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ABSTRACT

In this paper we build a model of market competition among religious denominations, using a framework that involves incomplete contracts and the production of club goods. 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 governance structure affect its ability to attract adherents. We test these predictions using data on the foreign operations of US Protestant denominations in 2005 from the World Christian Database. Consistent with the model, we find that (1) denominations with stricter religious doctrine attract more adherents in countries in which the risk of natural disaster or disease outbreak is greater and in which government provision of health services is weaker, and (2) denominations with a decentralized governance structure attract more adherents in countries in which the productivity of pastor effort is higher. These findings shed light on factors determining the composition of religion within countries, helping account for the rise of new Protestant denominations in recent decades.

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1. INTRODUCTION

Rivalry between religious groups is a constant feature of human society. Historically, competition was often resolved by military conflict (Iyigun, 2008), with victors imposing their religion on the vanquished. Today, it is common for religious groups to compete for adherents through the market. Over the last 50 years, options for religious practice have expanded globally, as the end of colonialism, the demise of communist regimes, and the spread of democracy have weakened the control of state-sponsored churches and reduced the prevalence of governments based on anti-clericalism (Michelthwait and Wooldridge, 2009).[1] Religious groups, be they Christian, Jewish, or Muslim, are increasingly international in outlook, with the goal to build global bodies of believers, rather than simply national ones (Thomas, 2010).

In this paper, we build a model of market competition among religious groups and apply it to the foreign operations of Protestant denominations headquartered in the US. 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.[2] A denomination enters a market by choosing to recognize local congregations as members of its global organization, which is analogous to international licensing or franchising. In our theoretical model, three attributes of a denomination affect its membership. One is its attractiveness to believers, which we treat as a characteristic similar to firm productivity (Melitz, 2003). A second is its religious doctrine. We apply Iannaccone's (1994) insight that stricter religious groups are more efficient in organizing the production of quasi-public goods, which attract believers. A third attribute is organizational structure. Some denominations are centralized, placing authority over pastors and doctrine in the hands of international bodies, whereas others are decentralized, giving individual congregations control (Chaves, 1993a). We use a model with incomplete contracts (Grossman and Hart, 1986) to show how centralization affects denomination performance. In the empirical estimation, we examine the number of adherents that US-headquartered denominations attract in foreign markets. The US is the largest exporter of Protestant Christianity, with the country's history of religious freedom fomenting a competitive religious market with churches active in expanding abroad (Brouwer, Gifford, and Rose. 1996).

[1] Recent work has applied market analysis to the Protestant Reformation and the Counter-Reformation (Ekelund, Hebert and Tollison, 2006), the development of religion in America (Finke and Stark, 2008), and the designation of Catholic saints (Barro, McCleary, and McQuoid, 2010).

[2] See Iannaccone (1998) for a discussion of literature on treating churches as payoff maximizing firms.

Christian denominations may seem an unusual application for the analysis of multinational enterprises. Four aspects of global Christianity motivate our study. One is its scale and diversity. Between 1970 and 2005, the share of Christians in the global population remained stable at 33%,[3] whereas the share of Protestants among Christians rose from 26% to 35%, with their growth displacing the traditional church (Catholics and Orthodox). US headquartered denominations have been at the forefront of the recent global expansion in Protestantism, building on the earlier work of missionaries who in the 19th century began to evangelize Africa, Asia, and Latin America (Woodberry and Shah, 2004). However, not all Christian groups have been equally successful. Strikingly, it is Protestant denominations with the most restrictive religious doctrine and distinctive worship practices that have enjoyed the most growth (Brouwer, Gifford, and Rose, 1996). In 2010, Pentecostalism, a movement that originated in the United States in the early 1900s involving ecstatic worship and a literal reading of the Bible, along with other so-called "renewalist" groups, had 400 to 600 million adherents worldwide, accounting for a quarter of all Christians. While the global expansion of these groups has attracted interest from other social sciences (e.g., Meyer, 2004, Robbins, 2004, and Woodberry, 2008), it has received little attention from economists.

A second motivation is that the growth of Protestant Christianity tends to create a more dynamic religious marketplace, challenging religious and political elites (Freston, 2001; Woodberry and Shaw, 2004). Protestant denominations vary in their impacts on the political landscape. For example, evangelical Christians are prominent in the United States, whereas Pentecostal and charismatic Christians have acquired political clout in Ethiopia, Kenya, and elsewhere in East Africa.[4] Recent literature examines the dominance of single religions and overall religiosity at the national level. Barro and McCleary (2005) identify 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, state controls on religion, and the education of the populace. We extend the literature by examining competition among many religious groups, which allows us to examine determinants of the composition of religion and to evaluate the

[3] 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.
[4] "Slain by the Spirit," *The Economist*, July 3, 2010.

market value of specific denominational characteristics.

A third motivation for our paper is to examine how the provision of social services affects the relative demand for religion. The functions of a congregation include organizing worship, educational activities, and charitable undertakings, in which individual congregants are both consumers and producers. These services have the quality of club goods, giving congregants 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. Having a stricter religious doctrine constrains individual choice, which raises the cost of secular goods, thereby increasing the incentive for individuals to participate in church life. A related line of work suggests that the demand for religion expands when the government decreases the supply of public services that compete with church-supplied club goods. Hungerman (2005) finds that member donations and community spending increased in the US Presbyterian church following welfare reform in 1996, which reduced government-provided social services; and Gruber and Hungerman (2007) find that the expansion in social services under the US New Deal crowded out charitable religious activities. In international settings, Berman (2000) and Chen (2010) use Iannaccone (1992) to explain the organization of ultra-orthodox Judaism in Israel and the expansion of Islamic worship following the Indonesian financial crisis, respectively.[5]

We bring these strands of literature together by examining how demand for and supply of public services affect the relative success of strict denominations in a large number of countries. Across countries, there is wide variation in the provision of public services and in exposure to health or income shocks that affect demand for these services. Controlling for denomination and country fixed effects, and for the interaction between strictness and a large number of country characteristics, we find that stricter denominations attract more members in countries with a weaker provision of health services and with higher incidence of natural disasters and disease outbreaks. Placebo tests show no such interaction effect between these country characteristics and theoretically irrelevant features of religious doctrine, such as the frequency of communion. To take an example from recent headlines, prior to the 2010 earthquake in Haiti, the largest Protestant groups in the country (which included Adventist and Pentecostal churches) were US based denominations that maintain a strict religion doctrine. In the aftermath of the earthquake,

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

it appears to be these groups that have seen the sharpest increases in church activity.[6]

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 are relatively stable over time and 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 multinational organizational structure is endogenous (e.g., Nunn, 2007; Rajan and Wulf, 2006; Marin and Verdier, 2008). Bloom, Sadun, and Van Reenen (2009) examine what makes multinational firms more decentralized; we ask the complementary question of where decentralized organizations are more likely to succeed. 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 (manager) and a denomination (headquarters) are subject to incomplete contracts.[7] In decentralized denominations, the pastor has greater authority, which increases his incentive to exert effort in serving his congregation; in centralized denominations, the denominational headquarters has greater authority, which gives it more control over how congregations operate.

The model predicts that in countries in which the productivity of pastor effort is higher, decentralized denominations will have larger membership, due to pastors having stronger effort incentives. To test the prediction, we capture the productivity of pastor effort in a country using the availability of communication and transportation infrastructure. In linking labor productivity with infrastructure, we follow recent literature in public finance and macroeconomics (e.g., Fernald, 1999; Roller and Waverman, 2001). The return on pastor effort depends on his ability to connect with congregants, which is a function of the ease of local communications and the cost of internal transport. We find that decentralized denominations attract more members in

[6] See Tom Phillips, "Religion Fills Void Left by Aid Agencies," *The Guardian*, Jan. 25, 2010; Anne Barnard, "Suffering, Haitians Turn to Charismatic Prayer", *New York Times*, November 24, 2010; Kwame Dawes, "Amid Disasters, A Preacher Holds Fast to His Faith in Haiti," *USA Today*, Jan. 5, 2011; and Christophe Wargny, "Haiti in the Hands of the NGOs," *Counterpunch*, Jan. 7, 2011.

[7] See Allen (1995) for an incomplete contracts view of church organization.

countries with better communications and *land* transportation. Placebo tests show that no such interaction effect exists for *air* transportation, which is unlikely to affect pastor productivity. The relative success of less hierarchical organizations thus appears to depend on the productivity of agents with managerial responsibilities.

In section 2, we present our data on the size, religious doctrine, and governance structure of denominations. In section 3, we present a model of entry and competition among religious groups and derive the empirical specifications. In section 4, we present results from estimating the model. And in section 5, 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 across countries, giving numbers of affiliated members and congregations in 1970 and 2005.[8] Each denomination is identified by its name, religious tradition (e.g., Baptist, Holiness-Pentecostal, Reformed-Presbyterian), and megabloc, and is accompanied by information on its international affiliation. Megablocs include Roman Catholics, Orthodox, and Anglicans, which constitute the historic or traditional church; conventional Protestants; Independents, which includes churches that have split from Protestant denominations or that are unaffiliated with international church bodies; and Marginals, which are groups considered outside the Christian mainstream, the largest of which are the Mormons and the Jehovah's Witnesses. With some abuse of terminology, we use the term Protestant to refer to four WCD blocs: Anglicans, traditional Protestants, Independents, and Marginals.

