

**Exporting Christianity:
Governance and Doctrine in the Globalization of US Denominations**

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Abstract. In this paper we build a model of international competition between religious denominations by adapting the organizational framework in Aghion and Tirole (1997) and the club good model in Iannaccone (1992). We treat denominations akin to multinational enterprises, which decide which countries to enter based on local market conditions and their own productivity. The model yields predictions for how a denomination's religious doctrine and organizational structure affect its ability to attract adherents. We test these predictions using data on the foreign operations of US Protestant denominations from the World Christian Database. Consistent with the model, we find that (1) denominations with a decentralized governance structure have larger membership in countries in which the productivity of pastor effort is higher (as measured by the quality of communications and transportation infrastructure), and (2) denominations with stricter religious doctrine have larger membership in countries in which the government provides fewer social services and in which economic uncertainty (associated with risk of natural disaster) is greater. These findings shed light on the rapid global expansion of new Protestant denominations in recent decades.

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1. Introduction

Over the last 150 years, Christianity has globalized, not through the usual historical path of military conquest, but through the market. The process began in the later 19th century as Protestant missionaries from western countries went abroad to evangelize Africa, Asia, and Latin America (Woodberry and Shah, 2004). In the second half of the 20th century, the movement accelerated as the end of colonialism, the demise of communist regimes, and the spread of democracy expanded options for religious practice in countries long dominated by state-sponsored churches or anti-clericalism (Mickelthwait and Wooldridge, 2009). The consequence has been churning in the religious marketplace. Between 1970 and 2005, whereas the share of Christians in the global population remained stable at 33%,¹ the share of Christians in Protestant churches (including independent and non-mainstream groups) rose from 26% to 35%, with their growth coming at the expense of formerly state-sponsored churches (Anglicans, Roman Catholics, Orthodox). Denominations headquartered in the United States have been at the forefront of the recent global expansion in Protestantism. Excluding the US population, between 1970 and 2005 the share of global Protestants belonging to denominations headquartered in the US rose from 13% to 23%. Strikingly, it is denominations with the most restrictive religious doctrine and distinctive worship practices (eg, Pentecostals, Jehovah's Witnesses, Mormons) that tend to have the largest market share (Brouwer, Gifford, and Rose, 1996).

In this paper, we examine the number of adherents that denominations based in the United States attract in foreign markets. We treat a denomination akin to a multinational enterprise, which chooses which markets to enter based on the combined objectives of attracting members and generating revenues. We focus on US headquartered denominations because the

¹ According to the World Christian Database (<http://www.worldchristiandatabase.org>), the share of Christians in the global population was 34.5% in 1900, 33.4% in 1970, and 33.0% in 2005.

United States is the largest exporter of Protestant Christianity and because we have relatively complete data on the foreign operations of US groups. In the theoretical model that we develop, three attributes of a denomination affect its membership. One is its overall attractiveness to believers, which we treat as a fixed characteristic similar to firm productivity (Melitz, 2003). A second is organizational structure. Some denominations (eg, Methodists) are centralized, placing authority over pastors and church doctrine in the hands of national or international bodies (Chaves, 1993a). Others (eg, Baptists) are decentralized, with individual congregations controlling religious practice and the hiring and firing of pastors. We use an organizational model based on incomplete contracts (Grossman and Hart, 1986) and the delegation of authority (Aghion and Tirole, 1997) to show how the degree of centralization interacts with local market conditions to affect a denomination's performance and then test these predictions empirically. A third attribute of a denomination is its religious doctrine. Iannaccone (1994) suggests that stricter religious groups are more efficient in organizing the collective production of quasi-public goods. We examine empirically whether the value consumers place on strictness depends on a country's capacity to provide social services. Data for the analysis are from the World Christian Database, which enumerates the number of Christians by denomination and country.

Christian denominations may seem an unusual subject for the analysis of multinational enterprises. Four aspects of global Christianity motivate our study. One is simply its scale. According to the WCD, in 2010 Pentecostalism, a movement that originated in the United States in the early 1900s involving ecstatic worship (eg, speaking in tongues) and a literal reading of the Bible, along with other so-called "renewalist" groups, had 600 million adherents worldwide, accounting for 26% of all Christians. While the global expansion of these Christian groups has attracted intense interest from other social sciences (eg, Meyer, 2004, Robbins, 2004, and

Woodberry, 2008), it has received little attention from economists. Our work helps account for the differential performance of religious groups in expanding abroad.

A second motivation is that the growth of Protestant Christianity tends to create a more competitive religious marketplace, challenging existing religious and political elites (Freston, 2001).² Recent literature examines the dominance of single religions and overall religiosity at the national level. Barro and McCleary (2005) identify the factors that determine which countries have state religions; McCleary and Barro (2006) find that the fraction of the population that participates in religious activities is decreasing in per capita income and government regulation of religion; and Barro and Hwang (2007) relate conversion to major religions in a country to religious pluralism, absence of state controls on religion, and having a more educated populace. We extend the literature by examining competition among many religious groups, which allows us to estimate the value of specific denominational characteristics.

A third motivation for our paper is to examine how the capacity of the state to provide social services affects the demand for religion. The functions of a congregation include organizing worship, educational activities, and charitable undertakings, for which individual congregants are both consumers and producers. These services have the quality of club goods, in the production of which congregants have an incentive to free ride on the efforts of others. In seminal work, Iannaccone (1992) identifies strictness as a means for religious groups to reduce free riding. In his model, having a stricter religious doctrine constrains individual choice, which raises the cost of secular goods and services, thereby increasing the incentive for individuals to participate in church life. An implication is that demand for religion expands (contracts) when

² In related work, Woodberry and Shaw (2004) suggest that the arrival of Protestant missionaries in non-Western countries in the 19th and early 20th centuries brought modern printing technology, primary and secondary education, and organizational innovations, contributing to democratization in the exposed countries later in the 20th century. Nunn (2010) that historical exposure of a village to Christianity missionaries has long lasting effects on religious participation of individuals native to the locale.

the government decreases (increases) the supply of public services that compete with church supplied club goods. In empirical work, Hungerman (2005) finds that church-member donations and community spending expanded in the United States following welfare reform in 1996, which reduced government social services; and Gruber and Hungerman (2007) find that the expansion in social services under the US New Deal in the 1930s crowded out church charitable activities. In international settings, Berman (2000) and Chen (2010) use the Iannaccone (1992) framework to understand the social organization of ultra-orthodox Jews in Israel and the expansion of Islamic schools following the Indonesian financial crisis, respectively.³

In our sample, denominations are differentiated by their religious doctrine and worship practices. Stricter denominations emphasize beliefs that impose time costs and social constraints on an individual's lifestyle, which complicate interacting not just with non-Christians but with Christians outside of the denomination. These include belief in the inerrancy of the Bible, the damnation of non-believers, maintaining a high standard of moral behavior, seeking to convert others to the fold, and ecstatic (and frequent) expressions of faith. Our contribution is to examine how the demand for strictness in religious doctrine is affected by government provision of social services and the demand for these services engendered by economic uncertainty. Controlling for denomination and country fixed effects, we find that stricter denominations are larger in countries with weaker provision of health services and higher incidence of natural disasters. These results hold accounting for the interaction between denominational characteristics and a country's per capita GDP, implying that stricter groups succeed where governments underperform in the provision of social services, relative to a country's level of development, and where the threat of aggregate shocks is greater.

³ Relatedly, Scheve and Stasavage (2006) find that across advanced countries there is a negative correlation between the intensity of religious belief and government social spending.

A final motivation for our study is to apply recent theoretical developments in organizations and international trade (Antràs and Rossi-Hansberg, 2009). In our framework, each denomination decides which countries to enter, based on local market conditions and its own productivity, organizational structure, and religious doctrine. Important for our analysis, a denomination's organization and doctrine change slowly over time and are common across congregations (Melton, 1989; Chaves, 1993b). We can therefore examine how organizational form affects denominational performance, which is distinct from the usual context in which organizational structure is endogenous (eg, Nunn, 2007; Bloom, Sadun, and Van Reenen, 2009). In our model, entry into a market is subject to a fixed cost, which similar to Melitz (2003) keeps low productivity groups from entering countries with small markets or high barriers. To reach adherents, a denomination must hire a local pastor to manage a congregation. Following Antràs (2003) and Antràs and Helpman (2006) we assume that transactions between a pastor and a denomination are subject to incomplete contracts; following Marin and Verdier (2008) we model how the allocation of authority affects pastor incentives. In denominations with a decentralized structure, the pastor has greater authority, which increases his incentive to invest in serving the congregation; in denominations with a centralized structure, the denominational headquarters has greater authority, which gives it more control over how congregations operate.

The model predicts that in countries where the productivity of pastor effort is higher, decentralized denominations will have larger membership and more congregations, owing to stronger effort incentives for pastors. We test these predictions by examining how the interaction between country and denominational characteristics affect denomination size, capturing the productivity of pastor effort in a country using the quality of communication and transportation infrastructure. The return on pastor effort depends on his ability to identify and

connect with potential congregants, which is a function of the ease of local communications, and the ability of congregants to attend church functions, which is a function of internal transport costs. We find that decentralized denominations are larger and have more congregations in countries that have better communications and land transportation. To the extent the process of economic development leads to greater ease in communications and transportation, it may shift market share toward religious organizations that are less hierarchical.

In section 2, we discuss data on denominations regarding their size, religious doctrine, and governance structure. In section 3, we present a model of entry and competition among Christian denominations. In section 4, we derive the empirical specifications. In section 5, we present the results from estimating the model. And in section 6, we offer final discussion.

2. Data and Empirical Setting

2.1 Christian denominations

The data for our analysis are from the World Christian Database (WCD). The WCD tracks religious affiliation for Christian denominations in 215 countries, providing numbers of affiliated members and congregations in 1970 and 2005. Each denomination is identified by its name, religious tradition (e.g., Baptist, Holiness-Pentecostal, Reformed-Presbyterian), and megabloc, and is accompanied by notes giving denominations' international affiliation. Megablocs include Roman Catholics, Orthodox, and Anglicans, which constitute the historic or traditional church; Protestants, which constitute most organized Protestant denominations; Independents, which includes churches that have split from Protestant denominations or that are unaffiliated with international church bodies; and Marginals, which are groups considered on the fringe of the Christian mainstream, the largest of which are the Church of Jesus Christ of Latter

Day Saints (Mormons) and the Jehovah's Witnesses. With some abuse of terminology, we use the term Protestant to refer to Anglicans, Protestants, Independents, and Marginals.

In the raw WCD, there are over 6,300 individual denominations. These represent a far smaller number of denominational aggregates, which have a common international governing body (eg, World Assemblies of God Fellowship), internal governance structure, and religious doctrine. We identify denominational aggregates by combining sub-denominations that have (a) a common megabloc, tradition, and name (after translation into English), or (b) a common megabloc, tradition, and association with an international denomination. For a few countries in the sample, our procedure fails because the WCD does not record data on individual denominations and instead groups them into a single category designated "union of bodies of different traditions." We drop a country from the sample if more than 20% of affiliated Christians fall into this category. The excluded countries include six large nations (Australia, Canada, China, Congo, Germany, and Pakistan) and 10 small ones.⁴

In the empirical analysis, we focus on the performance of Protestant denominations headquartered in the United States (while controlling for competition from non-US groups through country fixed effects).⁵ Three features of the data motivate this choice. First, because of the history of religious freedom and separation of church and state in the United States, US denominations that have survived have done so because of their success in the marketplace and not because of preferential government treatment (Finke and Stark, 2008). The relative performance of US denominations thus reflects their appeal to adherents.⁶ Second, the US is the

⁴ The small excluded countries are Bahrain, Bouganville Island, the Cayman Islands, Liechtenstein, Madagascar, the Maldives, the Marshall Islands, Micronesia, Norfolk Island, and the Solomon Islands. In 2005, the excluded countries in total represented 13% of Christians in the WCD.

