive features of the above separating equilibrium. One is that the behavior cost  $b$  exists in particular medium range. If the cost is too low then it does not screen out the 0-type children that would always remain free-riders, and if it is too high then it screens out the  $a$ -type child that is a potential future contributor. The other feature is that each child chooses for herself whether or not to join. These children are best thought of as adult potential converts that are either actively seeking affiliation or being actively recruited by the group. This assumption does not reflect a child whose join decision is effectively made by a parent.

If the parent is a high-capital adult, then we can envision the parent choosing that the child joins even when not the child’s best response. Parents in any religious group can make such a choice for their children, but, as I now demonstrate, this distinction is particularly important for ultra-strict religious groups. Specifically, consider an ultra-strict equilibrium where children of group members are required to join but not contribute, and where all others—including young people that could form high capital upon participation—are deterred from choosing to join due to the behavior cost  $b$  associated with strictness being too high. Such a group can only survive if it maintains a sufficiently large birth rate.

Suppose that each adult has  $1 + g$  children, i.e., if the number of adults in period  $t$  is  $n_t$  then the number of adults in period  $t + 1$  is  $n_{t+1} = (1 + g)n_t$ . Parameter  $g > 0$  is thus the birth rate. Further suppose that the child’s type identical to her parent’s type. This assumption is largely for convenience, yet the primary results will obtain with a more general setting in which religious proclivities are correlated imperfectly or are independent across generations. Finally, suppose as mentioned above that children of adult group members are required to join (at cost  $b$ ) and contribute (at cost 1).

<sup>13</sup> This medium level screening cost is similar to that in Spence (1973) original examination of education as a screening device.

The equilibrium of interest has high-capital adults join and contribute, the children of those high-capital adults join but not contribute, and all others not join and not contribute. The conditions necessary for this equilibrium to exist (not shown here) can be derived in a manner similar to the conditions derived for the separating equilibrium in Section 4.4, but with one important difference: behavior cost  $b$  must be higher here than in the separating equilibrium in order to deter the  $a$ -type children of low capital adults from joining. This higher  $b$  can be understood as an ultra-strict behavioral level in this new group. Consistent with the three propositions in Section 3, this ultra-strict church has a lower rate of free-riding than non-strict churches, a less-skewed distribution of contribution, and welcomed free-riders in the form of the children.

The size of the group over time in the equilibrium will depend on how the birth rate  $g$  compares with the capital accumulation probability  $a$ . The membership in time  $t$  is comprised high capital adults and their children. With  $m_t$  high-capital adults in time  $t$ , total membership in time  $t$  is

$$|M_t| = (1 + g)m_t + m_t.$$

Any high-capital adult must have been an  $a$ -type, so all children of group members are also  $a$ -type. Proportion  $a$  of those children become high capital adults in period  $t + 1$ :

$$m_{t+1} = a(1 + g)m_t,$$

$$|M_{t+1}| = (1 + g)m_{t+1} + m_{t+1}.$$

To survive over time, the group must have

$$\begin{aligned} |M_{t+1}| &\geq |M_t| \Rightarrow \\ (1 + g)a(1 + g)m_t + a(1 + g)m_t &\geq (1 + g)m_t + m_t \Rightarrow \\ \left(2 - \frac{2}{a}\right) + \left(3 - \frac{1}{a}\right)g + g^2 &\geq 0 \Rightarrow \\ (g + 2)\left(\frac{a + ag - 1}{a}\right) &\geq 0. \end{aligned}$$

With  $a > 0$ , group survival requires that the growth rate be sufficiently high:

$$\begin{aligned} \frac{a + ag - 1}{a} &\geq 0 \Rightarrow \\ g &\geq \frac{1 - a}{a}. \end{aligned}$$

Intuitively, as the rate of capital accumulation ( $a$ ) decreases, a higher growth rate is needed for the group to maintain its membership size or grow.

**Claim 4.** An ultra-strict church must have a sufficiently high birth rate to survive.

Of course, parents in churches that are not ultra strict may also require their children to join. Yet such churches do not screen out the  $a$ -type children of non-church members, thus creating a place for converts play a larger role in group continuance in those churches. Although a high internal birth rate will help such groups continue through time, they do not need to rely solely on a high birth rate.

## 5. Discussion

This paper argues for a dynamic generalization of Iannaccone's original stigma-screening theory. Religious contributors are not born but are produced through the process of religious capital formation. To gain future contributors, a religious group must allow some individuals to ride for free while they form religious capital. Because this capital formation process is costly and risky, a group can choose, via the requirement of strict behavioral codes, to screen out those individuals less likely to form religious capital. Thus, stigma-screening can be understood as a way to improve the return on a church's religious capital investment.