In the raw WCD, there are over 6,300 individual denominations, which represent a much smaller number of denominational aggregates that share an international governing body, internal organizational structure, and religious doctrine. We form denominational aggregates by combining sub-denominations that have a common (a) megabloc, (b) religious tradition, and (c)

[8] The WCD is maintained by Gordon-Conwell Theological Seminary and builds on material originally published in the *World Christian Encyclopedia* (WCE) by Barret, Kurian, and Johnson (2001). The WCE compiled periodic censuses that individual Christian denominations conduct of their membership and produced initial estimates of the number of adherents by denomination in 1970. These estimates were cross-checked against information obtained from national censuses, national church bodies, and interviews of church leaders. The WCD further updates denomination counts in the WCE to 2005, based on cross-correlated information from 5,000 questionnaires of national church bodies, field surveys in 200 countries, a large body of published and unpublished contemporary material provided by individual churches, and interviews of bishops, church leaders, and theologians.

name or association with an international governing organization.[9]

In the empirical analysis, we focus on Protestant denominations headquartered in the United States. 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 survive because of their success in the marketplace and not because of preferential government treatment (Finke and Stark, 2008).[10] Second, the US is the 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.[11] Between 1970 and 2005, the share of Christians belonging either to 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 US denominations and thereby verify the completeness of the WCD. Our sample includes 130 US denominations that have adherents abroad enumerated in the WCD.[12]

The denominations in our sample have distinct historical origins. Mainline traditions include movements brought from Europe to the United States in the 17th and 18th centuries (e.g., Congregationalists, Lutherans, Methodists, Presbyterians, and Quakers). They include the oldest US Protestant groups and tend to be relatively liberal in religious doctrine. Figure 2 shows that in 2005 mainline denominations accounted for 12% of adherents outside of the United States that belong to US denominations, down from 23% in 1970. Evangelical and fundamentalist denominations, such as Southern Baptists, include groups that split off from mainline denominations in the 19th and early 20th centuries, typically over doctrinal disputes. These groups

[9] In some countries, owing to government regulation of religion, the WCD groups denominations into "union of bodies of different traditions." We drop a country from the sample if more than 20% of its affiliated Christians fall into this category. These include six large nations (Australia, Canada, China, Congo, Germany, and Pakistan) and 10 small ones, which in 2005 represented 13% of Christians in the WCD.

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

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

[12] We begin with 204 Protestant denominations headquartered in the United States. Of these, 16 are not found in the WCD (including some older groups that have been subsumed into newer denominations and some very small groups not captured by the WCD), 42 have no congregations in the WCD outside of the US (including old denominations in the process of dying out and a few recently created entities with minimal foreign presence), 8 have congregations outside the US but only in countries excluded from the sample owing to aggregation problems (see note 9), and 8 are very small denominations on which we could find no information on their organization or doctrine.

maintain strict religious beliefs. From 1970 to 2005, their share of foreign adherents in US denominations fell somewhat, from 29% to 25%.[13]

The fastest growing traditions are Christian renewalists, which include Pentecostals and Charismatics, and non-mainstream groups, including the Seventh Day Adventists, Mormons, and Jehovah's Witnesses. Pentecostalism, now a century old, has a strict religious doctrine similar to evangelicals and fundamentalists but also espouses a belief that speaking in tongues (glossolalia) is evidence that one has been baptized spiritually. Speaking in tongues, and other ecstatic practices including healing and prophesying, are essential to Pentecostal worship, which makes it distinct theologically from other Protestants (Robbins, 2004). For the last 100 years, there has been debate within Christianity over speaking in tongues, with many fundamentalists rejecting the practice (Melton, 1989).[14] Between 1970 and 2005, the share of foreign adherents in US denominations belonging to Pentecostal or other renewalist groups rose from 22% to 37%.

Mormons and Jehovah's Witnesses are considered outside the Christian mainstream because they accept 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 to convert non-believers. Between 1970 and 2005, these two groups, plus Seventh Day Adventists, saw their share of foreign adherents belonging to US denominations rise from 16% to 21%.[15]

Table 1 lists the 35 largest Protestant denominations worldwide (based on their adherents outside the US), of which 24 are headquartered in the United States. 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 80th rank having fewer than 0.1 million. Figure 3a plots for US denominations the number of adherents abroad against the number of adherents in the United States. The strong positive relationship indicates that denominations successful in the United

[13] Another 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 purify themselves of sin (and are then to sin no more). Between 1970 and 2005, their share of foreign adherents of US denominations fell from 12% to 6%.

[14] The Charismatic movement, which emerged in the United States in the 1960s, includes individuals who left mainline denominations and now embrace speaking in tongues.

[15] The other Marginal category in Figure 2 includes very small denominations outside the Christian mainstream.

States are also successful globally, consistent with a Melitz (2003) style framework.

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 10.9% of country-denomination cells have positive entries; by 2005, the share rises to 13.5%. As seen in Figure 3b, US denominations that attract more adherents in the United States (and presumably are more "productive") are present in more countries abroad. In the empirical analysis, we address the entry of denominations into countries in order to control for possible selection bias in estimating determinants of denomination size.

2.2 Denominational doctrine and governance

In the production of religious services, the church is the factory, the pastor is the manager, and, given that worship is a collective activity, congregants are both workers and consumers (Iannaccone, 1998). The denomination provides 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 the 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. In many cases, the core elements of a denomination's doctrine and governance were established by a religious entrepreneur who founded the organization.[16] In the early years of a movement, some elements of doctrine and structure are malleable but once codified tend to change only slowly over time (Melton, 1989; Chaves and Sutton, 2004; Finke and Stark, 2008).

Congregations that belong to a denomination share a defined religious doctrine, given in the denomination's statement of faith. The doctrine is a system of belief that is in part what attracts adherents to church. Christianity is organized around the life and teachings of Jesus Christ, as described in the New Testament of the Christian Bible. 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

[16] For example, Aimee Semple McPherson founded the Foursquare Church, Joseph Smith founded the Mormons, Charles Taze Russell founded the Jehovah's Witnesses. See Allen (1995) for case studies of church foundings.

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 an eternal life of suffering in hell, (f) one should dress modestly, avoid smoking or drinking, keep sexual activity within marriage, and avoid situations that conflict with these mores, (g) believers should be sanctified and thereby purified from sin (as in the Holiness movement; see note 13), (h) speaking in tongues is evidence of one's baptism in the Holy Spirit (as in Pentecostalism), and (i) divine healing is an ongoing practice available to believers. Each of these beliefs imposes time costs, lifestyle constraints, and impediments to maintaining relationships with non-Christians or Christians in other denominations. 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 be active in the life of a congregation.

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. The 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 dimensions along 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 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 doctrinal dummy variables is greater than or equal to 0.5, which applies to 45% of the denominations in the sample. Figure 4 shows the distribution for the row mean of the nine doctrine variables for US denominations. The cutoff of 0.5 captures a break in the distribution between the top two quintiles of denominations and the rest; the cutoff divides denominations between those above the median and those at the median or below. Empirical results presented in section 4 are robust to raising the strictness cutoff to 0.6, which reduces the share of strict denominations to 32%, and to dropping any individual dimension of strictness from the calculation of the row mean.

In Iannaccone's (1992) club good model of religious organizations, which we incorporate into our model of denominations in section 3, stricter groups elicit greater participation from their members by raising the perceived cost of secular goods and services. To examine how strictness relates to religious participation among the denominations in our data, we use the General Social Surveys in 2000, 2002, and 2004, which sample the U.S. population on religion, politics, and social behavior. The GSS contains detailed data on the denominational affiliation of individuals who self-identify as Protestant, where the GSS denominations span two thirds of those in our data.[17] In unreported results, we find that, controlling for age, gender, and educational degree, individuals in the GSS belonging to strict denominations (according to our definition) are 25% more likely than individuals in non-strict denominations to attend religious services at least once a week. These findings are consistent with survey evidence from other sources (Iannaccone, 1998), which show that the strictness of the religious group to which individuals belong correlates positively with the time and money that individuals contribute to church organizations. In the US, strict denominations thus succeed in attracting individuals with a relatively strong willingness to participate actively in church life.

In terms of organization, belonging to a denomination means a congregation agrees to govern itself according to a pre-specified structure. There is well-recognized variation in the degree of centralization among denominational governance systems.[18] The most decentralized system is a congregational polity, in which the congregation retains control over the hiring and firing of pastors and religious doctrine (Chaves, 1993b). The denomination, through national or international bodies, operates at arms' length. It provides congregations with a range of services, including recommending pastoral candidates, providing guidance on theology, publishing educational material, training pastors and lay leaders, extending loans for church construction, organizing national ministries to reach new converts, raising funds to support global operations, and organizing relief in response to disasters (as in Haiti following the 2010 earthquake). In return for these services, congregations pay fees to the denomination.[19] Local churches, in effect, use the denomination as a consulting service.

[17] For one-third of the individuals in the GSS, the denomination affiliation given (e.g., Other Baptist, Other Presbyterian, Church of God) is too aggregate to match to the denominations in our sample.

[18] Bloom, Sadun, and Van Reenen (2009) suggest that regional variation in the organization of religion may affect organizational choices by private firms. They find that multinational firms are more prone to centralized decision making in regions in which hierarchical religions (Catholicism, Eastern Orthodoxy, and Islam) are more prevalent.

[19] In the United States, individual congregations on average keep 79% of the revenues they generate, a share that has remained stable over time (Chaves, 1998).

In centralized denominations, control rights reside 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, and set religious doctrine for member churches. The denomination, in effect, has the power to license its brand – including the denomination name, religious doctrine, and governance structure – to individual congregations and decide who will manage each church. There are two common forms of centralized governance. In an episcopal (or connectional) structure, power resides in the bishopric, as in the United Methodist Church, the Evangelical Lutheran Church, and the Mormon Church. The chief authority over congregations within a region is a bishop, who ordains pastors, assigns pastors to churches, adjudicates disputes, and performs administrative duties. A council of bishops controls church doctrine. A second hierarchical system is the presbyterian structure, as in the Presbyterian Church USA and the Reformed Church. 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.