⁵ Focusing on US based Christian denominations excludes Roman Catholics (headquartered in Italy), Anglicans (headquartered in the UK), and Orthodox groups (headquartered in Greece or Eastern European countries).

⁶ While religious organizations in the United States receive preferential tax treatment, these benefit are available to all religious institutions and do not favor specific groups.

largest single exporter of Protestant Christianity. Figure 1 shows the share of global Protestants outside of the United States by the headquarters country of the denomination.⁷ Between 1970 and 2005, the share of Christians belonging to either the Anglican Church (headquartered in the UK) or to other non-US-headquartered denominations each fell, the former from 14% to 10% and the latter from 17% to 15%. Denominations headquartered in the United States saw their market share rise (from 13% to 23%). Third, outside sources, including *The Handbook of Denominations in the United States*, (Mead, Hill, and Atwood, 2001), allow us to identify the universe of denominations located in the US and thereby verify the completeness of the WCD. We begin with 204 Protestant denominations headquartered in the United States. Of these, 16 are not found in the WCD,⁸ 42 have no congregations in the WCD outside of the United States,⁹ 8 have congregations outside the US but only in countries excluded from the sample owing to the aggregation problems mentioned above, and 8 are very small denominations on which we could find no information on their organization or doctrine, leaving us with a sample of 130 US denominations that have adherents abroad enumerated in the WCD.

Table 1 lists the 35 largest Protestant denominations worldwide (excluding their adherents in the US), of which 24 are headquartered in the United States. Of the top 15 denominations, 11 are from the US. The size of denominations varies immensely, with the largest US denomination (Assemblies of God), having 42.4 million adherents outside of the United States in 2005, the 10th largest (United Methodist Church USA), having 3.7 million, the 30th largest (Pentecostal Church of God) having 0.6 million, and all denominations below the

⁷ Unclassified or Independent denominations are congregations with an unknown denominational affiliation (mainly very small congregations) or that have no denominational affiliation.

⁸ These 16 denominations include groups that over time have been subsumed into newer denominations, groups created relatively recently which in the WCD may be subsumed in older denominational categories, very small groups not captured by the WCD, and one Jewish organization that has Christian roots.

⁹ These include a number of old denominations that appear to be in process of dying out and a few recently created entities with minimal foreign presence.

80th rank having fewer than 0.1 million. For each US denomination, Figure 2 plots its log rank in terms of size against its log number of global affiliated Christians. The curvature in the relationship is distinct from the log linearity found in firm size distribution for manufacturing industries, which tend to exhibit a power law (Gabaix, 2009). For denominations, size increases by more than proportion to rank, indicating the dominance of the largest groups.

Related to the variation in denomination size, there is also variation in the number of countries in which denominations operate. Most denominations are present in fewer than a dozen countries. Table 2 shows the number of countries in the estimation sample in which US denominations have a presence in 1970 and in 2005. In 1970, only 9% of country-denomination cells have positive entries; by 2005, the share rises to 12%. Given the large number of zero cells, in the empirical analysis we address the entry of denominations into countries in order to control for selection bias in estimating determinants of denomination size.

2.2 Denominational religious traditions

The denominations in our sample have emerged from several religious traditions. Mainline traditions include movements brought from Europe to the United States in the 17th and 18th centuries that ultimately established a major US presence. The largest of these are the Baptists, Congregationalists, Disciples of Christ, Lutherans, Methodists, and Presbyterians,¹⁰ each of which today contains multiple denominations.¹¹ Mainline denominations, which include the oldest Protestant groups in the United States, tend to be relatively liberal in terms of religious doctrine. Figure 3 shows that in 2005 mainline denominations accounted for 12% of adherents

¹⁰ Smaller mainline groups include the Quakers, Moravians, and Reformed Church. Episcopalians, another mainline group, are excluded from the sample given their association with the Anglican Church, which is based in the UK.

¹¹ For instance, the Presbyterian tradition includes the Bible Presbyterian Church, Cumberland Presbyterian Church, Orthodox Presbyterian Church, Presbyterian Church in America, and Presbyterian Church USA, each of which has its own religious doctrine (though they have in common a presbyterian governance structure).

outside of the United States that belong to US denominations, down from 23% in 1970.

Evangelical and fundamentalist denominations, such as the Southern Baptist Convention, include groups that split off from US mainline denominations in the 19th and early 20th centuries, typically over doctrinal disputes, with evangelicals and fundamentalists defined by a literal reading of the Bible and a strong emphasis on repentance and conversion. From 1970 to 2005, their share of foreign adherents in US denominations also fell, from 29% to 25%. Another important schismatic tradition, the Holiness Movement, split off from mainline Methodists in the late 19th century. It emphasizes the restrictive doctrine of sanctification, in which believers are expected to purify themselves of sin (and are then sin no more). Between 1970 and 2005, their share of foreign adherents of US denominations fell from 12% to 6%.

The traditions with the fastest growing membership are the so-called Christian renewalists, which include Pentecostals and Charismatics, and certain non-mainstream groups, including the Seventh Day Adventists, Mormons, and Jehovah's Witnesses. Pentecostalism, now just over a century old, has a strict religious doctrine similar to evangelicals and fundamentalists but also espouses a belief that speaking in tongues is evidence that one has been baptized spiritually. Speaking in tongues, and other ecstatic practices including healing and prophesying, are essential features of Pentecostal and other renewalist worship services, which make them distinct liturgically from other Protestant groups (Robbins, 2004). For the last 100 years, there has been debate within Christianity over whether to endorse speaking in tongues. Groups that reject the practice, including many fundamentalists, often do so strongly (Melton, 1989). The Charismatic movement, which emerged in the United States in the 1960s, includes many individuals who have left mainline denominations and who have embraced speaking in

tongues.¹² Between 1970 and 2005, the share of foreign adherents in US denominations belonging to Pentecostal and other renewalist traditions rose from 22% to 37%.

Mormons and Jehovah's Witnesses are considered outside the Christian mainstream in part because of their acceptance of religious texts other than the Christian Bible. Additionally, Mormons maintain a strict dietary regimen, rigid guidelines on charitable giving, and a requirement that young men provide two years of missionary service; Jehovah's Witnesses have an elaborate theology surrounding the end of the world and are required to go door-to-door seeking to convert non-believers. Adventists, whose origins trace to mid-19th century movements that believed the return of Jesus Christ to earth was imminent, have strict religious doctrine, maintain a vegetarian diet, and observe the Sabbath on Saturday, rather than Sunday. Together, between 1970 and 2005 these three groups saw their share of foreign adherents belonging to US denominations rise from 16% to 21%.¹³

2.3 Denominational doctrine and governance

In the production of religious services, the church is the equivalent of the factory, the pastor is the factory manager, and, given that worship is a collective activity, congregants are both workers and consumers (Iannaccone, 1998). The role of the denomination is to provide the intellectual property used in production, which includes religious doctrine and a system of governance (Chaves, 1993a). Denominations range in form from loose membership associations to rigidly hierarchical bodies. We code denominations according to their governance structure and the strictness of their religious doctrine, using information from Melton (1989), Barrett, Kurian, and Johnson (2001), the World Christian Database, and denomination websites.

¹² The neocharismatic movement, which emerged in the United States in the 1970s, is similar to charismatics in terms of practice but emerged from independent churches unaffiliated with mainline Protestantism.

¹³ The Marginal category in Figure 2 includes a number of small denominations outside the Christian mainstream (Unitarians, Swedenborgians, Christadelphians, the Unification Church, and the Children of God).

In many cases, the core elements of a denomination's doctrine and governance were established by a religious entrepreneur who founded the organization (eg, Aimee Semple McPherson for the Foursquare Church, Joseph Smith for the Mormons, Charles Taze Russell for the Jehovah's Witnesses). In the early years of a movement, some elements of doctrine and structure are malleable but once codified tend to change very slowly over time (Melton, 1989; Chaves and Sutton, 2004; Finke and Stark, 2008).¹⁴ In our empirical analysis, we treat doctrine and structure as stable over the 1970 to 2005 period, as consistent with historical evidence.

Congregations that belong to a denomination typically share a defined religious doctrine, given in the denomination's statement of faith (available on most denomination websites). The doctrine is a system of belief that is in part what attracts potential adherents to church. Christianity is organized around the life and teachings of Jesus Christ as contained in the New Testament of the Christian Bible, in which Christ is portrayed as the Son of God who offers eternal salvation to those who believe in him. Following Hoge (1979), Iannaccone (1998), and Ekelund, et al. (2006), we define strict religious doctrine to include the following beliefs: (a) the Bible is the literal word of God and therefore infallible, (b) to become a Christian one must openly repent one's sins and accept Christ as lord and savior (be "born again"), (c) one should try actively to convert others to Christianity, (d) Christ will return to earth soon and believers should prepare for his second coming, (e) those who have not converted are damned to a life of suffering in hell, (f) one should dress modestly, avoid smoking or drinking, keep sexual activity within marriage, and shun any social or cultural activities that contradict these mores, (g) believers should be sanctified and thereby purified from sin (eg, the Holiness movement), (h) speaking in tongues is evidence of one's baptism in the Holy Spirit (eg, Pentecostalism), and (i)

¹⁴ Over the 20th century, Chaves (1993b) identifies a shift in power from religious authorities to administrative authorities in US denominations, which relates to a gradual (and uneven) tendency for religious groups to secularize.

divine healing is an ongoing practice available to believers. Each of these beliefs imposes time costs, lifestyle constraints, and/or impediments to maintaining relationships with non-Christians. In the language of Iannaccone (1992), they stigmatize believers, raising the cost of participating in secular activities and helping other adherents identify those willing to participate actively in the life of a congregation (and the production of club goods).

Table 3 gives the share of US denominations that abide by the beliefs (a)-(i), above. Some beliefs – evangelism, repentance and conversion, infallibility of the Bible, and damnation of non-believers – are common to most groups, with at least 70% of US denominations adopting one of these beliefs. Others – the imminence of Christ’s second coming, sanctification, speaking in tongues, restrictions on dress, and divine healing – are less common. The second set of beliefs represents the means through which strict groups differentiate themselves. For example, the Assemblies of God, a Pentecostal denomination, endorses speaking in tongues but not sanctification. The Church of the Nazarene, a conservative Methodist denomination associated with the Holiness Movement, endorses sanctification but not speaking in tongues. Both endorse divine healing, though they differ on the imminence of Christ’s second coming.

To measure strictness in an environment in which denominations are differentiated, we define a denomination to be strict if the row mean of the nine doctrine dummy variables is greater than 0.6, which applies to 32% of the denominations. Figure 4 shows the distribution for the row mean of the nine doctrine variables for US denominations. The cutoff of 0.6 captures a break in the distribution between the top tercile of denominations and the rest. Later empirical results are robust to varying the definition of strictness either by raising the row mean cutoff or by excluding from the row mean beliefs that are common to most denominations.

In terms of organization, belonging to a denomination means a congregation agrees to

govern itself according to a pre-specified structure. There is wide variation in the degree of centralization among denominational governance systems.¹⁵ The most decentralized denominations have a congregational polity. The congregation retains control over the hiring and firing of pastors, religious doctrine, and, often times, ownership of church property. The denomination, through national or international bodies, operates at arms' length. It provides congregations with a wide range of services, including identifying (but not choosing) pastoral candidates, providing non-binding guidance on theology, publishing educational material for use in services, training to pastors and lay leaders, extending loans for church construction or expansion, organizing regional or national ministries reach new converts, and raising funds to support global operations (Chaves, 1993b). In return for these services, congregations pay fees to the denomination.¹⁶ Local churches, in effect, use the denomination as a consulting service. Decentralized denominations can be found among mainline Protestants (Baptists, Congregationalists, Disciples of Christ), the Holiness Movement (Church of God (Anderson)), and Pentecostals (Pentecostal Church of God, United Pentecostal Church).