One insight from this theory is that strict churches rationally allow a degree of heterogeneity in their memberships. This heterogeneity is limited because certain individuals are screened out due to the stigmatizing behavioral requirements, yet it is still there in a form that serves an important institutional purpose. The welcomed free-riders are potential future contributors, and their free-riding is seen as an investment by the church.

A second insight is that the fostering of heterogeneous memberships does not undermine the stigma-screening logic. Instead, both methods combine to foster both high contributions and high religious capital formation. It is simplest to think of allowing free-riders as independent of the stigma-screening. Dynamically allowing free-riders is necessary when individuals are born with no capital and must form it before contributing, and this is so even if the religious goods are perfectly excludable. Stigma-screening is an independent mechanism to increase contribution levels when there are different types of individuals. A useful comparison is a firm hiring a new employee. The firm will screen potential applicants when some types of applicants have the potential to be more productive than others, but it will also use its own resources to invest in that worker's firm-specific human capital once hired. The theory presented here develops this idea in the context of collectively produced religious goods.

This revised theory suggests a rethinking of the term free-rider in the context of religion. Just exactly what type of behavior constitutes free-riding behavior? The stigma-screening process screens out certain types of free-riders but screens in other types. These desirable types do in fact free-ride temporarily, but they are welcomed in the hope that they do not free-ride forever. It may be contrary to the essence of what is meant by the label free-rider to describe individuals who are investments in the church's future. We should rethink what constitutes religious free-riding and distinguish among the different types of free-riding. Acknowledging the difference in individuals' ability to form religious capital and variation in acceptance of those individuals by the church is a step in this direction.

The institutional impulse to allow free-riding can also extend to other, non-religious, settings. Iannaccone (1992) explains that the stigma-screening process helps us understand not just the behavior of strict churches but also that of communes and collectives because they all produce social goods yet have difficulties measuring different types of contributions. To the extent that individuals in these other settings must have high human capital tied to the group in order to contribute, the revised stigma-screening logic will hold as well.

Of course, actual groups exist in richer environments than that of the abstract model presented in Section 4, and they will often have developed other means by which to moderate the degree of free-rider investment. The LDS Church mentioned earlier again serves as a useful example. As explained by McBride (2007), the LDS Church allows many non-contributing individuals to consume various socially produced goods—such as the enjoyment of worship services, use of Church-produced printed materials, home visits, certain forms of ecclesiastical support, certain rituals—and many of these are easy to exclude. Many of these goods foster religious capital formation, yet the LDS Church also excludes some of the most important religious goods to contributors—access to certain rituals, certain ecclesiastical positions, etc. This is a case where the group openly allows free-riders to consume some but not all goods, and by so doing it both allows and limits free-riding. Future theoretical work should examine the conditions under which a religious group offers some but not all benefits to free-riders.

Future work has many other avenues to pursue. One direction is to confront the multiplicity of equilibrium strategies that a group could choose. As evidenced by Table 1, a multiplicity of strictness strategies are chosen in the real world; some churches actively stigma-screen while others do not. This paper does not offer a theory of why some but not all churches choose to be strict. A more general model would account for the group's preferences and would benefit from

a consideration of various factors relevant to religious organizations. Montgomery (1996), for example, examines how the evolution of a church's strictness depends not only on religious capital formation but also on the "voice" expressed by members.

Another way to generalize the model with the goal of studying churches' strategy selection is to consider multiple religious groups into a religious economy and identify what selection pressures may lead some churches to converge on low-contribution equilibria while others converge to medium or high-contribution equilibria. It is possible that market forces may drive the selection of groups into different strictness niches or out of the religious market altogether. A strong preference for low-strictness religion by a sufficient number of consumers may create space for the survival of low-contribution churches despite a high proportion of free-riders. However, if growth is higher in medium-strict churches, then low-contribution churches may experience diminished market share. A closer examination is needed to identify the conditions under which some types of groups are driven out of the market. Empirical work would be particularly insightful on this topic as there exists publicly available membership data for many churches in the highly competitive U.S. religious market.

Another avenue involves the examination of religious production functions. The simplified model in this paper considered only average contributions as relevant for religious good production because this is the important factor that generates the free-rider problem. Including the level of contributions in the production function has the potential to yield still further insights into our understanding of religious good production. A further line of work can examine how groups with strong motivations for membership growth handle the free-rider problem. The model here discussed group survival and not growth per se. Future work along these lines will lead to the development of a more comprehensive theory of religious free-riding and improve our understanding of this understudied sector of production and consumption.

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