We define a denomination to be decentralized if it has a congregational polity, which as seen in Table 3 applies to 55% of denominations. Among the denominations, the correlation between having a congregational polity and being strict is -0.16, implying that decentralized denominations are modestly less likely to have a strict religious doctrine.

2.3 Global expansion by denominations

Denominations tend to enter a country by supporting missionaries or organizing mass revival meetings (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).

To examine the intensive and extensive margins more formally, we follow Eaton, Kortum

and Kramarz (2004) and use the identity, $N_{jk} \times (M_{jk} / N_{jk}) = M_k \times (M_{jk} / M_k)$, where N_{jk} is the number of congregations for denomination j in country k, M_{jk} is the number of affiliated Christians for denomination j in country k, and M_k is the total number of Christians in country k. We then estimate the following two regressions (with robust standard errors in parentheses and the constant terms dropped):

$$\ln N_{jk} = \underset{(0.006)}{0.846 \ln M_k} + \underset{(0.007)}{0.794 \ln \frac{M_{jk}}{M_k}}$$

$$\ln \frac{M_{jk}}{N_{jk}} = \underset{(0.006)}{0.154 \ln M_k} + \underset{(0.007)}{0.206 \ln \frac{M_{jk}}{M_k}}$$

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 relates to 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_k), 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_{jk} /M_k), 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, through adding congregations.

3. THEORY

In this section, we present a model of competition between denominations within national markets. We proceed by deriving the demand for participation in denominations, characterizing the interaction between denomination headquarters and pastors in supplying religious services, solving for the market equilibrium, and, finally, deriving comparative statics for denomination size, where we distinguish denominations by their strictness and governance structure.

3.1. Model setup and the demand for religion

Each country, *k*, has many regional markets, indexed by *m*. In market *m* of country *k*, a total number of O_k^m individuals choose among religious organizations. To enter a country, a denomination incurs a fixed cost, f_k, which captures the cost of sending missionaries abroad or organizing a ministry. To be present in a regional market, a denomination must establish a congregation, which requires a fixed cost, f_{ck}.[20] A denomination provides the congregation with access to its credence goods, whose value in utility is δ_{jk}. Each congregation is managed by a pastor, who serves members at marginal cost, g_k, plus the cost of his effort, given by,

$$c(e_{jk}^m) = \exp(h_k e_{jk}^m), \tag{1}$$

per member of the congregation, where $h_k > 0$ affects effort costs. Following Besley and Ghatak's (2005) formulation of objectives in non-profit organizations, we assume that the pastor values both the number of congregation members, with weight γ, and monetary income from serving the congregation. Likewise, a denomination values the number of believers it attracts, also with weight γ, as well as the monetary income its congregations generate.[21]

Members of the congregation enjoy services provided by the church and contribute time and money to help provide worship services, outreach to new members, charitable activities, and other club goods. We adopt a discrete choice framework and specify that the utility for person *i* in country *k* from participating in denomination *j* in local market *m*, u_{ijk}^m, is given by,

$$u_{ijk}^m = (\delta_{jk} + \alpha_k e_{jk}^m) + V_{jk}^m(., p_{jk}^m) + \varepsilon_{ijk}^m, \quad \alpha_k > 0, \tag{2}$$

where e_{jk}^m is the pastor's effort level and the term $\alpha_k e_{jk}^m$ captures the pastor's contribution to the quality of religious services perceived by congregants. When α_k is high, the marginal impact of pastor effort on utility is large. The price, p_{jk}^m, is a per-person membership fee, which may take

[20] Effectively, we assume that to serve a market a denomination must engage in foreign direct investment, implying that there is no "export" option. In practice, some denominations do reach members through radio and television programming, which are forms of exporting religious services. Since we lack data on the extent to which individual denominations use radio and TV ministries, such activities are outside of the scope of our analysis.

[21] As compared with Besley and Ghatak (2005), we (i) assume that the principal and the agent have the same mission objective (i.e., congregation membership) and so abstract away from the matching between principals and agents, and (ii) consider an incomplete-contract environment. The weighting parameter, γ, affects the price level (see equations (5) and (8)) and so denomination size, but does not affect how denomination size varies with the key parameters of our model, α_k, h_k, and π_{Sjk}. Therefore, Propositions 1 and 2, below, still hold even if the denomination and the pastor place different utility weights on the number of believers.

the form of volunteer work or donations.[22] ε_{ijk}^{m} is an iid extreme value error term, observable to person *i*. We motivate V_{jk}^{m} (.) using the club-good model of Iannaccone (1992), where each congregation is a club and members take congregation size as given. Each member consumes a secular good, whose quantity is S_{ijk}^{m} and whose shadow price is π_{Sjk}, and participates in the congregation at intensity level R_{ijk}^{m} , with shadow price π_{Rjk}. We assume shadow prices are constant across regions within a country. The quality of club goods produced by a congregation is increasing in the average participation intensity of its members, Q_{jk}^{m}. Congregation members choose S_{ijk}^{m} and R_{ijk}^{m} to maximize sub-utility, $u_c(S_{ijk}^{m}, R_{ijk}^{m}, Q_{jk}^{m})$, taking the choices of other members as given, and subject to the budget constraint, $\pi_{Sjk} S_{ijk}^{m} + \pi_{Rjk} R_{ijk}^{m} \leq I_{ijk}^{m} - p_{jk}^{m}$, where I_{ijk}^{m} is income and we assume an interior solution with positive participation.[23] For each member of the congregation, $V_{jk}^{m}(\pi_{Sjk}, \pi_{Rjk}, I_{ijk}^{m} - p_{jk}^{m}, Q_{jk})$ is the indirect utility of the club good at the Nash equilibrium.

Following Iannaccone (1992) we model the strictness of a denomination as a tax that increases the shadow price of the secular good: $\pi_{Sjk} = \pi_{Sk} + \pi_{Sj}$, where π_{Sj} is high if denomination *j* is strict. Strictness imposes time costs or other constraints on consuming secular goods, which lowers real income.[24] But strictness also raises individual and average participation intensity in a congregation (as long as the secular good and church participation are substitutes), consistent with our findings from the GSS discussed in section 2. Iannaccone (1992) shows that the utility gains from higher participation can more than offset the loss in real income: $\partial V_{jk}^{m} / \partial \pi_{Sjk} > 0$. We show in an appendix the conditions under which it is also true that $\partial^2 V_{jk}^{m} / \partial (\pi_{Sjk})^2 > 0$, meaning that an increase in the price of secular goods increases marginal utility more for strict groups than for less strict ones. Throughout the analysis, we assume these conditions hold. Finally, it is easy to show that $-\beta \equiv \partial V_{jk}^{m} / \partial p_{jk}^{m} < 0$; an increase in the membership fee decreases members'

[22] We leave unspecified whether the membership fee is paid in donations of time or money owing to Gruber's (2004) empirical finding that religious giving and religious attendance are substitutes.

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

[24] Consistent with this conception of the costs of religious participation, Lipford and Tollison (2003) find that increased religious participation is associated with lower individual income.

disposable income and thereby reduces utility. Summarizing the properties of indirect utility,

$$-\beta \equiv \frac{\partial V_{jk}^m}{\partial p_{jk}^m} < 0, \quad \frac{\partial V_{jk}^m}{\partial \pi_{Sjk}} > 0, \quad \text{and} \quad \frac{\partial^2 V_{jk}^m}{\partial (\pi_{Sjk})^2} > 0. \tag{3}$$

To match our data we focus on individual choices among Protestant denominations, with other religious groups remaining in the background.[25] To derive the total number of individuals who participate in denomination *j*, X_{jk}^m, we apply Anderson, de Palma and Thisse (1992) and Feenstra (2004), to obtain the following expression,

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

$$P_k^m = \sum\nolimits_j \exp[\delta_{jk} + \alpha_k e_{jk}^m + V_{jk}^m], \tag{4}$$

where μ_{jk}^m is the market share of denomination *j* in market *m* and P_k^m measures the competitiveness of market *m*, akin to a price index for religious services. While we focus on Protestant denominations, other religious groups are implicitly captured in the term, P_k^m, which we control for in the estimation using country fixed effects. By equation (4), $\partial \ln X_{jk}^m / \partial p_{jk}^m = -\beta$, such that the parameter $\beta > 0$ measures the elasticity of demand for church membership; a high β indicates elastic demand. Equation (4) also implies that $\partial \ln X_{jk}^m / \partial e_{jk}^m = \alpha_k$, such that denomination size is increasing in the productivity of pastor effort.

3.2 Organizational structure and pastor incentives

To consider the determination of denomination membership fees and pastor effort, we assume 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, which determine congregation

[25] Our assumption in equation (2) that ε_{ijk}^m is iid extreme value implies independence of irrelevant alternatives (IIA). IIA allows us to estimate the model with data on a subset of the religious choices available to individuals in a country. This approach applies to the following decision structures: (a) a nested structure in which individuals first choose among religious aggregates (e.g., Protestantism, Catholicism, Judaism, Islam, etc.), before choosing among individual denominations or groups within these aggregates, in which case our analysis would apply to the subbranch of the decision tree that applies to choice among Protestant denominations; or (b) a non-nested structure in which individuals choose among all religious groups simultaneously, in which case we would be applying IIA and estimating outcomes among the Protestant subset of choices available. Under either structure, we control for unobserved religious options using country fixed effects, which capture market competitiveness, as seen in (4).

membership. (iii) The denomination and pastor bargain over the monetary surplus generated in market *m* (Grossman and Hart, 1986). Bargaining results from incomplete contracts, as we assume that no contract can be written at stage (ii) to govern trade at stage (iii). We assume both parties' outside options are 0 and that each gets half the monetary surplus.