In centralized denominations, authority resides not in the congregation but higher up in the denominational hierarchy. Denominational bodies above the congregation screen applicants to the ministry, assign pastors to churches, discipline pastors, set religious doctrine for member churches, and may control the disposition of church property. The denomination, in effect, has the power to license its brand – including the denomination name, religious doctrine, and government structure – to individual congregations and decide who will manage each

¹⁵ Bloom, Sadun, and Van Reenen (2009) suggest that within regions organizational structures in religion may be associated with organizational choices by private firms. They find that multinational firms are more prone to centralize decision making in firm headquarters in regions in which the prevalence of hierarchical religions (Catholicism, Eastern Orthodoxy, and Islam) is greater.

¹⁶ In the US, congregations on average keep 79% of the revenues they generate, a share that has remained stable over time (Chaves, 1998).

congregation. The form of centralized governance structures comes in several varieties. In an episcopal or connectional structure, power resides in the bishopric. The chief authority over congregations within a region is a bishop, who ordains pastors, assigns pastors to churches, adjudicates disputes, and performs various administrative duties. A general council of bishops controls church doctrine. Episcopal denominations can be found among mainline Protestants (Methodists, Lutherans), Pentecostals (International Church of the Foursquare Gospel), Holiness-Pentecostals (Church of God (Cleveland)), and Marginals (Mormons).

An alternative hierarchical system is the presbyterian structure. Power resides in a regional governing body known as the presbytery, which consists of a pastor and an elder from each congregation, and other church leaders. The presbytery ordains, installs, and removes pastors and establishes and dissolves congregations. Above the presbytery is a general assembly, which resolves disputes at the presbytery level and settles issues of religious doctrine. Denominational families with a presbyterian structure can be found among mainline Protestants (Presbyterian Church, Reformed Church), Seventh Day Adventists, the Holiness Movement (Church of the Nazarene), and Pentecostals (Pentecostal Holiness Church).

We define a denomination to be decentralized if it has a congregational polity, which as seen in Table 3 applies to 55% of US denominations. Among US denominations, the correlation between having a congregational polity and being strict, according to our definition (row mean of doctrinal variables greater than 0.6), is -0.19, implying that decentralized denominations are modestly less likely to have a strict religious doctrine.

2.4 Global expansion by denominations

Denominations typically create and maintain a presence in a country through supporting missionaries, organizing mass revival meetings, or another form of ministry (Brouwer, Gifford,

and Rose, 1996). Once it has established itself in a market, it may grow either by attracting additional members to existing congregations or by adding congregations. Figure 5 plots the log number of affiliated Christians against the log number of congregations, where each data point represents the worldwide total for a denomination. The log linear relationship between affiliated Christians and congregations suggests that global expansion by a denomination occurs more on the extensive margin (adding congregations) than on the intensive one (adding members to existing congregations). For the theoretical analysis, it appears that creating and managing congregations is important for determining the size of a denomination.

To examine the intensive and extensive margins more formally, we follow Eaton, Kortum and Kramarz (2004) and use the identity , $N_{dc} \times (M_{dc}/N_{dc}) \equiv M_c \times (M_{dc}/M_c)$, where N_{dc} is the number of congregations for denomination d in country c , M_{dc} is the number of affiliated Christians for denomination d in country c , and M_c is the total number of Christians in country c . We then estimate the following two regressions (with robust t statistics in parentheses):

$$\begin{aligned} \ln N_{dc} &= 0.846 \ln M_c + 0.794 \ln M_{dc}/M_c \\ &\quad (0.006) \quad (0.007) \\ \\ \ln M_{dc}/N_{dc} &= 0.154 \ln M_c + 0.206 \ln M_{dc}/M_c \\ &\quad (0.006) \quad (0.007) \end{aligned}$$

where the sample includes the 130 US denominations across the countries in which they operate. By the logic of least squares, across the two regressions the constant and error terms sum to zero and the coefficients on each variable sum to one. The magnitude of the coefficients indicates how aggregate variation in market size affects the number of congregations (the extensive margin) and Christians per congregation (the intensive margin). In response to a 10% increase in country market size (M_c), the number of congregations increases by 8.5% and members per congregation by 1.5%; similarly, in response to a 10% increase in market share for a

denomination in a country (M_{dc} / M_c), the number of congregations increases by 7.9% and members per congregation by 2.1%. This is further evidence most adjustment in the size of denominations occurs at the extensive margin, though adding congregations.

3. Theory

3.1. Model Set-up

In this section, we present a model of denomination size in which denominations compete for members in many national markets. Each country, k , consists of many regional markets, indexed by m , that vary in size. To be present in a market, a denomination must establish a congregation. The denomination headquarters (the principal) provides intellectual property (doctrine) and management services to the congregation and its pastor. The pastor (the agent) manages the activities of the congregation. Members of the congregation are both consumers and workers; they enjoy the services provided by the church and contribute money and time to support the production of religious services. In regional market m of country k , a total number of O_k^m individuals choose among Christian denominations.

The project of congregation-building has a quality dimension and a price dimension. On the quality dimension, the denomination and the pastor must connect with members of the congregation (eg, relating doctrine to the specifics of their personal lives). We follow Aghion and Tirole (1997) and assume that there are many ways of making the connection. Among them, one and only one works for a given market m ; across local markets, the correct way of making the connection may vary. On the price dimension, the denomination and the pastor must set a price, p_{jk}^m , for congregational members, where j indexes denominations. When price is high, participation requires more resources from congregational members (eg, in the form of volunteer work or donations). As quality and price vary there can an infinite number of ways to build the

congregation. Regardless of quality or price, each congregation requires a fixed cost of f_{ck} . The denomination also incurs a fixed cost f_k to enter country k , which captures initial mission work (\cdot).

We adopt a discrete choice framework and specify that the utility for person i in country k from participating in Christian denomination j in local market m , u_{ijk}^m , is

$$u_{ijk}^m = I(\cdot) + V_{jk}^m(\cdot, p_{jk}^m) + \varepsilon_{ijk}^m, \quad (1)$$

where $I(\cdot)$ is an indicator variable that equals 1 if denomination j and its pastor succeed in connecting with congregation members, and 0 otherwise. In other words, the success of making the connection increases the utility by one unit for every member of the congregation. ε_{ijk}^m is an iid extreme value error term. ε_{ijk}^m is observable to person i and only to person i . $V_{jk}^m(\cdot)$ represents the other sources of utility from church services and we motivate $V_{jk}^m(\cdot)$ using the club-good model of Iannaccone (1992), where each congregation is a club and members take congregation membership as given. Each member consumes a secular good, S , with the market-invariant shadow price π_{Sjk} , and church participation R , with the shadow price π_{Rjk} . Members also benefit from higher “quality” of the congregation, Q_{jk} , which increases with average participation across members within the congregation. Congregation members maximize the club-good utility of $u_c(S, R, Q)$. Since the participation charge, p_{jk}^m , is on a per-head basis and not for participation intensity,¹⁷ R , the congregation members face the budget constraint of $\pi_{Sjk}S + p_{jk}R \leq I_k - p_{jk}^m$, where we assume interior solution with positive participation. Congregation members play the non-cooperative game where each individual takes the others’ participation as given, and $V_{jk}^m(\pi_{Sjk}, \pi_{Rjk}, I_k - p_{jk}^m, Q_{jk})$ is the members’ indirect utility at the Nash equilibrium.

It is easy to show that $-\beta \equiv \partial V_{jk}^m / \partial p_{jk}^m < 0$. An increase in participation charge decreases members’ disposable income and so reduces utility. Iannaccone (1992) shows that $\partial V_{jk}^m / \partial \pi_{Sjk} >$

¹⁷ In other words, p_{jk}^m does not affect the marginal cost of participation intensity, R , as we implicitly assume that the pastor and the denomination do not internalize the effect of p_{jk}^m on R .

0. The intuition is that an increase in the price of the secular good reduces its consumption but raises church participation (when the secular good and church participation are substitutes) and so raises average participation. The gains from higher participation can more than offset the loss in real income and so utility increases. We show in the Appendix that, $\partial^2 V_{jk}^m / \partial (\pi_{sjk})^2 > 0$. The intuition is that the increase in the price of the secular good raises utility more for strict denominations than for less strict ones. Summarizing the properties of indirect utility,

$$-\beta \equiv \frac{\partial V_{jk}^m}{\partial p_{jk}^m} < 0, \quad \frac{\partial V_{jk}^m}{\partial \pi_{sjk}} > 0, \quad \text{and} \quad \frac{\partial^2 V_{jk}^m}{\partial (\pi_{sjk})^2} > 0. \quad (2)$$

For the denomination and the local pastor, there is no uncertainty involved in setting the price p_{jk}^m . However, neither the denomination nor the pastor knows the right way to connect with congregation members prior to building the congregation. We assume that the denomination is exogenously endowed with hard information about connecting with members in country k , which may come from past experiences in the home country (the country in which the denomination is headquartered), missionary work embedded in the fixed entry cost f_k , or other sources. In every local market m in country k , the denomination can use its hard information itself, or costlessly transmit it to the local pastor; either way, the information brings probability E_{jk} of successfully choosing the right preaching style. We assume that E_{jk} is invariant across local markets m . On the other hand, the pastor in a given market m can gather soft information about connecting with members. The soft information is only useful in market m , and it cannot be transmitted to the other pastors of denomination j or to the denomination itself. In order to have probability $\rho_k e_{jk}^m$ of success ($\rho_k > 0$), the pastor must incur effort cost,

$$c(e_{jk}^m) = \exp[h_k e_{jk}^m], \quad (3)$$

to gather soft information *per* member of the congregation,¹⁸ where $h_k > 0$ affects effort costs.¹⁹

The pastor values both the number of congregation members, with weight γ , and the monetary income from serving the congregation. Likewise, a denomination values the number of believers it attracts, with weight θ , as well as the monetary income associated with the enterprise in a given country. We treat these weights as common across denominations and countries. There is also a variable cost g_k for serving each member of the congregation, which we assume is constant across regions within a country.

Timing is as follows. (i) The denomination decides whether or not to enter country k and market m . (ii) Price and effort levels, p_{jk}^m and e_{jk}^m , are chosen, and they determine congregation membership. (iii) The denomination and pastor bargain over the monetary surplus they produce in market m . Bargaining results from incomplete contracts, as no contract can be written at stage (ii) to govern trade at stage (iii). We assume both parties' outside options are 0 and each gets half the surplus; results are unchanged if we relate outside options to owning church property.

3.2 Authority and pastor incentives

We classify the organizational structure of a denomination as decentralized (D) or centralized (C), which is chosen by the denomination at an earlier time and taken as given. To facilitate comparison between the C and D structures, we assume $\theta = \gamma$ (i.e., the pastor and the denomination place equal value on attracting members).

Under the D structure, we follow Aghion and Tirole (1997) and assume that the local pastor has formal authority in both dimensions of the congregation-building project, connection

¹⁸ We have effort cost as increasing in congregation membership because we have already assumed that the benefit of effort increases in membership (recall that the success of making the connection increases utility for every congregation member). Suppose, instead, that effort cost does not depend on membership. Then average effort cost decreases with membership and we have increasing returns. This additional effect adds no insight to our model.