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. Under the D structure, the pastor has control rights over a congregation, which gives him the right to choose the membership fee, p_{jk}^m.[26] The joint monetary surplus for the congregation is $X_{jk}^m\ (p_{jk}^m - g_k)$, meaning the pastor's payoff is, $X_{jk}^m \gamma + 0.5 X_{jk}^m\ (p_{jk}^m - g_k) - f_{ck} - X_{jk}^m c(e_{jk}^m)$.[27] The first order conditions for effort and the membership fee are, respectively,

$$c'(e_k^D) + \alpha_{jk} c(e_k^D) = \alpha_{jk}[\gamma + \frac{1}{2}(p_k^D - g_k)], \tag{5}$$

$$p_k^D = \frac{1}{\beta} + g_k + 2[c(e_k^D) - \gamma]. \tag{6}$$

Due to logit demand in (4), indirect utility, V_{jk}^m, and market competitiveness, P_k^m, do not affect fees or effort, though they do affect the number of adherents; in the rest of this subsection, we drop the index for region (*m*) and denomination (*j*). Equation (5) says that a higher fee provides the pastor with stronger incentives to exert effort, as the left-hand side of (5) is increasing in effort. Equation (5) also says that the pastor has stronger incentives to exert effort when his productivity is higher (α_k is larger) or his marginal effort cost, h_k, is lower. Equation (6) says that an increase in effort cost, $c(e_k^D)$, leads to a more than one-for-one increase in membership fees. 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 hold-up, he

[26] Consider the following extension to incorporate elements of the framework describing the delegation of authority in Aghion and Tirole (1997). Suppose the project of congregation-building is the vector (connection, membership fee), where a successful connection between the pastor and members of the congregation causes the utility of members to rise. There is uncertainty about the correct way to connect with members, with a pastor-preferred connection option and a denomination-preferred connection option. The D structure allocates formal authority over the vector (connection, membership fee) to the pastor. Compared with our current framework, the pastor has even stronger effort incentives under the D structure since he can choose not only his preferred price but also his preferred connection. Such a setting would strengthen results derived below.

[27] In our setting the allocation of control rights has no impact on bargaining power. To relax this assumption, suppose control rights increase bargaining power. Then under the D structure the pastor has even stronger incentives since he receives more than half the surplus. This setting would strengthen our results. In other words, our results hold up as long as control rights do not *decrease* bargaining power too much.

over-compensates his effort in pricing. In (6), the pastor internalizes only his own non-monetary benefit to believers and not the denomination's. The other terms in (6) say that the membership fee is high if variable cost, g_k, is high, or demand is inelastic (β is low). From (5) and (6),

$$e_k^D = \frac{1}{h_k} \ln \frac{\alpha_k}{2\beta h_k}. \tag{7}$$

Equation (7) says that pastor effort is high when effort has a large marginal contribution to demand (α_k is high) or when the effort cost, h_k, is low.

Under the C structure, the control rights over the congregation rest with the denomination, such that the denomination chooses the membership fee. Since the denomination's payoff is $\theta X_{jk} + X_{jk}(p_{jk} - g_k)/2 - f_{ck}$,[28] it chooses the fee,

$$p_k^C = \frac{1}{\beta} + g_k - 2\gamma. \tag{8}$$

Equations (6) and (8) imply that the membership fee 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 payoff, leading the denomination to ignore the effort cost in pricing. Equations (1) and (4) still hold under the C structure, and the first order condition for pastor effort is still equation (5), except that fee is p_k^C. Plugging (8) into (5) we obtain

$$e_k^C = \frac{1}{h_k} \ln \frac{\alpha_k}{2\beta(h_k + \alpha_k)}. \tag{9}$$

Equations (6) and (9) 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, the price-setting right rests with the denomination, which ignores the effort cost in its pricing decision. For the pastor, lack of control rights under the C structure aggravates the hold-up problem, creating weak incentives to invest in effort.

To summarize, the denomination and the pastor disagree about pricing; the denomination prefers the lower price, p_k^C, (as defined in (8)) but the pastor prefers the higher price, p_k^D (as defined in (6)). Relative to the C structure, the D structure provides stronger incentives to the pastor by allocating control rights to him, which results in high effort but also a high membership

[28] 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.

fee.[29] Since we do not observe effort levels or membership fees in our data, we next examine predictions about the numbers of believers and congregations under the C and D structures.

3.3 Market equilibrium and denomination size

To examine the number of adherents and congregations in country *k* for denomination *j* 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 (6) and (7) into pastor utility, the denomination enters local market *m* if and only if

$$X_{jk}^{m,D} B \geq f_{ck}, \qquad B = \frac{1}{2\beta} - \gamma, \tag{10}$$

where $X_{jk}^{m,D}$ is given by (4) 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 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 $G_k(.)$ and pdf $g_k(.)$, and O_k is a shifter reflecting the total population of country *k*. It follows that the regional competitiveness index is given by $P_k^m = \mu_{jk}^D O_k s_m$, where μ_{jk}^D is given by (4) with price, p_k^D, and effort, e_k^D. μ_{jk}^D, the market share of denomination *j*, is constant across markets in *k* where *j* is present. Equation (10) gives the threshold market size for entry:

$$\underline{s}_k^D = \frac{f_{ck}}{BO_k \mu_{jk}^D}, \tag{11}$$

Equation (11) says that a denomination enters more markets the lower is the fixed cost, the larger is country *k*, or the higher is a denomination's market share. In country *k*, the denomination 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. Following the urban economics literature (Gabaix, 2009), we assume the distribution of regional market size, $G_k(.)$, is Pareto with lower bound *b* and shape parameter *a*, such that $G_k(s) = 1 - (b/s)^a$. It follows that,[30]

[29] Consistent with these predictions, in US congregations pastor salaries rise more quickly with church attendance in denominations with congregational polities than in hierarchical denominations (McMillan and Price, 2003).

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

$$\ln \mu_{jk}^{D} = \alpha_k e_k^{D} + \delta_{jk} + V_{jk}^{D}(., p_k^{D}) - \ln P_k ,$$

$$\ln n_{jk}^{D} = a \ln \frac{Bb}{f_{ck}} + a \ln O_k + a \ln \mu_{jk}^{D}$$

$$\ln X_{jk}^{D} = \ln \frac{ab^a B^{a-1}}{(a-1)(f_{ck})^{a-1}} + a \ln O_k + a \ln \mu_{jk}^{D} . \qquad (12)$$

Equation (12) implies that the intensive margin, X_{jk}^{D}/n_{jk}^{D}, does not depend on market size or market share and that all the adjustment of X_{jk}^{D} is through the extensive margin, n_{jk}^{D}, broadly consistent with the empirical findings in subsection 2.3. Such predictions are typical of models with firm heterogeneity (Melitz, 2003). To determine the condition under which a denomination enters country *k*, note that the denomination receives variable profits $0.5 X_{jk}^{m} (p_{jk}^{m} - g_k)$ from regional market *m* and total variable profit $\int_{\underline{s}_k^D}^{\infty} \frac{1}{2}(p_k^D - g_k) X_{jk}^{m} dG(s_k^m) = \frac{1}{2}(p_k^D - g_k) X_{jk}^{D}$ from country *k*. Using the expression for X_{jk}^{D} in (12), denomination *j* enters country *k* if

$$\ln \frac{p_k^D - g_k}{2} + \ln \frac{ab^a B^{a-1}}{(a-1)(f_{ck})^{a-1}} + a \ln O_k + a \ln \mu_{jk}^{D} \geq \ln f_k . \qquad (13)$$

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

$$\underline{s}_k^{C} = \frac{f_{ck}}{BO_k \mu_{jk}^{C}}, B = \frac{1}{2\beta} - \theta ,$$

$$\ln \mu_{jk}^{C} = \alpha_k e_k^{C} + \delta_{jk} + V_{jk}^{C}(., p_k^{C}) - \ln P_k ,$$

$$\ln n_{jk}^{C} = a \ln \frac{Bb}{f_{ck}} + a \ln O_k + a \ln \mu_{jk}^{C}$$

$$\ln X_{jk}^{C} = \ln \frac{ab^a B^{a-1}}{(a-1)(f_{ck})^{a-1}} + a \ln O_k + a \ln \mu_{jk}^{C} , \qquad (14)$$

Under the C structure, denomination *j* enters country *k* if

$$\ln[\frac{p_k^C - g_k}{2} - \frac{B(a-1)}{ab^a}] + \ln \frac{ab^a B^{a-1}}{(a-1)(f_{ck})^{a-1}} + a \ln O_k + a \ln \mu_{jk}^{C} \geq \ln f_k . \qquad (15)$$

With these results in hand, we derive comparative statics. We first examine the effect of religious doctrine on denomination size. We consider how shocks to the market for secular goods

affect the relative size of strict groups. From club-good utility, changes in the price of the secular good change the demand for strictness. For denomination j in country k, we assume that the shadow price for the secular good can be decomposed as, $\pi_{Sjk} = \pi_{Sj} + \pi_{hk} + \pi_{dk}$, for all local markets m. π_{Sj} is high for the adherents of denomination j if denomination j is strict; π_{hk} is high for the population of country k if country k has a weak supply of social services (implying higher queuing costs and therefore higher shadow prices for these services); and π_{dk} is high for country k if there is strong demand for social services. The first property follows Iannaccone's (1992) conception that membership in a strict religious group raises the cost of consuming secular goods. The second property follows from the standard notion that price is negatively correlated with supply shocks. And the third property holds because the indirect utility function, $V_{jk}(.)$, implies that the marginal utility of the secular good is $\partial u_c(.)/\partial S_{jk} = [\partial V(.)/\partial I_k]\pi_{Sjk}$, where $u_c(.)$ is the (direct) club-good utility. Strong demand for social services increases the marginal utility of the secular good and so raises its price, π_{Sjk}.[31]

What happens to participation in denominations when the shadow price of the secular good increases? Suppose, for instance, that the availability of social services in country k falls. Then π_{hk} increases, and utility increases for all denominations in country k, strict or not, since $\partial V/\partial \pi_S > 0$, by equation (3). This outcome is consistent with the findings that church-provided services compete with government-run welfare programs in Hungerman (2005) and Gruber and Hungerman (2007). However, there is an additional effect, as well. The increase in indirect utility is higher for strict denominations, for which π_{Sjk} is higher, since $\partial^2 V/\partial(\pi_S)^2 > 0$ by equation (3). In other words, strict denominations face a relatively large increase in demand if government provision of social services falls. Summarizing,

> Proposition 1 Weaker government provision of (and/or stronger demand for) social services raise the size of strict denominations by more than less strict ones:

$$\frac{\partial^2 \ln G^O_{jk}}{\partial(\pi_{hk})\partial(\pi_{Sj})} > 0, \quad \frac{\partial^2 \ln G^O_{jk}}{\partial(\pi_{dk})\partial(\pi_{Sj})} > 0, \text{where } G = X, n \text{ and O = D, C.}$$

The appendix contains the proof.

Turning to the effect of organizational structure on size, by equations (12) and (14), the

[31] We assume that the increase in the marginal utility of the secular good dominates the change in the marginal utility of income. This holds, for example, when the club-good utility, $u_c(.)$, is homothetic in income.

size of a decentralized denomination relative to a centralized one is,

$$\ln \frac{n_{jk}^{D}}{n_{jk}^{C}} = \ln \frac{X_{jk}^{D}}{X_{jk}^{C}} = a[\alpha_k (e_k^D - e_k^C) + (V_{jk}^D - V_{jk}^C)]. \quad (16)$$

Equation (16) implies that there is an ambiguous ranking of absolute size for centralized and decentralized denominations, as such a comparison depends on all the elements of the indirect utility function $V_{jk}(.)$. 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_k increases (or h_k decreases). Then pastor effort increases and size increases for both C and D structures. Intuitively, given that the D structure provides the pastor with stronger incentives, the increase in α_k should have a larger impact under the D structure. We show in an appendix that[32]

> Proposition 2. 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:
>
> $$\frac{\partial \ln(G_{jk}^D / G_{jk}^C)}{\partial \alpha_k} > 0, \quad \frac{\partial \ln(G_{jk}^D / G_{jk}^C)}{\partial h_k} < 0, \text{ where } G = X, n.$$

To summarize, our model generates two predictions: (1) Doctrine: Weaker provision of (or stronger demand for) social services raises the number of adherents and congregations more for strict denominations than less strict ones (Proposition 1); and (2) Organization: An increase in the marginal value of pastor effort (or decrease in effort cost) raises the numbers of adherents

[32] It is possible to extend the analysis to ownership of church property. Following Grossman and Hart (1986), we assume that ownership and control rights rest with the same party. Under the D structure the local congregation owns the church, but under the C structure the denomination owns the church. In practice, under a congregational polity, the congregation tends to own church buildings, while under episcopal or presbyterian polities, the denomination typically controls church property. 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 controls 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. We assume that the monetary surplus shrinks to the fraction $d_k^D < 1$ of the size when bargaining is successful. The denomination then gets fraction $(1 - d_k^D)/2$ of the monetary surplus in bargaining, while the pastor receives fraction $(1 + d_k^D)/2$. Under the C structure, the denomination owns the church. Should bargaining fail, pastor effort no longer affects demand and the monetary surplus collected by the denomination shrinks to the fraction $d_k^C < 1$ of the size under successful bargaining. The pastor's outside option is 0. The denomination receives the share $(1 + d_k^C)/2$ of the monetary surplus in bargaining and the pastor receives the share $(1 - d_k^C)/2$. Other derivations go through and Propositions 1 and 2 hold.

and congregations more for a decentralized denomination than a centralized one (Proposition 2). Although we have focused on Protestant denominations in deriving these predictions, our framework can be applied to competition among other religious groups, as well.

3.4 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:

$$V_{jk}^{O} = -\beta p_k^{O} + c_0 + c_1 I_k + J(\pi_{Sjk}, \pi_{Rjk}), \quad \text{O = D, C,} \tag{17}$$

where $J(\pi_{Sjk}, \pi_{Rjk})$ is a second-order polynomial involving the shadow prices for secular goods, π_{Sjk} and π_{Rjk}, and the c's are constants. We assume that π_{Rjk} is country-k specific and denote the vector (I_k, π_{Rk}) by $\mathbf{Z_k}$. We also assume that the general quality of denomination j's credence good in country k is $\delta_{jk} = \varsigma_j - c_3 t_{jk}$, where

$$t_{jk} = \tau_k + d_{jk} + \eta_{jk}. \tag{18}$$

τ_k is trade costs common to denominations in country k, d_{jk} is trade costs in k specific to denomination j (e.g., distance to denomination headquarters), and η_{jk} is an iid random cost (which allows the ranking of denominations across countries to differ). Finally, we measure π_{hk} and π_{dk} using the vector $\mathbf{H_k}$, which includes the supply of and demand for social services in country k, and π_{Sj} by the strictness of denomination j, STR_j (recall that $\pi_{Sjk} = \pi_{dk} + \pi_{hk} + \pi_{Sj}$). We then have the following empirical specification for $V_{jk}^{O} + \delta_{jk}$:

$$V_{jk}^{O} + \delta_{jk} = \gamma_j + \gamma_k + c_2 \mathbf{Z_k} STR_j + \eta_1 \mathbf{H_k} STR_j - c_3 t_{jk}, \quad \text{O = D, C,} \tag{19}$$

where γ_j and γ_k are denomination and country fixed effects, which absorb the variables with j- and k-specific subscripts (e.g. p_k^{O}, $\mathbf{Z_k}$, and ς_j). By Proposition 1, the coefficient $\eta_1 < 0$.

Plugging equation (19) into (12) and (14), it follows that,

$$\ln X_{jk}^{O} = f^{O}(\alpha_k, h_k) + \gamma_j + \gamma_k + c_2 \mathbf{Z_k} STR_j + \eta_1 \mathbf{H_k} STR_j - c_3 t_{jk},$$

$$\ln n_{jk}^{O} = f^{O}(\alpha_k, h_k) + \gamma_j + \gamma_k + c_2 \mathbf{Z_k} STR_j + \eta_1 \mathbf{H_k} STR_j - c_3 t_{jk}, \tag{20}$$

where the c's are constants, O = {*Decentralized*, *Centralized*}, and the fixed effects γ_j and γ_k

have absorbed the *j* (denomination) and *k* (country) specific variables. In equation (20), X_{jk}^{O} and n_{jk}^{O} are, respectively, the numbers of adherents and congregations that denomination *j* has in country *k*, and α_k (h_k) is the marginal value (cost) of pastor effort in country *k*. Proposition 2 implies that $\partial f^D / \partial \alpha_k > \partial f^C / \partial \alpha_k$ (i.e., increases in the marginal product of pastor effort have a larger positive impact on the size of decentralized denominations than on centralized ones) and that $\partial f^D / \partial h_k < \partial f^C / \partial h_k$. We approximate $f^O(.)$ by $\lambda_1 \mathbf{R_k} + \eta_2 \mathbf{R_k} DEC_j$, where $\mathbf{R_k}$ measures the productivity of pastor effort in country *k* and DEC_j measures the decentralization of denomination *j*, where by Proposition 2, $\eta_2 > 0$. Equation (20) implies the following regressions:

$$\ln X_{jk} = \gamma_j + \gamma_k + \eta_2 \mathbf{R_k} DEC_j + \eta_1 \mathbf{H_k} STR_j + \lambda_3 \mathbf{Z_k} STR_j + \lambda_4 t_{jk} + u_{jk},$$

$$\ln n_{jk} = \gamma_j + \gamma_k + \eta_2 \mathbf{R_k} DEC_j + \eta_1 \mathbf{H_k} STR_j + \lambda_3 \mathbf{Z_k} STR_j + \lambda_4 t_{jk} + v_{jk}. \quad (21)$$

In equation (21), u_{jk} and v_{jk} are error terms capturing unobserved trade costs (assumed uncorrelated with the regressors), and $\mathbf{Z_k}$ is expanded to include the competitiveness of the country's religious market (P_k) and country size (O_k). By Proposition 1, $\eta_1 < 0$: stronger supply of (or weaker demand for) social services reduces the size of strict denominations by more than non-strict ones; by Proposition 2, $\eta_2 > 0$: higher productivity of pastor effort increases the size of decentralized denominations by more than centralized ones.

4. EMPIRICAL RESULTS

4.1 Regression variables and estimation method

Following equation (21), we regress the log size of a denomination in a country, measured as the number of adherents or congregations in 2005, on country fixed effects, γ_k, denomination fixed effects, γ_j, and interactions between country and denomination characteristics.[33] Denomination effects absorb doctrinal strictness and governance structure, the quality of a denomination's credence goods, other determinants of denomination productivity, and entry barriers specific to a denomination and constant across countries. Country effects absorb national market size (related to population, urbanization, average income, education,

[33] Although the WCD counts adherents in 1970 and 2005, we lack data for most regressors prior to 1970, limiting our analysis to the 2005 cross section. However, we do use the 1970 WCD data in our treatment of selection bias.

etc.), barriers to the import of religion common across denominations, variable costs in providing services to congregants common across denominations, and the competitiveness of the religious market in a country (as defined in equation (4)), which captures the variety of religious options available in a country (whether Protestant or not). The key regressors are interactions between a denomination's governance structure (DEC_j =1 if a denomination has a congregational polity and is decentralized) or religious doctrine (STR_j =1 if the denomination is above the median in terms of doctrinal strictness) and country characteristics that capture the productivity of pastor effort or the supply of and demand for social services. Table 4 provides summary statistics.