¹⁹ In equation (3) h_k only affects the variable cost of pastor effort. Results are similar if we allow h_k to affect the fixed cost for pastor effort as well.

and setting price. In deciding how to connect with congregation members, the pastor uses his soft information if he is informed; if not, the pastor uses the hard information that the denomination transmits to him (in which case the denomination has real authority). This implies the success probability of making connection is $\rho_k e_{jk}^m + (1 - \rho_k e_{jk}^m) E_{jk}$. We assume that the congregation members are risk neutral. For person i in market m , the expected utility from denomination j is

$$U_{ijk}^m = E_{jk} + \alpha_{jk} e_{jk}^m + V_{jk}^m(\cdot) + \varepsilon_{ijk}^m, \quad \alpha_{jk} = \rho_k(1 - E_{jk}), \quad (4)$$

where $V_{jk}^m(\cdot)$ is indirect utility from church participation. $\alpha_{jk} > 0$ captures the marginal impact of pastor effort on demand. Intuitively, α_{jk} is high when the denomination has limited hard information (E_{jk} is low), or when country k 's infrastructure facilitates the pastor's collection of soft information (ρ_k is high). We apply Anderson, de Palma and Thisse (1992) and Feenstra (2004) and derive the total number of individuals who participate in denomination j ,

$$X_{jk}^m = \mu_{jk}^m O_k^m, \quad \mu_{jk}^m = \frac{\exp[\alpha_{jk} e_{jk}^m + V_{jk}^m + E_{jk}]}{P_k^m}$$

$$P_k^m = \sum_j \exp[\alpha_{jk} e_{jk}^m + V_{jk}^m + E_{jk}], \quad \alpha_{jk} = \rho_k(1 - E_{jk}), \quad (5)$$

where μ_{jk}^m is the market share of denomination j in market m and P_k^m measures the competitiveness of market m .²⁰ By equation (5), $\partial \ln X_{jk}^m / \partial p_{jk}^m = -\beta$, and so the parameter $\beta > 0$ measures the elasticity of demand for church membership; a high β indicates elastic demand.

Under the D structure, the local pastor also has formal authority in setting price.²¹ Since the joint monetary surplus from the congregation is $X_{jk}^m(p_{jk}^m - g_k)$, the pastor receives utility $X_{jk}^m \gamma + 0.5 X_{jk}^m(p_{jk}^m - g_k) - f_{ck} - X_{jk}^m c(e_{jk}^m)$ from building the congregation.²² The first order

²⁰ While we focus on Christian denominations, other religious groups are implicitly captured in the term P_k^m , which we control for in the estimation using country fixed effects.

²¹ There is no uncertainty about price and so there is no distinction between formal and real authority over price.

²² In our setting the allocation of formal authority has no impact on bargaining power. To relax this assumption, suppose formal authority increases bargaining power. Then under the D structure the pastor has even stronger

conditions for effort and price are,

$$c'(e_k^D) + \alpha_{jk} c(e_k^D) = \alpha_{jk} [\gamma + \frac{1}{2}(p_k^D - g_k)] \quad (6)$$

$$p_k^D = \frac{1}{\beta} + g_k + 2[c(e_k^D) - \gamma], \quad (7)$$

Due to the logit demand equation (5), indirect utility, V_{jk}^m , quality of hard information, E_{jk} , and market competitiveness, P_k^m , do not affect price or effort, though they do affect the number of adherents (we therefore drop denomination subscript j and regional superscript m on price and effort). Equation (6) says that a higher price provides the pastor with stronger incentives to exert effort, as the left-hand side of equation (6) is an increasing function of effort level. Equation (6) also says that the pastor has strong incentives when his effort has large impact on demand (α_{jk} is high) or when effort cost, h_k , is low. Equation (7) says that an incremental increase in effort cost, $c(e)$, leads to a more than one-for-one increase in price. This is due to the hold-up problem under incomplete contracts. Since the pastor captures only half of the monetary surplus, he is not fully compensated for his effort. To alleviate the hold-up problem, he over-compensates his effort in pricing. In (7), the pastor does not internalize the non-monetary benefit to the denomination from attracting believers, θ . The other terms in (7) say that price is high if variable cost, g , is high, or demand is inelastic (β is low). From (6) and (7),

$$e_k^D = \frac{1}{h_k} \ln \frac{\alpha_{jk}}{2\beta h_k}. \quad (8)$$

Equation (8) says that pastor effort is high when effort has a large marginal contribution to demand (α_{jk} is high) or when effort cost, h_k , is low.

incentives since he gets more than half the surplus. This strengthens our results. In other words, our results hold up as long as formal authority does not decrease bargaining power too much.

Under the C structure, we follow Aghion and Tirole (1997) and assume that the denomination has formal authority in making connection and setting price, which are the two dimensions of the congregation-building project. The denomination also has real authority in choosing how to connect with congregation members if it is informed; if not, the denomination optimally gives the pastor real authority in doing so. This implies the success probability of making connection is $E_{jk} + (1 - E_{jk})\rho_k e_{jk}^m$, which is the same as under the D structure. The intuition is that there is no disagreement between the denomination and the pastor about how to connect with members since there is only one right way to make the connection.²³ As a result, equations (4) and (5) also hold under the C structure. On the other hand, under the C structure, price-setting authority rests with the denomination, which receives the payoff $\theta X_{jk}^m + X_{jk}^m(p_{jk}^m - g_k)/2 - f_{ck}$ in local market m ,²⁴ and chooses the price

$$p_k^C = \frac{1}{\beta} + g_k - 2\theta. \quad (9)$$

Equation (9) says that the denomination does not internalize the non-monetary benefit to the pastor from attracting believers, γ . In addition, (7) and (9) imply that price is lower under the C structure than under the D structure: $p_k^C < p_k^D$. This is because the cost of pastor effort does not enter into the denomination's utility, leading the denomination to ignore the effort cost in pricing. The first order condition for pastor effort is still equation (6), except that price is p_k^C .

Plugging (9) into (6) we obtain

²³ There is disagreement over price (the pastor prefers p_k^D but the denomination prefers p_k^C) and so there is disagreement over the congregation-building project, which is the vector (connection, price). The assumption that the pastor and the denomination agree on connection simplifies the algebra. Suppose we relax this assumption so that there is a pastor connection and a denomination connection. Then under D structure the pastor has even stronger incentives since he can not only choose his preferred price but also his preferred connection. This would strengthen our results. On the other hand, if one party has authority over price but not over connection, then connection and price are two separate projects. This would be an extension of Aghion and Tirole (1997), where there is only one single project, and imply four organizational types instead of two.

²⁴ We choose to have the denomination bear the church fixed cost, f_{ck} , in order to simplify the expressions for the entry threshold and the number of churches and believers. Who bears f_{ck} has no effect on the first order conditions.

$$e_k^C = \frac{1}{h_k} \ln \frac{\alpha_{jk}}{2\beta(h_k + \alpha_{jk})}. \quad (10)$$

Equations (7) and (10) say that the effort level is lower under the C structure than the D structure: $e_k^C < e_k^D$. Under the C structure, price-setting authority rests with the denomination, which ignores the effort cost in its pricing decision. For the pastor, lack of authority under the C structure aggravates the hold-up problem, creating weak incentives to invest in effort.

To summarize, the denomination and the pastor have perfect congruence over how to connect with congregation members, which is the quality dimension of congregation-building. However, they disagree about pricing; the denomination prefers p_k^C (as defined equation (9)) but the pastor prefers p_k^D (as defined equation (7)). Relative to the C structure, the D structure provides stronger incentives to the pastor by allocating formal authority to him; this results in high effort level but also high price. Since we do not observe the effort level or participation charge in our data, we next examine the model's predictions about the numbers of believers and congregations under the C and D structures.

3.3 Aggregate size

To examine the numbers of believers and congregations in country k we aggregate across religious markets m within country k for a given denomination. We first derive results under the D structure; results for the C structure are analogous. Under the D structure, the denomination is active in markets where pastor utility is non-negative. Plugging (7) and (8) into pastor utility, the denomination enters local market m if and only if

$$X_{jk}^D B \geq f_{ck}, B = \frac{1}{2\beta} - \gamma \quad (11)$$

where X_{jk}^D is given by (5) with price and effort level equal to p_k^D and e_k^D . Intuitively, the

denomination enters larger markets and markets with lower entry and variable trade costs. We rewrite the population in local market m as $O_k^m = O_k s_m$, where s_m is the size of local market m , with cdf $G_k(\cdot)$ and pdf $g_k(\cdot)$, and O_k is a shifter reflecting the total population of country k . It follows that $X_{jk}^D = \mu_{jk}^D O_k s_m$, where μ_{jk}^D is given by (5) with price p_k^D and effort e_k^D . We assume that μ_{jk}^D , the market share of denomination j , is invariant across markets in k where i is present. Equation (11) gives the threshold market size for entry:

$$\underline{s}_k^D = \frac{f_{ck}}{B O_k \mu_{jk}^D}, B = \frac{1}{2\beta} - \gamma, \quad (12)$$

Equation (12) says that the denomination enters more markets the lower the fixed cost, the larger country k , or the higher the denomination's market share. The denomination, then, has $n_{jk}^D = \int_{\underline{s}_k^D}^{\infty} g(s_k^m) ds_k^m = 1 - G_k(s_k^D)$ congregations and $X_{jk}^D = \mu_{jk}^D O_k \int_{\underline{s}_k^D}^{\infty} s_k^m g(s_k^m) ds_k^m$ adherents in country k .

Following the urban economics literature, we assume that the distribution $G_k(\cdot)$ is Pareto with lower bound b and shape parameter a ; i.e., $G_k(s) = 1 - (b/s)^a$. We can show that²⁵

$$\begin{aligned} \ln \mu_{jk}^D &= \alpha_{jk} e_k^D + V_{jk}^D(\cdot, p_k^D) - \ln P_k, \\ \ln n_{jk}^D &= a \ln \frac{Bb}{f_{ck}} + a \ln O_k + a \ln \mu_{jk}^D \\ \ln X_{jk}^D &= \ln \frac{ab^a B^{a-1}}{(a-1)(f_{ck})^{a-1}} + a \ln O_k + a \ln \mu_{jk}^D, B = \frac{1}{2\beta} - \gamma. \end{aligned} \quad (13)$$

Equation (13) implies that the intensive margin, $\frac{X_{jk}^D}{n_{jk}^D}$, does not depend on the market size or

market share ($\frac{X_{jk}^D}{n_{jk}^D} = \frac{f_{ck} a}{B(a-1)}$) and that all the adjustment of X_{jk}^D is through the extensive margin,

n_{jk}^D , consistent with the empirical findings in section 2. Such predictions are typical of models

²⁵ P_k and V_{jk} are invariant across markets because price, effort level, and market share are invariant across markets.

with firm heterogeneity (Melitz, 2003). To determine the condition under which the denomination enters country k , note the denomination derives variable profits $0.5X_{jk}^m(p_{jk}^m - g_k)$ from local market m and total variable profit $\int_{s_k^D}^{\infty} \frac{1}{2}(p_k^D - g_k)X_{jk}^m dG(s_k^m) = \frac{1}{2}(p_k^D - g_k)X_{jk}^D$ from country k . Using the expression for X_{jk}^D in (14), we show that denomination j enters country k if

$$\ln \frac{p_k^D - g_k}{2} + \ln \frac{ab^a B^{a-1}}{(a-1)(f_{ck})^{a-1}} + a \ln O_k + a \ln \mu_{jk}^D \geq \ln f_k. \quad (14)$$

Under the C structure, we can derive the entry threshold, market share, and total number of congregations and adherents analogously:

$$\begin{aligned} s_k^C &= \frac{f_{ck}}{BO_k \mu_{jk}^C}, B = \frac{1}{2\beta} - \theta, \\ \ln \mu_{jk}^C &= \alpha_{jk} e_k^C + V_{jk}^C(\cdot, p_k^C) - \ln P_k, \\ \ln n_{jk}^C &= a \ln \frac{Bb}{f_{ck}} + a \ln O_k + a \ln \mu_{jk}^C \\ \ln X_{jk}^C &= \ln \frac{ab^a B^{a-1}}{(a-1)(f_{ck})^{a-1}} + a \ln O_k + a \ln \mu_{jk}^C \end{aligned} \quad (15)$$

Under the C structure, denomination j enters country k if

$$\ln \left[\frac{p_k^C - g_k}{2} - \frac{B(a-1)}{ab^a} \right] + \ln \frac{ab^a B^{a-1}}{(a-1)(f_{ck})^{a-1}} + a \ln O_k + a \ln \mu_{jk}^C \geq \ln f_k \quad (16)$$