Consider first measures of social service demand and supply, $\mathbf{H_k}$. Berman (2000) and Chen (2010) stress the mutual insurance quality of many of the services that religious groups provide, which include child care, free meals, help in finding work, basic health care, and other charitable offerings. Hungerman (2005) and Gruber and Hungerman (2007) find that in the United States state expansion of social services crowds out church activities. Consistent with these findings, we assume that the club goods produced by congregations substitute for social services provided by the state. In terms of state-provided social services, we focus on public resources that assist individuals in weathering health shocks. In many countries, governments are the primary providers of health services, especially for the poor or middle class. We examine whether more expansive public health services means weaker demand for services provided by religious groups, where we measure availability of health services using medical personnel (nurses and midwives) per capita,[34] log hospital beds per capita, and health expenditure as a share of GDP, from World Development Indicators averaged over 1970-2004.

The demand for social services provided by the state is likely to be greater where the incidence of adverse shocks is higher. We measure aggregate shocks using the incidences of natural disasters and disease outbreaks based on data from the International Emergency Event Database (www.emdat.be). While such shocks are temporary, they are often severe in nature, leading to large disruptions in consumption. Anthropological evidence from traditional societies shows that the number of religions present in a region is positively correlated with disease load

[34] Physicians are an obvious additional type of medical personnel. However, in many poor countries physicians play a relatively small role in the delivery of health care, with nurses being far more prevalent (Clemens, 2007). Among the poorest 30 countries in the sample, the median nation has 0.5 physicians and 5 nurses per 10,000 people, such that the ratio of nurses to physicians is 10 to one. In the rest of the sample, the ratio of nurses to physicians is 3 to one. Below, we discuss results including physicians per capita interacted with strictness as a regressor but we do not include the variable in estimating the principal components of health services.

(Fincher and Thornbill, 2008), consistent with the idea that religious organizations provide insurance against the risk of contagion. We measure shock incidence as the number of events that occurred in a country over 1970 to 2004 (for disasters) or 1995-2004 (for disease outbreaks),[35] divided by the number of years in the period, which is the annualized shock incidence. We define a serious natural disaster as an earthquake over seven on the Richter scale, a windstorm (i.e., hurricane) lasting five days or more, or a landslide or volcanic eruption that affects more than 1000 people. Disease measures cover cholera, dengue fever, influenza/SARS, and meningococcal outbreaks that affect more than 1000 people. Serious natural disasters are unfortunately common events, with mean annual probabilities of occurrence of 1% (hurricanes) to 3% (earthquakes, volcanic eruptions). Mass disease outbreaks are also common, with mean annual occurrence probabilities of 0.3% (influenza/SARS) to 2% (cholera). We also examine how strictness interacts with financial development, which may capture the potential to hedge against environmental risk through financial markets.

Our measure of the productivity of pastor effort, $\mathbf{R_k}$, is the quality of communications and transportation infrastructure, including telephone mainlines per capita, cellular subscriptions per capita, road network (total length and fraction of roads paved), and passenger cars per capita.[36] A pastor's responsibilities include communicating with congregants (to learn about their preferences and encourage participation in church events), reaching out to new converts, and conferring with church leaders on managing the congregation. Pastor effort is likely to be more productive (or less costly) the better are communication services in a country. The success of a pastor also depends on the number of congregants he is able to attract to his church. A pastor's geographic reach will be more expansive in countries in which the cost of internal transport is lower. These transport costs depend, in turn, on the size and quality of road networks and the availability of passenger vehicles. Macroeconomics and public finance literatures give abundant evidence on how public infrastructure affects industrial productivity. There is a robust positive correlation between public infrastructure, measured in terms of roads and highways or telecommunications capacity, and industrial TFP (e.g., Morrison and Schwartz, 1996; Fernald, 1999; Roller and Waverman, 2001). We examine whether the productivity effects of

[35] We use a shorter window for disease outbreaks than for natural disasters because country coverage of disease outbreaks broken by type of disease is incomplete in the1970s and 1980s.

[36] As a matter of convention, we measure usage or access rates (e.g., cellular subscriptions per capita) in levels and factor quantities (e.g., hospital beds or passenger cars) as log values (which implicitly are in log per capita terms, given that log population interacted with strictness and decentralization appears as a regressor).

infrastructure depend on the governance structure of establishments, in our case religious denominations. Infrastructure data are from the WDI, averaged over 1991-2005.[37]

Although we control for country fixed effects, additional country characteristics (e.g., education, average income) may have different effects on strict versus non-strict (or centralized versus de-centralized) denominations. If these characteristics are correlated with our main regressors, the estimation may be subject to omitted-variable bias. To address this concern, we include interactions between decentralization and strictness and country characteristics shown to correlate with religiosity (Barro and McCleary, 2005; McCleary and Barro, 2006; Sacerdote and Glaeser, 2001), including educational attainment, per capita GDP, population size, urbanization, life expectancy, the fertility rate, distance from the United States, whether a country's official language is English, government regulation of religion (Grim and Finke, 2006), whether the country had a state religion in the past, the rule of law, ethnic fractionalization, the fraction of the population that had migrated to the US as of 1970, and indicators for whether Catholicism, Islam, Orthodoxy, Hinduism or Buddhism, or Judaism is the dominant religion in a country. We also employ placebo tests and examine individual types of natural disasters (e.g., earthquakes) and disease outbreaks (e.g., influenza/SARS), as we explain in subsections 4.3 and 4.4.

Another estimation issue is that most denominations are not present in most countries (see Table 2), creating potential problems with sample selection. We present results based on three estimation methods: OLS, a Heckman (1979) correction for sample selection, and a nonparametric correction for sample selection, motivated by Das, Newey, and Vella, (2003). 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 Heckman or nonparametric approaches, we need variables that are correlated with a denomination's presence in a country in 2005 but not independently correlated with the error terms in equation (21). We use two instruments for denomination presence in 2005. One (available for all denominations) 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 denomination size in 2005 only through denomination and country fixed effects. A second instrument (available for most denominations) is the entry decisions in 1970 of

[37] Measures of communications infrastructure are unavailable for many countries before 1990, which accounts for why we average their values over a shorter time span than for health services.

denominations with a similar number of adherents in the United States.[38] The reasoning behind this instrument is that size in the United States, the home country for all denominations in our sample, captures 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 entry, the entry decisions of denominations with similar numbers of US adherents are likely to be correlated. The identifying assumption is that the unobserved barriers to entry of similarly US-sized denominations are uncorrelated. In nonparametric estimation, we use a linear probability, probit, or logit model to estimate the probability a denomination is present in a country in 2005 and then construct dummy variables that capture the value of the predicted probability of presence based on dividing predicted values into 50 equal-sized bins.[39] We include these dummies in the second-stage regression for log denomination size.

4.2 Main estimation results

Table 5 presents baseline OLS results. We show coefficient estimates for four sets of interactions: between denomination strictness and (a) country incidence of natural disasters, (b) country incidence of disease outbreaks, and (c) country health infrastructure; and between a denomination being decentralized and country communications and transportation infrastructure. The data contain multiple measures of a country's infrastructure, which are likely to be correlated with each other. Because including these measures together introduces collinearity into the regression, we begin by using the first principal component of the infrastructure variables and later examine the results for the individual measures. We treat disasters, disease outbreaks and health services similarly.[40] By construction, the first principal components have mean zero and a standard deviation of one.

The first column of Table 5 shows that the interactions between strictness and the

[38] We define similar sized denominations using a size window of log 3 (matching to each denomination, other denominations with log US size plus or minus 1.5). Because the window for neighboring denominations is truncated for the largest and smallest groups, the instrument is not defined for these denominations.

[39] Results are similar when we use bins of 100 instead of 50 in the second-stage estimation. We also experimented with using the polynomials of estimated propensity scores and obtained similar results.

[40] For disasters, we use the first principal component of four incidence variables: earthquakes, landslides, volcanic eruptions, and windstorms; for disease outbreaks, we use the first principal component for four events: cholera, dengue fever, influenza/SARS, and meningococcal outbreaks; for health services, we use the first principal component of three variables: medical personnel per capita, log hospital beds, and health expenditure as a share of GDP; and for communications and transportation infrastructure, we use the first principal component of five variables: telephone mainlines per capita, cellular subscribers per capita, log road network per square kilometer, percent roads paved, and log passenger cars

incidences of natural disasters and disease outbreaks are positive and precisely estimated. To understand the results, recall that the regressions include country and denomination fixed effects. Interpreting the within-denomination variation, the results indicate that a strict denomination will tend to attract more adherents in countries with a higher incidence of disasters, be they geological, meteorological, or biological in origin. Equivalently, the within-country variation indicates that a country that has a higher incidence of disasters will tend to have its Christian believers more concentrated in strict denominations. The coefficient estimates suggest that the impact of disasters on denomination size is large. A one standard deviation increase in the incidence index is associated with an increase in the relative size of strict denominations of 22 log points for either natural disasters (e.g., going from Austria to Nicaragua) or disease outbreaks (e.g. going from Italy to Nepal). In column (1), we also see that the interaction between strictness and the provision of health services is negative and precisely estimated. A strict denomination will tend to have more adherents in countries with worse provision of health services (or, equivalently, a country with worse health services will tend to have more of its believers in strict groups).