3.4 Main results

We first examine the effect of organizational structure on size (in terms of membership or number of congregations). By equations (13) and (15),

$$\ln \frac{n_{jk}^D}{n_{jk}^C} = \ln \frac{X_{jk}^D}{X_{jk}^C} = a[\alpha_{jk}(e_k^D - e_k^C) + (V_{jk}^D - V_{jk}^C)]. \quad (17)$$

Equation (17) implies that it is difficult to compare the size of a decentralized denomination with a centralized one, as such comparison depends on all the elements of the indirect utility function $V_{jk}(\cdot)$, such as the general quality of a denomination's religious good in country k . However, we can examine the differential impacts that a change in the marginal contribution (or cost) of pastor effort has on the size of decentralized and centralized denominations. Suppose α_{jk} increases (or h_k increases). Then effort level increases and so size increases for both C and D structures. Intuitively, given that the D structure provides the pastor with stronger incentives, the increase in α_{jk} should have a larger impact on the D structure. We show in the Appendix that

Proposition 1. A change in the marginal contribution or marginal cost of pastor effort has a larger impact on the size of decentralized (D) denominations than centralized (C) denominations;

$$\text{i.e. } \frac{\partial \ln(G_{jk}^D / G_{jk}^C)}{\partial \alpha_{jk}} > 0, \quad \frac{\partial \ln(G_{jk}^D / G_{jk}^C)}{\partial h_k} < 0, \quad \text{where } G = X, n.$$

Tuning to the effect of doctrine on size, we hypothesize that in country k for denomination j , the shadow price for the secular good is $\pi_{Sjk} = \pi_{Sk} + \pi_{Sj}$ for all markets m . π_{Sk} is high for the population of country k if country k has low public spending on health per capita, or high frequency of natural disaster. π_{Sj} is high for the adherents of denomination j if denomination j is strict. Suppose health spending per capita in country k is low (and vice versa if the frequency of natural disaster is high). Then π_{Sk} increases, and utility increases for all denominations in country k , strict or not, since $\partial V / \partial \pi_S > 0$ by equation (2). This is consistent with the findings that church-provided services compete with government-run welfare programs (Hungerman, 2005; Gruber and Hungerman 2007). In addition, the increase in indirect utility is higher for strict denominations, for which π_{Sj} is higher, since $\partial^2 V / \partial (\pi_S)^2 > 0$ by equation (2). In other words, strict denominations face relatively high demand if the provision of public goods by the government is

weak. Summarizing,

Proposition 2 Weaker government provision of social services (higher π_{sk}) raises the size of strict

denominations (π_{sj} high) by more than less strict ones; i.e. $\frac{\partial^2 \ln X_{jk}^O}{\partial(\pi_{sk})\partial(\pi_{sj})} > 0$, $\frac{\partial^2 \ln n_{jk}^O}{\partial(\pi_{sk})\partial(\pi_{sj})} > 0$,

where $O = D, C$.

3.5 Extensions

We can also extend our analysis to incorporate ownership of church property. We assume that ownership and authority rest with the same party; i.e., under the de-centralized (D) structure the local congregation owns the church, but under the centralized (C) structure the denomination owns the church (in practice, under a congregational polity, the congregation owns church buildings, while under episcopal or presbyterian polities, the denomination typically controls the disposition of church property). In our analysis, as in Grossman and Hart (1986), ownership affects the pastor's incentives by changing his outside option should bargaining fail. Under the D structure, the denomination's outside option remains 0, but the pastor owns the church and should bargaining fail the pastor converts the church into an independent entity, in which case the denomination input no longer affects demand and the pastor collects the fraction ϕd_{jk}^D of the monetary surplus, where $d_{jk}^D < 1$ and $\phi < 1$. The denomination then gets the fraction $(1 - \phi d_{jk}^D)/2$ of the monetary surplus in bargaining, while the pastor receives the fraction $(1 + \phi d_{jk}^D)/2$. Under the C structure, the denomination owns the church. Should bargaining fail, pastor effort no longer affects demand and the denomination collects $X_{0k}^m(p_{jk}^m - g_k)$, where $X_{0k}^m = X_{jk}^m/\exp(\alpha_{jk}e_k^m)$ and is independent of effort level. The pastor, on the other hand, has outside option 0. Let $d_k^C = 1/\exp(\alpha_{jk}e_k^C)$, where e_k^C is the pastor's optimal effort level under the C

structure. The denomination then gets the fraction $(1 + \phi d_k^C)/2$ of the monetary surplus in bargaining and the pastor gets the fraction $(1 - \phi d_k^C)/2$. Propositions 1 and 2 continue to hold.

To summarize, our model generates the following three predictions, which we take to the data: (1) Entry and extensive margin: An increase in membership in a country is associated with an increase in the number of congregations (denominations grow by expanding the number of congregations rather than by expanding adherents per congregation); (2) Organization: An increase in the marginal value of pastor effort raises the numbers of adherents and congregations more for a decentralized denomination than a centralized one (Proposition 1); and (3) Doctrine: Weaker government provision of social services raises the number of adherents and congregations more for strict denominations than less strict ones (Proposition 2).

4. Empirical Specifications

To take our predictions to the data, we show in an appendix that we can obtain the following second-order Taylor approximation for the indirect utility function

$$V_{jk}^O = -\beta p_k^O + c_0 + c_1 I_k + c_2 \ln Q_{jk} + J(\pi_{Sjk}, \pi_{Rjk}), \quad O = D, C, \quad (18)$$

where $J(\pi_{Sjk}, \pi_{Rjk})$ is a second-order polynomial involving π_{Sjk} and π_{Rjk} and the c 's are constants. We assume that π_{Rsk} is country- k specific and denote the vector (I_k, π_{Rk}) by \mathbf{Z}_k . We also assume $\ln Q_{jk} = \varsigma_j - c_3 t_{jk}$, where ς_j represents the general quality of denomination j 's religious good, and

$$t_{jk} = \tau_k + d_{jk} + \eta_{jk}, \quad (19)$$

where τ captures variable trade costs common to all denominations in country k , d captures trade costs in k specific to denomination j (e.g., distance to denomination headquarters), and η is an iid random cost (which allows the ranking of denominations across countries to differ). Finally,

following our earlier discussions for Proposition 2 we assume that $\pi_{Sjk} = \pi_{Sj} + \pi_{Sk}$. We measure π_{Sk} using the vector \mathbf{H}_k , which includes measures of the provision of and demand for social services in country k . We measure π_{Sj} by the strictness of denomination j , DOC_j . We then have the following empirical specification for V_{jk}^O ,

$$V_{jk}^O = c_0 - \beta p_k^O + \zeta_j + c_4 \mathbf{Z}_k + c_5 \text{DOC}_j \mathbf{Z}_k + \eta_1 \mathbf{H}_k \text{DOC}_j - c_3 t_{jk}, \quad O = D, C, \quad (20)$$

where the coefficient of interest is η_1 . By Proposition 2, $\eta_1 < 0$.

We then plug equation (20) into (13) and (15) to show that

$$\begin{aligned} \ln X_{jk}^O &= f^O(\alpha_{jk}, h_k) + a[\ln O_k - \ln P_k] + c_4 \mathbf{Z}_k + c_5 \text{DOC}_j \mathbf{Z}_k + \eta_1 \mathbf{H}_k \text{DOC}_j - c_3 t_{jk} + c_6 \\ \ln n_{jk}^O &= f^O(\alpha_{jk}, h_k) + a[\ln O_k - \ln P_k] + c_4 \mathbf{Z}_k + c_5 \text{DOC}_j \mathbf{Z}_k + \eta_1 \mathbf{H}_k \text{DOC}_j - c_3 t_{jk} + c_7 \end{aligned} \quad (21)$$

where c_6 and c_7 are constants and $O = \{\text{Decentralized}, \text{Centralized}\}$. In equation (21), X_{jk}^O and n_{jk}^O are, respectively, the numbers of adherents and congregations denomination j has in country k , and α_{jk} (h_k) is the marginal value (cost) of pastor effort in country k . Proposition 1 implies that $\partial f^D / \partial \alpha_{jk} > \partial f^C / \partial \alpha_{jk}$ (i.e., increases in the marginal product of pastor effort have a larger positive impact on decentralized denominations than on centralized ones) and that $\partial f^D / \partial h_k < \partial f^C / \partial h_k$. We approximate $f^O(\cdot)$ by $\lambda_1 \mathbf{R}_k + \eta_2 \mathbf{R}_k \text{DEC}_j$, where \mathbf{R}_k measures the quality of communication and transportation infrastructure in country k for denomination j and DEC_j measures the decentralization of denomination j . Since high infrastructure quality is associated with high α_{jk} and/or low h_k , Proposition 1 implies $\eta_2 > 0$. Equation (21) implies the following regressions:

$$\begin{aligned} \ln X_{jk} &= \gamma_j + \eta_2 \mathbf{R}_k \text{DEC}_j + \eta_1 \mathbf{H}_k \text{DOC}_j + \lambda_1 \mathbf{R}_k + \lambda_2 \mathbf{Z}_k + \lambda_3 \text{DOC}_j \mathbf{Z}_k + \lambda_4 \mathbf{Y}_{jk} + u_{jk} \\ \ln n_{jk} &= \gamma_j + \eta_2 \mathbf{R}_k \text{DEC}_j + \eta_1 \mathbf{H}_k \text{DOC}_j + \lambda_1 \mathbf{R}_k + \lambda_2 \mathbf{Z}_k + \lambda_3 \text{DOC}_j \mathbf{Z}_k + \lambda_4 \mathbf{Y}_{jk} + v_{jk} \end{aligned} \quad (22)$$

In equation (22), γ_j represents denomination fixed effects, \mathbf{Y}_{jk} includes trade costs for denomination j in country k , u_{jk} and v_{jk} are error terms capturing unobserved trade costs (assumed

uncorrelated with the regressors), and we have expanded the vector \mathbf{Z}_k to include country market size (O_k) and competitiveness (P_k). The dependent variables, X_{jk} and n_{jk} , are the numbers of believers and congregations denomination j has in country k for 2005. For the infrastructure quality \mathbf{R}_k we include such variables as the numbers of phone lines and mobile phone subscribers per capita and the density of the road network in country k . For the vector \mathbf{H}_k we include such variables as the number of midwives and hospital beds per capita, and the frequency of earthquakes, volcano eruptions and civil war in country k . The measures for decentralization, DEC_j , and strictness, DOC_j , are explained in section 2. We control for trade costs (\mathbf{Y}_{jk}) using the geographic distance between the U.S. and country k (results are similar when we use linguistic dis-similarity instead). We control for \mathbf{Z}_k using country fixed effects.

5. Empirical Results

5.1 Regression variables and estimation method

In the estimation, we regress the log size of a denomination in a country, measured either as the number of adherents or the number of congregations in 2005, on country fixed effects, denomination fixed effects, and the interaction between country and denomination characteristics. Denomination fixed effects absorb doctrinal strictness and governance structure; the “productivity” of a denomination, in terms of its average attractiveness to adherents; and barriers to entry that are specific to a denomination and constant across countries, which may exist if some denominations are singled out for exclusion (eg, the Unification Church and the Children of God, which are frequently characterized as cults). Country fixed effects absorb national market size (related to population, urbanization, average income, education, etc.), cultural or political barriers to the import of religion that are common across denominations, and

variable costs in providing services to congregants that are common across denominations.

The key regressors in the estimation are interactions between a denomination's governance structure ($D=1$ if a denomination has a congregational polity and is therefore decentralized) or religious doctrine ($S=1$ if the denomination is in the top tercile of denominations in terms of doctrinal strictness) and country characteristics that capture the productivity of pastor effort, the state provision of social services, and the demand for social services associated with economic uncertainty. We also include interactions between denomination decentralization (D) and doctrinal strictness (S) and other country characteristics, including log per capita GDP, log population, the urbanization rate, log distance from the United States, whether a country speaks English, government regulation of religion (Grim and Finke, 2006), the fraction of the population that had migrated to the US in 1970, and indicators for whether Islam, Hinduism or Buddhism, or Catholicism are the dominant religion.

We capture the productivity of pastor effort using the quality of communications and transportation infrastructure, including telephone mainlines per capita, cellular subscriptions per capita, personal computers per capita, internet usage, road density (total length) and quality (fraction of roads paved), and passenger cars per capita.²⁶ A pastor's responsibilities include communicating with congregants to learn about their preferences and encourage their participation in church events, reaching out to new converts, and conferring with church leaders on managing the congregation. These efforts are likely to be easier the better are communication services in a country. The success of a pastor also depends on the number of congregants he is capable of attracting to his church. Presumably, a pastor's geographic reach will be more expansive in countries in which the cost of internal transport is lower. These transport costs

²⁶ As a matter of convention, we measure usage or access rates (eg, cellular subscriptions per capita) in levels and factor quantities (eg, personal computers or passenger cars relative to the population) as log ratios.

depend, in turn, on the size and quality of road networks and the availability of passenger vehicles. The measures of communications and transportation we use are from the World Development Indicators. Table 4 gives summary statistics.

Congregations produce a variety of club goods, which vary in their substitutability with social services provided by the state. Berman (2000) and Chen (2010) stress the mutual insurance quality of many of the services that religious groups provide, which include care for children, free meals, help in finding work, basic health care, and other charitable offerings, in particular after members have been subject to adverse shocks. In terms of state social services, we focus on public resources that assist individuals in weathering negative health shocks. In many countries, governments are important providers of health services. Following Hungerman (2005) and Gruber and Hungerman (2007), the more expansive are public health services, the weaker may be demand for the services provided by religious groups.²⁷ We measure availability of health services using nurses and midwives per capita, hospital beds per capita, physicians per capita, and health expenditure as a share of GDP, also from the WDI.

The reliance of individuals on social services provided by the state is likely to be greater where the incidence of adverse shocks is higher. Following Raddatz (2007), we measure three types of aggregate shocks: natural disasters, balance of payments crises, and civil or military conflict. While these shocks are temporary, they are often severe in nature, sufficient to lead to large disruptions in consumption. We measure the incidence of these shocks as the number of events that occurred in a country over 1970 to 2005 divided by the number of years in the period, which we refer to as the annualized shock incidence. Following Yang (2008), we define a serious natural disaster as an earthquake over seven on the Richter scale, a windstorm (ie,

²⁷ Fincher and Thornhill (2008) find that the number of religions present within a region is larger the greater is the disease load, which they interpret to mean that individuals seek to form groups with greater exclusivity in environments in which risk of contagion is greater.

hurricane) lasting a five days or more, or a landslide, volcanic eruption, or wave surge (ie, tsunami) that affects more than 1000 people. Data on these events are from the International Emergency Event Database (<http://www.emdat.be/>). In the last several decades, armed insurgencies have occurred in many countries, with these conflicts often involving thousands of casualties and lasting a decade or more. We measure serious conflict (be it extra-state, intra-state, internal, or internationalized internal in nature) as an event that resulted in the deaths of over 1000 people. The source is the CSCW Monadic Armed Conflict Database from the International Peace Research Institute (<http://www.prio.no/>).

Finally, to capture balance of payments crises, which are typically followed by a banking crises and collapse in GDP, we use the measures of sudden stops in Cavallo (2007), which indicates whether a country has a large decline in its current account, with foreign capital inflows suddenly reversing and becoming capital outflows. Calvo (1998) associates such episodes with a loss in investor confidence in a country, as occurs when investors downgrade expectations about a country's capacity to service its debts or maintain a pegged exchange rate. Cavallo's definition of a sudden stop is whether a country experiences a decline of greater than two standard deviations in a current account surplus in successive years, where he measures the standard deviation four different ways. We take the average incidence across the four measures.

As seen in section 2, most denominations are not present in most countries, creating the potential for sample selection bias. We present results based on three estimation methods: OLS, a standard Heckman (1979) estimator, and a semi-parametric estimator. The concern with OLS is that the regressors may be correlated with an omitted variable, which is the expectation of the error term conditional on a denomination being present in the country. In either the Heckman or semi-parametric approaches, we need variables that are correlated with a denomination's

presence in a country in 2005 but not independently correlated with the error term in the number-of-adherents regression. We use two instruments for denomination presence in 2005. One is an indicator for whether the denomination was present in the country in 1970, with the identifying assumption being that presence in 1970 is correlated with the error for number of adherents in 2005 only through denomination and country fixed effects. A second instrument is the entry decisions in 1970 of denominations with a similar number of adherents in the United States. The reasoning behind this instrument is that size in the United States indicates a denomination's average attraction to adherents, similar to firm sales being a sufficient statistic for firm productivity in the Melitz (2003) model. Since denomination productivity affects its entry choices, the entry decisions of denominations with a similar number of adherents in the United States should be correlated. The identifying assumption is that the unobserved barriers to entry of similarly US-sized denominations are uncorrelated.

In semi-parametric estimation, we first estimate the probability of presence in 2005, using either logit, probit, or linear probability, and then construct a polynomial in the predicted probability of presence in a country or dummy variables that capture the value of the predicted probability, based on dividing the probabilities into equal sized bins of 50 or 100. In the Heckman and semi-parametric approaches, the results are similar when using both instruments together or just one of the two instruments on its own. The magnitudes of the coefficient estimates are also similar between the OLS, Heckman, and semi-parametric regressions.

5.2 Main estimation results

Table 5 presents the baseline results for interactions between being decentralized ($D=1$) and infrastructure variables. We begin with these regressors as we have infrastructure data on a relatively large number of countries. Because we have ten infrastructure variables in Table 4,

which are highly correlated with each other, we begin by including the first principal component of these variables. All regression also include interactions between the decentralized and strictness dummies and an additional set of country characteristics (per capita GDP, population, urbanization rate, US immigrant population in 1970, distance to the US, English language, dominant religion, and the regulation of religion). We begin with log congregations as the dependent variable, as this measure of denomination size may be less subject to measurement error than the number of adherents.

Either in the OLS or Heckman specification, the interaction between decentralization and communications/transportation infrastructure is positive and very precisely estimated. Decentralized denominations have more congregations in countries in which the quality of communications and transportation infrastructure is better. This finding is consistent with Proposition 1, which states that the relative size of decentralized denominations is larger in countries in which the marginal productivity of pastor effort is higher (or the marginal cost of pastor effort is lower). The magnitude of the coefficient estimates in the OLS and Heckman specifications are similar, suggesting the correlation between the interactions of interest and the expectation of the error condition on presence is small. The weak correlation may be explained by the factors that account for entry having little relation to the factors that account for size. Such an outcome might obtain if denominations put a premium on entering hard to reach countries which had populations that had yet to be evangelized. Consistent with this reasoning, the coefficient on the inverse Mills ratio is negative, indicating a negative correlation between the error in the equation explaining presence and that in the equation explaining size. Again, if denominations desire to enter countries where their likelihood of success is low (owing to placing greater value on reaching individuals “hostile” to Christianity), then the unobserved

factors accounting for a denomination's presence in a country (its perception of the size of the population that has not heard the word of God) may be negatively related the unobserved factors accounting for a denominations success in attracting adherents.

In Table 6, we modify the sample by dropping countries in which Islam is the dominant religion and introduce a second measure of denomination size, the log number of adherents in 2005. Islamic countries are likely to be particularly resistant to evangelization (with some countries having outright bans on proselytizing to Muslims). Yet, the results are quite similar with or without Islamic countries in the sample. Results are also similar when we replace log congregations with log adherents, consistent with the image in Figure 5 that expansion in adherents and expansion in congregations are nearly synonymous.

In Table 7, we introduce individual communications and transportation infrastructure variables one at a time to see which may be driving the results in Tables 5 and 6. All variables are positive and precisely estimated except internet usage and the air transport network. Since we measure infrastructure variables as the average over 1995 to 2005, internet usage remains low in many countries during the sample period. The coefficient on the variable is positive but imprecisely estimated in all regressions. We include a measure of the air transport network as a placebo. The logic behind the land transport variables in the regression is that improved ability of pastors and congregants to move internally enhances pastor incentives to invest in building the congregation. But air transportation is likely to have little effect, since pastors recruit adherents almost entirely from within their immediate geographic area. The absence of correlation between denomination size and air transport infrastructure is therefore confirming evidence that only specific types of transportation infrastructure matter for denomination performance.

It is important to note that all regressions include interactions between decentralization

and per capita GDP. Improving communications and transportation infrastructure enhances the performance of decentralized denominations, holding constant the manner in which the level of development of a country may affect decentralized denominations' performance. The magnitude of the coefficients imply that increasing the availability of telephone mainlines by one standard deviation is associated with the relative size of decentralized denominations increasing by 40 log points. Whether intended or not, improvements in countries' communications and transportation infrastructure may increase the market share of less hierarchical religious groups.

In Table 8, we add interactions between the strictness of a denomination's religious doctrine ($S=1$ if strict) and measures of the provision of health services and the incidence of natural disaster and civil conflict. To begin, we use the first principal component of the four health variables and the first principal component of the five incidence measures for natural disasters. The specifications vary as to whether or not Islamic countries are included and which of the two size measures is used as the dependent variable. In all regressions the interaction between strictness and health services is negative and precisely estimated. The size of stricter denominations is relatively large in countries that do a worse job of providing health services to the population. This finding is consistent with Proposition 2, which states that stricter denominations are larger when public provision of social services is weaker (implying a higher price for secular goods that substitute for participation in religion).

The interaction between strictness and the incidence of natural disasters is positively and precisely estimated in three of the four regressions. It thus appears that stricter groups are relatively large in countries that are more prone to aggregate shocks. The interaction between strictness and incidence of civil and military conflict is positive but imprecisely estimated. Since both natural disasters and civil and military conflict add variance to individual consumption

profiles, one would expect individual demand for stricter groups to be higher where the incidence of either is higher. The absence of a significant interaction for conflict may reflect the difficulty of religious groups in operating in conflict prone environments. Note that the sample size in these regressions is smaller than in Tables 5-7, owing to the fact that data on natural disasters and civil and military conflict is available for a smaller number of countries. Still, the interaction between decentralization and the first principal component of infrastructure remains positive and precisely estimated in all regressions.

Extending the results, Table 9 shows interactions between strictness and the individual measures of health services and natural disasters. Decentralization interactions are included in these regressions but not shown for expositional convenience. Among the health variables, there is a negative and significant interaction between strictness and nurses per capita and hospital beds per capita but not for physicians per capita or public health expenditure in GDP. In many poor countries, physicians per capita is extremely low, with nurses providing the bulk of health care in the country. The results imply that increasing nurses per capita by one standard deviation would be associated with a reduction in the relative size of strict denominations by 25 log points. For natural disasters, there is a positive and significant interaction between strictness and three of the five measures: landslides, volcanic eruptions and earthquakes.

6. Final Discussion

Historically, religion has expanded across borders through military conquest. As one nation conquered another, it often imposed its religion on its new acquired subjects. Since the 19th century, market mediated transactions have steadily replaced conquest as the means through which religion moves across borders. Increasingly, individuals adhere to a particular religious

group because it is their choice. In some countries, governments still place many obstacles in the way of joining particular religions, but opportunities for religious organizations to attract new members internationally are as abundant as they have ever been.

Our theoretical model emphasizes two features that affect competition between religious groups within a country. One is the flatness of the governance structure, which affects the incentive of pastors to build congregations. There is no clear performance ranking of organizations in terms of their governance. More hierarchical organizations will be more successful in some environments and less successful in others. But there are key features of the national environment that are likely to influence their success. Our finding that decentralized organizations are larger in countries with better communications and transportation infrastructure suggests that investment choices governments make in providing infrastructure may influence the type of religious organizations that succeed in their countries.