These results are consistent with Proposition 1, which says that the relative size of strict denominations is larger in countries in which the shadow price of secular goods and services is greater. Strict denominations do better in countries in which the net demand for social services is stronger, where higher net demand may come from weaker government supply of social services (measured here in terms of health infrastructure) or stronger public demand for services associated with the risk of shocks to income or health. In our model, stronger demand for or weaker availability of social services increases queuing and therefore the implicit price of obtaining services, making membership in a strict religious organization (with its superior capacity for producing club goods) more attractive.

In the second column of Table 5, the interaction between denomination decentralization and country provision of communication and transportation infrastructure is positive and precisely estimated. Decentralized denominations attract more adherents in countries in which the supply of communications and transportation infrastructure is greater. This finding is consistent with Proposition 2, which states that the relative size of decentralized denominations is larger in countries in which the marginal productivity of pastor effort is higher. From our model, higher productivity of pastor effort has a larger effect on the size of decentralized

denominations, owing to stronger pastor effort incentives created by their having control rights. Our finding of positive effects of infrastructure on relative denomination size is broadly consistent with findings in the literature on how public infrastructure affects industrial productivity, and provides empirical evidence that governance structure affects performance for international organizations.

In column (3), we combine the strictness and decentralization interactions in a single regression, which leaves results unchanged. In columns (4)-(6), we measure denomination size using the log number of congregations, instead of the log number of adherents. The results are qualitatively the same. Because results for adherents and congregations are similar, we limit the presentation of further results to regressions with log adherents as the dependent variable. Later results are robust to using log congregations as the dependent variable, instead.

Table 6 contains results for alternative estimators. As Table 2 shows, many denominations have chosen not to enter certain countries. To address sample selection, we estimate two alternative models. Columns (1) and (2) show results for a Heckman estimator, in which we use as instruments either denomination presence in the country in 1970 (first column) or lagged presence plus average presence in 1970 of denominations that attract a similar number of adherents in the United States (second column). Columns (3)-(8) present results for a nonparametric correction for sample selection, in which we first estimate the probability of presence in 2005 using a linear probability, probit, or logit model and then use dummy variables for the predicted probability of presence in 2005 as regressors in the second stage estimation of log adherents in 2005. The instruments for presence in 2005 are the same as in the Heckman model. Appendix table A1 presents first stage results. Both the Heckman and nonparametric results are similar to column (3) of Table 5, suggesting that self-selection into entry does not appear to matter much for the coefficient estimates. To streamline the exposition going forward, we present results for two estimators: OLS and a nonparametric correction for sample section based on a first stage probit model, which corresponds to column (7) in Table 6.

The results in Tables 5 and 6 include controls for the interaction between strictness and decentralization and a long list of country characteristics, which are shown in appendix table A2. Among the notable results is that strictness interacts negatively with educational attainment (holding constant the interaction between strictness and log per capita GDP). In particular, we find that stricter denominations are smaller in countries in which a larger fraction of the

population has a tertiary education. This finding extends Barro and McLeary's (2006) result that religiosity declines as countries become richer. It may indicate that reliance on religious groups for social services is weaker in societies that are more educated (and more capable of self-insuring against income shocks) or that in more educated societies individuals are less attracted to stricter doctrines. Stricter denominations also attract relatively more adherents in countries that are more urbanized and that have higher life expectancy.

4.3 Placebo tests

In the regressions in Tables 5 and 6, we assume that we have included the relevant denomination and country characteristics that capture the logic of Propositions 1 and 2. To examine whether our results may simply be artifacts of the data, and unrelated to the workings of our model, we conduct placebo tests by interacting country variables with theoretically irrelevant denomination characteristics, and by interacting denomination strictness and decentralization with theoretically irrelevant country characteristics.

In Table 7, we consider placebos for health services and transportation infrastructure. The public health services that we examine – medical personnel per capita, the supply of hospital beds, and public health expenditure as a share of GDP – are labor, capital, or spending inputs that are likely to help individuals weather health shocks that affect their productivity and life expectancy. One concern is that these health services may be correlated with unobserved components of country income, in which case the negative strictness-health service interaction that we find may be a byproduct of richer countries having weaker preferences for strict religious doctrine. As a placebo for health services, we consider the supply of dentists per capita, which is increasing in average income, suggesting that dental care is a normal good.[41] While greater availability of dental care may enhance the quality of life, it does not represent the type of health service that theory suggests substitutes for the club goods provided by religious groups. In columns (1) and (2), we replace the strictness-health service interaction with the interaction between strictness and dentists per capita. The coefficients on the interaction are small and very imprecisely estimated, implying there is no relation between the availability of dental services and the success of strict denominations. These results help allay concerns that we may have misinterpreted the strictness-health service interaction in Tables 5 and 6.

[41] The correlation between log per capita GDP and dentists per capita is 0.64.

A related issue applies to our estimates of the interaction between denomination decentralization and communication and land transportation infrastructure. Infrastructure is meant to capture the productivity of pastor effort. However, the supply of transportation infrastructure might be correlated with unobserved country characteristics. For example, suppose decentralized governance structures were more likely to be chosen in higher income countries (which results in table A2 suggest is *not* the case, as decentralization interacts negatively with per capita GDP), then the positive interaction that we find between decentralization and infrastructure might simply be picking up a positive correlation between decentralization and unobserved components of country income. To examine this possibility, we use air transportation services, measured either as log passenger departures or log registered air carrier departures, as placebos. Air transportation is not an input in the production of pastor services because church members are drawn overwhelmingly from nearby regions. Thus, according to our model, we should find no result for air transportation. Columns (3)-(6) of Table 7 show results for interactions between decentralization and air transport. Coefficients are *negative*, rather than positive, and imprecisely estimated in all cases. These results suggest that the positive interaction between decentralization and infrastructure is not driven by omitted-variable bias. To threaten our identification, the omitted country variables must be correlated with land transportation but uncorrelated with air transportation.

Turning to theoretically irrelevant denomination characteristics, in Table 8 we replace denomination strictness with the frequency of Holy Communion. Communion is a practice conducted during worship services that symbolizes Christ's last supper prior to his crucifixion, at which he shared bread and wine with his disciples. Nearly all Christian denominations include some form of communion in their liturgy, which centers on simulating the taking of bread and wine, but they vary greatly in the frequency with which they practice the ritual. Some groups share communion weekly, others monthly, and still others quarterly or annually. The Bible does not dictate the frequency of communion. The frequency of its practice reflects, in part, the preferences of believers for pomp and circumstance in worship. We use communion frequency as a placebo for strict religious doctrine, as the ritual captures ceremonial features of worship but is not related to the stigmatizing features of doctrine that matters in theory for the denomination capacity to product club goods. We identify a denomination as practicing frequent communion if it does so at least monthly, which applies to 39% of the sample; results are similar when we

define frequent communion to be either weekly or quarterly. Monthly communion has a correlation of -0.22 with strictness and -0.09 with decentralization.

The first two columns of Table 8 are based on OLS; the second two columns are based on a nonparametric correction for sample selection. Relative to Table 5, we replace the interaction between strictness and disasters, disease, and health services with the interaction between communion frequency and these country variables. All communion frequency interactions are small quantitatively and imprecisely estimated. Thus, we find no significant interaction between country characteristics and theoretically unimportant features of religious practice.

4.4 Extended regression results

So far, we have focused on the interactions between key denomination characteristics and the principal components of relevant country characteristics. Next, we examine interactions between the denomination variables and the individual elements of disaster incidence, disease outbreaks, health services, and communications and transport infrastructure.

In Table 9, we present interactions between denomination strictness and the incidence of specific types of natural disasters. Other regressors are the same as in Table 5. For disasters, there is a positive and significant interaction between strictness and three of the four disaster measures: earthquakes, landslides, and volcanic eruptions, which in Table 4 are the disasters with a relatively high annual incidence. The impact of disaster incidence on denomination size is large quantitatively. Using the results in panel (b), increasing the incidence of disasters by one standard deviation is associated with an increase in the relative size of strict denominations by 19 log points for earthquakes (e.g., going from Italy to the Philippines) and 23 log points for either landslides (e.g., going from Austria to Colombia) or volcanic eruptions (e.g., going from Argentina to Papua New Guinea).

Turning next to biological events, Table 10 presents interactions between strictness and the outbreak incidences of cholera, dengue fever, influenza/SARS, and meningococcal illness. Strictness interacts positively with all but meningococcal outbreaks, with the strongest results for influenza/SARS. A one standard deviation increase in the incidence of influenza outbreaks is associated with an increase in the relative size of strict denominations of 17 log points.

In Table 11 we present the interactions between strictness and health services. There is a negative and significant interaction between strictness and medical personnel per capita and log

hospital beds; for health expenditure as a share of GDP the interaction is negative but imprecisely estimated. The results in panel (b) imply that increasing medical personnel by one standard deviation is associated with a reduction in the relative size of strict denominations by 32 log points (e.g., going from Ghana to Poland), with a one standard deviation increase in hospital beds associated with a 43 log point decrease in the relative size of strict groups (e.g., going from Ghana to Uruguay). Two additional results in Table 11 are for physicians per capita and financial development. The interaction of the former with strictness is imprecisely estimated, whereas the latter is negative and precisely estimated. The absence of a significant interaction between strictness and the supply of physicians may reflect the relatively small role that physicians, as opposed to nurses, play in the delivery of health care in many poor countries (see note 34). The negative interaction between strictness and financial development suggests that in countries with well-organized financial markets individuals are less reliant on assistance from religious organizations and more able to insure themselves against risk through private means.