One striking feature of the recent globalization of Christianity is the success of groups that maintain a strict religious doctrine. Strictness is not a feature imposed by religious elites but an attribute to which in many contexts individuals attach positive value. Our finding that the performance of strict groups is stronger in countries with worse health services and a higher incidence of aggregate shocks suggests that the provision of social insurance by national governments may affect the theological composition of national religious groups.

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Table 1: Largest 35 Protestant denominations in terms of adherents (outside the US)

Protestant denomination	HQ country	Global adherents (m), 2005
Anglicans	Britain	74.4
Assemblies of God	US	42.4
Seventh-day Adventist Church	US	16.7
Southern Baptist Convention	US	11.9
Jehovah's Witnesses	US	11.1
SIM Church	US	11.0
New Apostolic Church	Switzerland	7.4
Church of God (Cleveland)	US	7.0
Ch of Jesus Christ of Latter-day Saints	US	6.7
American Baptist Churches in the USA	US	5.7
SFM/NPY/FFFM	Sweden/Norway/Fin	4.0
Internat Ch of the Foursquare Gospel	US	3.7
United Methodist Church (USA)	US	3.7
Presbyterian Church (USA)	US	3.4
Africa Inland Church	Britain/US	3.2
Christian and Missionary Alliance	US	3.2
Methodist Church of Great Britain	Britain	2.9
Pentecostal Assemblies of God (Canada)	Canada	2.9
United Pentecostal Church	US	2.4
Christian Aviation Ministries	US	2.1
Christian Brethren (Open)	US	1.9
Baptist Unions/BWA	US	1.9
PEMS France	France	1.9
Pres Ch of East Africa (Ch of Scotland)	Britain	1.8
Evangelical Alliance Mission	US	1.6
Salvation Army	US	1.6
Apostolic Church Missionary Movement	Britain	1.5
OMS International	US	1.4
Church of the Nazarene	US	1.2
Evangelical Lutheran Ch in America	US	1.1
Church of God of Prophecy	US	1.0
Churches of Christ (Instrumental)	US	1.0
Zion Christian Church	South Africa	0.9
Former AUCECB	Russia	0.9
Moravian Church	US	0.9

Table 2: Presence of US denominations by country in 1970 and 2005

		Denomination present in 1970		Total
		0	1	
Denomination present in 2005	0	15,532	2	15,534 0.885
	1	436	1,580	2,016 0.115
Total		15,968 0.910	1,582 0.090	17,550

Notes: This table shows the number of cases in which a US denomination (No. of obs.=130) is present in a country (No. of obs.=135) in 1970 and 2005.

Table 3: Governance structure and religious doctrine of US denominations

Variable	Mean	St. Dev.
Denomination is decentralized (congregational polity)	0.554	0.499
Denomination is theologically strict (row mean > .6)	0.315	0.466
Is evangelism an essential function of all churches and believers?	0.808	0.396
Is repentance and conversion essential for all believers?	0.754	0.432
Is bible considered inerrant or infallible?	0.746	0.437
Is the damnation of non-believers emphasized?	0.700	0.460
Is imminence of 2nd coming of Christ emphasized?	0.262	0.441
Is sanctification emphasized?	0.223	0.418
Is speaking in tongues emphasized?	0.208	0.407
Are drinking, smoking, cultural activities, or dress restricted?	0.246	0.450
Is ongoing practice of divine healing emphasized?	0.292	0.457

Notes: the sample is the 130 US Protestant denominations listed in the appendix.

Table 4: Summary statistics for country variables

Variable	N	Mean	Std. Dev.
log GDP per capita	135	7.565	1.576
log population	135	15.880	1.520
Urban population/total population	135	0.395	0.233
Immigrants in US/total population	135	0.005	0.010
log distance to US	135	8.970	0.431
= 1 if English official language	135	0.193	0.396
= 1 if Islam dominant religion	135	0.267	0.444
= 1 if Buddhism, Hinduism dominant religion	135	0.081	0.275
= 1 if Catholicism dominant religion	135	0.319	0.468
regulation of religion index (Grim & Finke)	135	2.942	2.839
fixed mainlines per 1,000	135	15.415	18.081
cellular subscriptions per 1,000	135	14.349	15.103
log personal computers per 100	135	7.758	11.057
internet usage/bandwidth (1st principal comp)	135	0.035	1.018
air transport network (1st principal comp)	135	0.053	0.981
road network (1st principal comp)	135	0.002	1.012
log passenger cars per 1,000	135	12.650	15.365
log hospital beds per 1,000	135	1.002	0.939
midwives per 1,000	135	3.804	3.784
physicians per 1,000	135	1.270	1.218
public health expenditure/GDP x 100	135	3.579	1.976
annual incidence of sudden stops	119	0.018	0.018
annual incidence of military conflict	134	0.166	0.270
annual incidence of landslides (>1000 affected)	112	0.014	0.033
annual incidence of eruptions (>1000 affected)	112	0.020	0.084
annual incidence of wave surges (>1000 affected)	112	0.002	0.008
annual incidence of wind storms (5+ days)	112	0.011	0.021
annual incidence of earthquakes (>7 Richter)	112	0.028	0.080

Table 5: Baseline results for governance structure-infrastructure interactions

	log number of congregations	
	OLS	Heckman
D*infrastructure (1st principal comp)	0.590*** (0.159)	0.556*** (0.161)
D*log pc GDP	-0.573*** (0.141)	-0.585*** (0.149)
D*log population	-0.119** (0.047)	-0.126** (0.053)
D*urbanization rate	0.939* (0.501)	1.053* (0.551)
D*US emigration rate	-9.255 (7.781)	-6.082 (7.667)
D*log distance to US	0.002 (0.136)	-0.0628 (0.126)
D*English dummy	0.0899 (0.212)	0.0543 (0.230)
D*Islam dominant	0.890*** (0.305)	0.626** (0.308)
D*Hindu/Buddhism dominant	0.155 (0.271)	0.236 (0.294)
D*Catholic dominant	0.166 (0.159)	0.17 (0.154)
D*regulation index	-0.007 (0.036)	0.021 (0.037)
inverse Mills ratio		-0.638*** (0.080)
Denomination fixed effects	Y	Y
Country/region fixed effects	Y	Y
Sample	full	full
R squared	0.567	--
N	2016	14175

Notes: The dependent variable is the log number of congregations in 2005. D=1 if the denomination is decentralized (has a congregational polity). *infrastructure* is the first principal component of the ten communication and transportation infrastructure variables in Table 4. The independent variables not shown are dummy variables for the denomination and country/region. Standard errors are clustered by country. The first stage probit regression of denomination presence in a country in 2005 for the Heckman specification (not shown) includes as regressors whether the denomination was present in the country in 1970 and the average presence in the country in 1970 of denominations that have a similar size in the United States.

Table 6: Extended results for governance structure-infrastructure interactions

dependent variable Estimation	log congregations				log adherents			
	OLS	Heckman	OLS	Heckman	OLS	Heckman	OLS	Heckman
D*infrastructure (1st principal component)	0.590*** (0.159)	0.556*** (0.161)	0.596*** (0.157)	0.585*** (0.167)	0.641*** (0.205)	0.619*** (0.209)	0.667*** (0.192)	0.649*** (0.207)
Islamic countries?	Y	Y	N	N	Y	Y	N	N
denomination FEs	Y	Y	Y	Y	Y	Y	Y	Y
country FEs	Y	Y	Y	Y	Y	Y	Y	Y
N	2016	14175	1711	10395	2016	14175	1711	10395

Notes: The dependent variable in the first four columns is log congregations in 2005; in the second four columns it is log adherents in 2005. The other regressors (not shown) are the same as in Table 5; see notes for details. Standard errors are clustered by country.

Table 7: Results for individual governance structure-infrastructure interactions

dependent variable estimation	log congregations Heckman						
	infrastructure measure	telephone mainlines	cellular subscribers	log PCs	internet (1st pc)	log cars	road network (1st pc)
D*infrastructure Measure	0.0243*** (0.007)	0.0240*** (0.009)	0.0239*** (0.008)	0.114 (0.123)	0.0279*** (0.006)	0.262*** (0.099)	-0.0342 (0.136)
Islamic countries?	Y	Y	Y	Y	Y	Y	Y
denomination FEs	Y	Y	Y	Y	Y	Y	Y
country FEs	Y	Y	Y	Y	Y	Y	Y
N	14175	14175	14175	14175	14175	14175	14175

Notes: The dependent variable is log congregations in 2005. The other regressors (not shown) are the same as in Table 5. See notes to the table for details. Standard errors are clustered by country.

Table 8: Baseline results for religious doctrine interactions

estimation dependent variable	Heckman			
	log congregations		log adherents	
S*public health services (1st principal comp)	-0.326*** (0.122)	-0.347** (0.141)	-0.350** (0.139)	-0.366** (0.165)
S*incidence of natural disasters (1st principal comp)	0.0968*** (0.035)	0.066 (0.092)	0.168*** (0.041)	0.177* (0.097)
S*incidence of civil conflict	0.241 (0.220)	0.291 (0.273)	0.114 (0.215)	0.16 (0.280)
D*infrastructure (1st principal comp)	0.427*** (0.163)	0.412** (0.169)	0.465** (0.222)	0.472** (0.223)
Islamic countries?	Y	N	Y	N
denomination fixed effects	Y	Y	Y	Y
country fixed effects	Y	Y	Y	Y
N	11655	8610	11655	8610

Notes: The dependent variable in the first two columns is log congregations in 2005; in the second two columns it is log adherents in 2005. S=1 indicates a denomination has a strict religious doctrine. *public health services* is the first principal component of the four health variables in Table 4; *incidence of natural disasters* is the first principal component of the five disaster variables in Table 4. The other regressors (not shown) are those in Table 5 plus interactions between S and all country characteristics in Table 5. See notes to the table for details. Standard errors are clustered by country.

Table 9: Results for individual religious doctrine interactions

dependent variable estimation	log congregations Heckman								
	nurses & midwives	hospital beds	physicians	health expend.	land slides	volcanic eruptions	wave surges	wind storms	earth- quakes
S*interaction term	-0.067*** (0.020)	-0.276*** (0.103)	-0.041 (0.096)	-0.013 (0.040)	3.433** (1.695)	1.526*** (0.386)	6.153 (9.903)	0.547 (3.045)	1.825*** (0.593)
Islamic countries? N	Y 14175	Y 14175	Y 14175	Y 14175	Y 11760	Y 11760	Y 11760	Y 11760	Y 11760
S*interaction term	-0.062*** (0.019)	-0.258** (0.121)	-0.029 (0.113)	-0.008 (0.042)	1.783 (2.025)	1.230 (1.085)	-9.698 (12.100)	1.814 (3.086)	1.245 (1.066)
Islamic countries? N	N 10395	N 10395	N 10395	N 10395	N 8715	N 8715	N 8715	N 8715	N 8715

Notes: The dependent variable is log congregations in 2005. The other regressors (not shown) are those in Table 5 and those in Table 8. See notes to those tables for details. Standard errors are clustered by country.

Figure 1: Market share of denominations by headquarters country

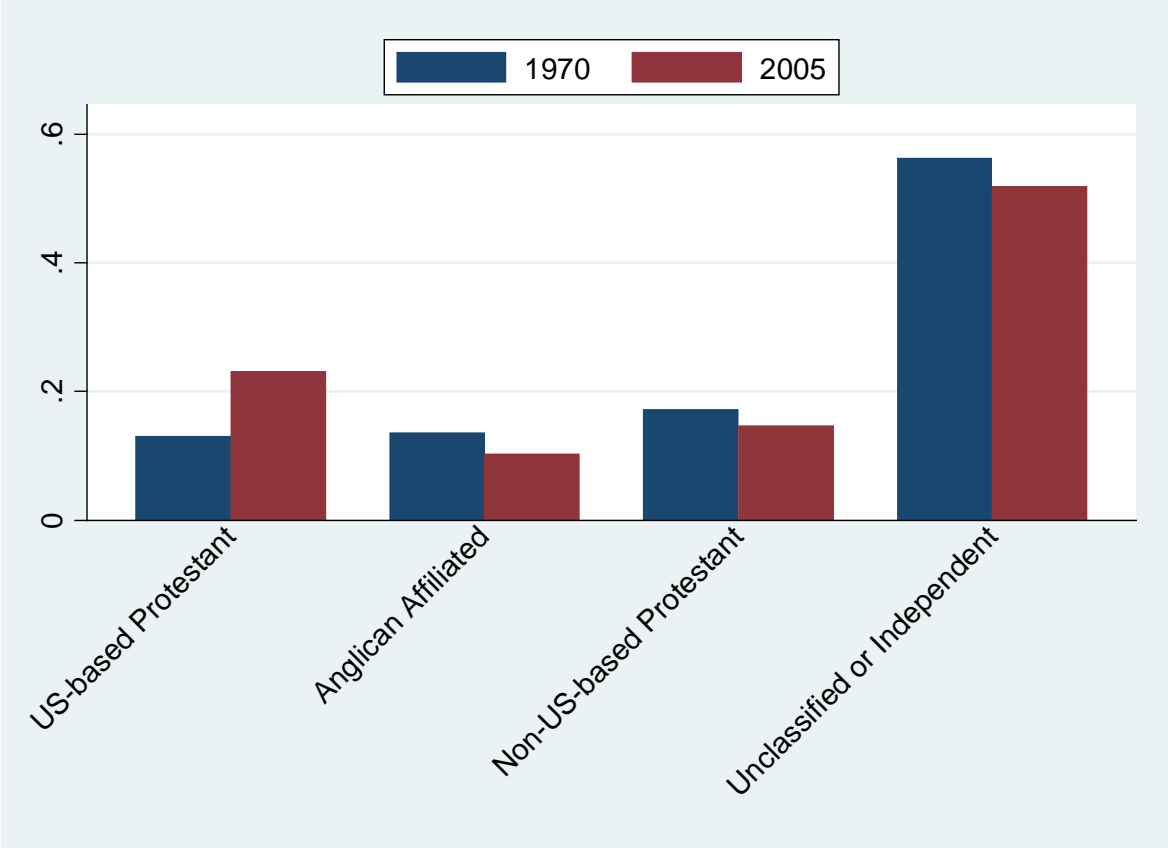


Figure 2: Size and rank of denominations headquartered in US in terms of total adherents

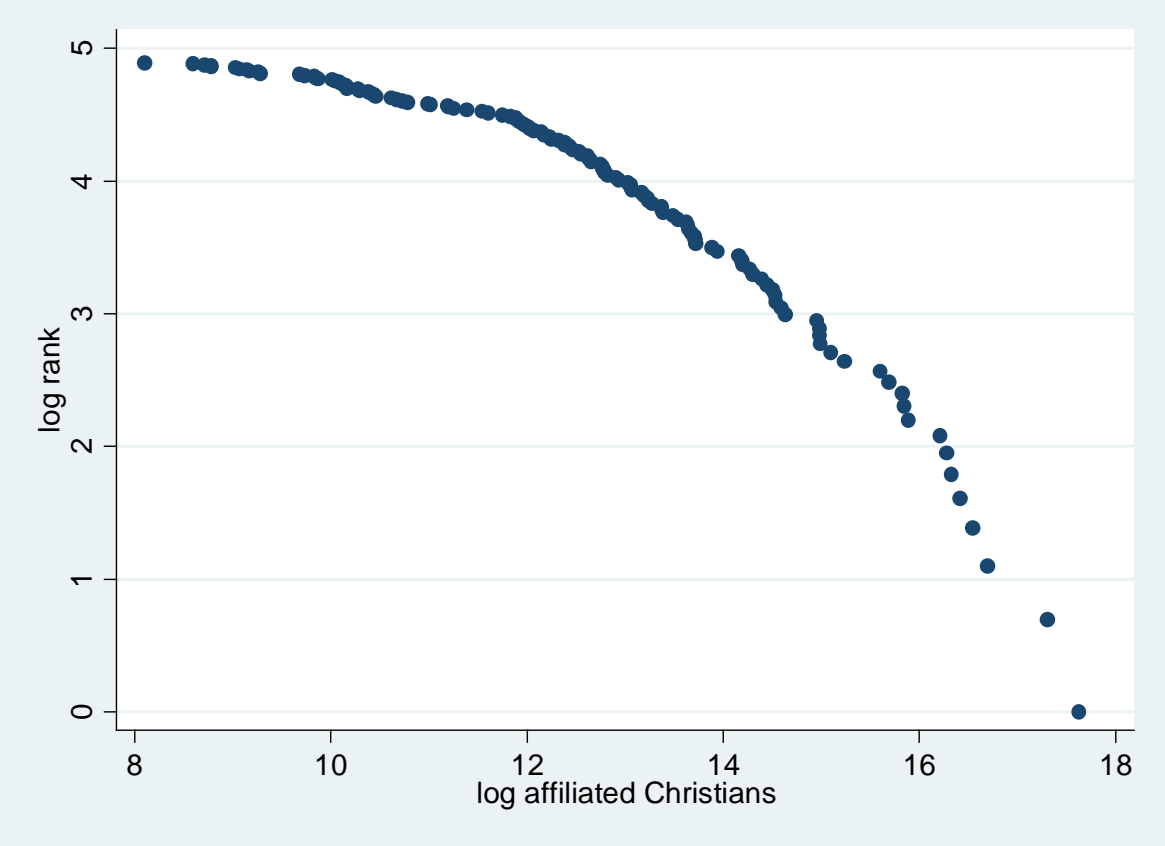


Figure 3: Share of foreign adherents in US denominations by religious tradition

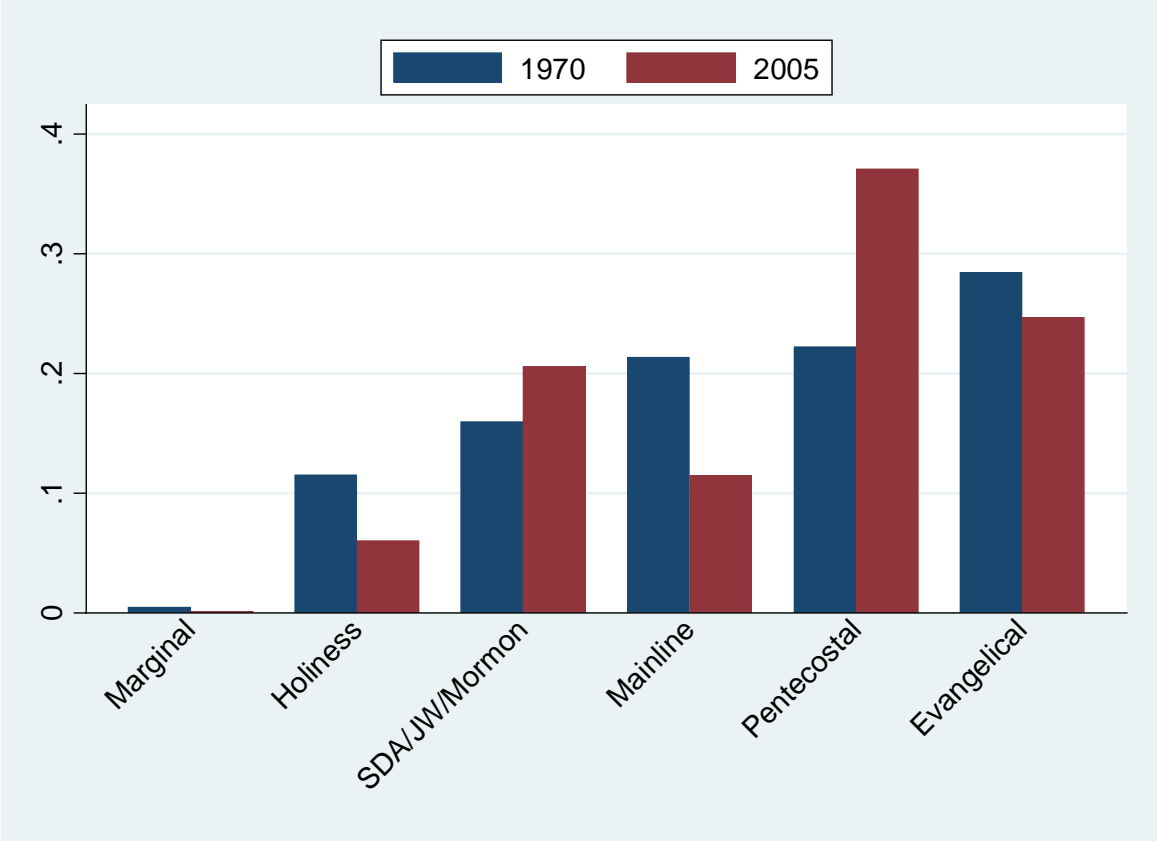


Figure 4: Distribution of doctrinal strictness across US denominations

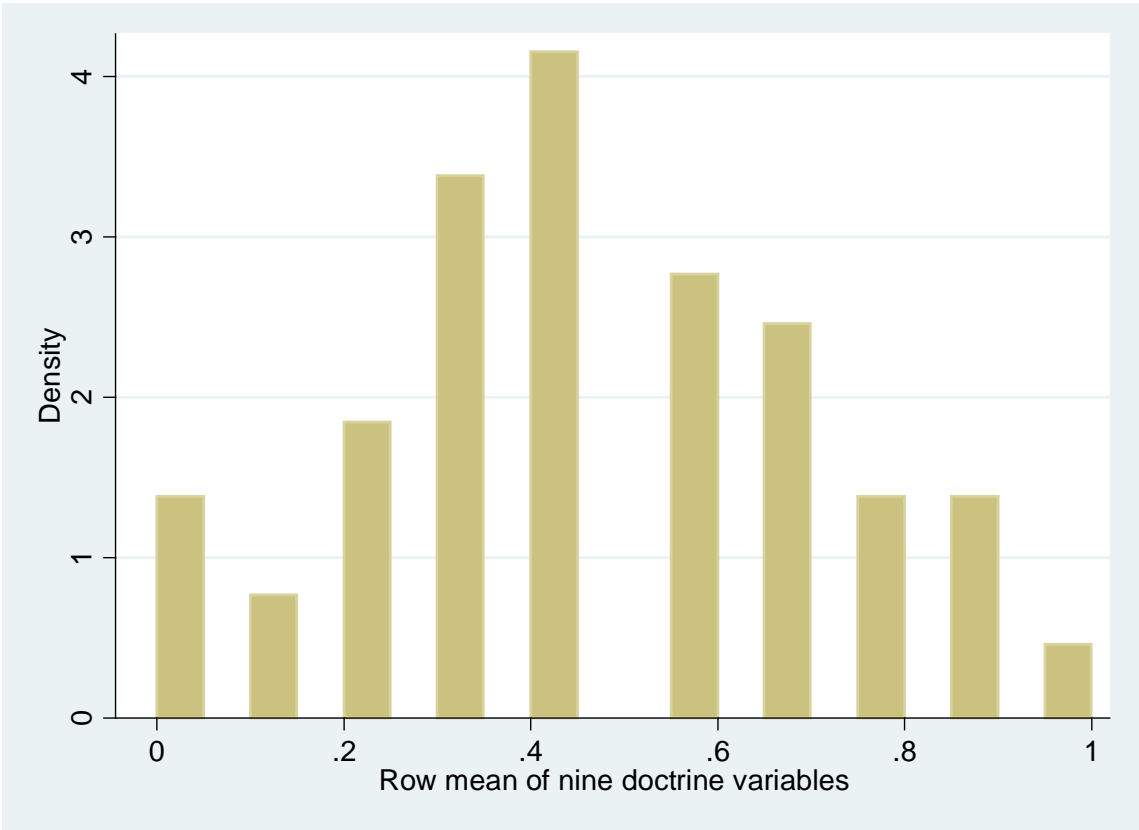


Figure 5: Global number of members and congregations by denomination