In Table 12, we consider the interaction between a denomination being decentralized and individual communications and transportation infrastructure variables. Decentralization interacts positively with telephone mainlines per capita, cellular subscribers per capita, log passenger cars, and the size of a country's road network, though coefficients are not precisely estimated in all cases. Whether intended or not, improvements in communications and transportation infrastructure appears to result in larger market shares for less hierarchical religious groups.

4.5 Discussion

What do our coefficient estimates imply about the relative performance of Protestant denominations in sample countries? Consider the primary country characteristics that affect the relative size of strict versus non-strict denominations: natural disasters, disease outbreaks, and delivery of health services.[42] Within sample countries, strict denominations are on average 18.2 log points larger than non-strict denominations. Based on coefficients from column (3) of Table 5, cross-country differences in the incidence of natural disasters explain 11.2% of this size difference, cross-country differences in the provision of health services explain 8.2%, and cross-country differences in the incidence of disease outbreaks explains less than one percent.

[42] The effects of communication and transportation infrastructure on the relative size of decentralized denominations are similar, and we do not discuss them to save space; e.g., in the Guinea-Senegal example, the difference in infrastructure explains 13.3% of the relative size difference in decentralized denominations.

To further illustrate the quantitative significance of our results, we present two examples, one involving Guatemala and Honduras, the other Guinea and Senegal. Both pairs consist of neighboring countries that have similar per capita GDPs, and we examine which factors matter for explaining within-pair differences in the relative size of strict denominations. The exercise amounts to a double differencing as we consider the average log relative size of strict denominations in one country minus that in another.

First, consider Guatemala and Honduras, two Central American nations. In Guatemala, the average size advantage of strict denominations is 41.7 log points, versus 23.8 in Honduras, for a double difference of 17.9 log points. The two countries have relatively similar per capita GDPs ($4675 in Guatemala, $3028 in Honduras), identical patterns of disease outbreaks, and very similar delivery of health services. Where they differ is in the incidence of natural disasters. Owing to its distinct geography, Guatemala has active volcanoes, whereas Honduras does not, resulting in Guatemala having an over eight percent higher annual frequency of either volcanic eruptions or of severe earthquakes. Using coefficient estimates from column (3) of Table 5, the difference in the incidence of natural disasters can account for 17.7% of the relative size difference in strict denominations between the two countries.

Our next example is Guinea and Senegal, two neighboring countries in East Africa that have similar per capita GDPs ($1012 in Guinea, $1373 in Senegal). The average relative size advantage of strict denominations is 148.8 log points in Guinea and 59.4 log points in Senegal, for a double difference of 89.5 log points. While the two countries have nearly identical incidences of natural disasters, Guinea has a higher incidence of disease outbreaks and poorer delivery of health services. Again using coefficients from column (3) of Table 5, these two factors together can account for 11.0% of the relative size advantage of strict denominations in Guinea versus Senegal. While Guatemala-Honduras and Guinea-Senegal are just two examples, they illustrate the manner in which natural disasters, disease outbreaks and health services affect the relative performance of strict denominations across countries.

5. FINAL DISCUSSION

In the last four decades, religious groups headquartered in the United States have expanded rapidly across borders, much as US multinational enterprises have sought new markets abroad. In both cases, globalization has been made possible by the dismantling of government

barriers, to foreign religious groups in the former case and to foreign direct investment in the latter. Much as US multinationals rely on their organizational advantages and superior intellectual property to compete in foreign markets (Bloom, Sadun, and Van Reenan, 2009), US Christian denominations succeed on the basis of their governance structure and religious doctrine. Along these two dimensions, denominations are remarkably heterogeneous.

US denominations with strict doctrine, including Pentecostals, Mormons, and Jehovah's Witnesses, have had among the most notable successes in attracting foreign adherents. The literature provides explanations for why strict religious groups have prospered in Israel (Berman, 2000) and Indonesia (Chen, 2010) based on Iannoccone's (1992) model of religious groups as clubs that produce quasi-public goods (which have mutual insurance properties) for their members. Our contribution is to show theoretically and empirically how denominations compete for believers and how country characteristics affect the market value of a denomination's attributes. Strictness is more desirable in countries in which individuals are more exposed to shocks associated with natural disasters and disease outbreaks. It is less desirable in countries with better health services, a more educated population, and better developed financial markets. One interpretation of these findings is that weak governments and weak institutions favor strict religious organizations. What may in part account for the recent globalization of Protestant Christianity is the lowering of state barriers to religion (Barro and Hwang, 2007), coupled with the slow expansion of state capacity in many developing countries, leaving individuals without public or private means to insulate themselves against risk.

There are sharp differences across religious organizations in terms of governance. The traditional Christian church, encompassing Catholics, Eastern Orthodox, and Anglicans, is strongly hierarchical, with the bishopric controlling church doctrine and the hiring and placement of pastors and other religious personnel. The Protestant Reformation introduced greater diversity in organization form into Christianity (Ekelund, Hebert, and Tollison, 2006), but the advent of Protestantism did not mean a complete break with centralized control. Some Protestant denominations maintain the hierarchical features of the traditional church, whereas as others endow local congregations with considerable power.

In theory, congregation control implies stronger incentives to pastors to invest in building their churches. Our finding that decentralized denominations attract more adherents in countries with better communication and transportation infrastructure is consistent with this reasoning, and

provides empirical evidence for the recent theoretical developments of organization and international trade. Our results also help account for the attraction of the non-traditional church in countries as they develop. Development typically brings with it improvements in infrastructure, creating advantages for more decentralized religious groups. The rise of independently run mega-churches in the United States is an example of this phenomenon (Brouwer, Gifford, and Rose, 1996). The process of economic development thus appears to change the composition of religious organizations, leading to less strictness (to the extent that development brings greater insulation from risk, through either state programs or private markets) and more decentralization (to the extent that improved infrastructure strengthens managerial investment incentives).

Finally, there is variation in doctrine and organization within non-Christian religions, for which our framework is relevant. For example, the radical form of Sunni Islam practiced by al-Qaeda and the Taliban is stricter than the main branches of Sunni Islam. Shia Islam (e.g. Iran, Yemen) has a hierarchy of Imams and tends to be more centrally organized than Sunni Islam (e.g. Egypt, Indonesia). Among the countries in which Shia and Sunni Islam are present, there is variation in the government provisions of public services. Our finding that weak governments and institutions favor strict religious groups suggests that future research could explore the link between weak states or weak local and regional institutions and radical Islam.

APPENDIX

1. Properties of the Indirect Utility Function, Equation (3)

Iannaccone (1992) shows that $\partial V_{jk}{}^{m}/\partial\, \pi_{Sjk} > 0$ if

$$\frac{\varepsilon_{r\pi_s}}{k_s} > \frac{1-\varepsilon_{Fr}\varepsilon_{Rq}}{k_q\varepsilon_{Fr}}, \tag{A1}$$

where F is the function mapping average participation to the club-good quality, Q, ε_{ij} is the elasticity of i with respect to j and k_j is the expenditure share of j (e.g. $\varepsilon_{r\pi_s}$ is the elasticity of church participation with respect to the shadow price of the secular good, and k_q is the shadow expenditure share of the club-good quality, Q). Condition (A1) is more likely to hold if the consumption of the secular good, S, is a close substitute for religious participation, R, (relative to its expenditure share), the marginal contribution of Q to utility is high, and/or Q is strongly complementary with R.

To derive the expression for $\partial^2 V_{jk}{}^{m}/\partial(\pi_{Sjk})^2$ we differentiate both sides of equation (11) in Iannaccone (1992) to get (where we drop the subscripts and superscripts and $U^e = V(.)$):

$$\frac{d^2U^e}{d\pi_s^2} = \frac{d}{d\pi_s}\left(\frac{\partial V}{\partial \pi_s}+\frac{\partial V}{\partial Q_e}\frac{dQ_e}{d\pi_s}\right) = \frac{d}{d\pi_s}\left(-S\frac{\partial V}{\partial I}\right)+\frac{d}{d\pi_s}\left(\frac{\partial V}{\partial Q_e}\frac{dQ_e}{d\pi_s}\right)$$

$$= \left[-\frac{\partial S}{\partial \pi_s}\frac{\partial V}{\partial I}-\frac{\partial S}{\partial Q_e}\frac{dQ_e}{d\pi_s}\frac{\partial V}{\partial I}-S\frac{d}{d\pi_s}\left(\frac{\partial V}{\partial I}\right)\right]+\left[\frac{\partial^2 V}{\partial Q_e^2}\left(\frac{dQ_e}{d\pi_s}\right)^2+\frac{\partial^2 V}{\partial Q_e\partial \pi_s}\frac{dQ_e}{d\pi_s}+\frac{\partial V}{\partial Q_e}\frac{d^2Q_e}{d\pi_s^2}\right],$$

where $U^e = V(.)$ is the equilibrium utility level and Q_e is the equilibrium level of the club-good quality. Let $\frac{\partial^2 V}{\partial I\partial \pi_s} = V_{IS}$, $\frac{d^2Q_e}{d\pi_s^2} = Q_{eS}^{''}$, $\frac{\partial^2 V}{\partial Q_e\partial \pi_s} = V_{eS}$, $\frac{\partial^2 V}{\partial I\partial Q_e} = V_{Ie}$, and $\frac{\partial^2 V}{\partial Q_e^2} = V_e^{''}$. $V_e^{''} < 0$ by the quasi-convexity of the indirect utility function, but the signs of V_{IS}, V_{eS}, V_{Ie} and $Q_{eS}^{''}$ are ambiguous. After some manipulation we obtain

$$\frac{d^2U^e}{d\pi_s^2} = \left(S\frac{\partial S}{\partial I}-\frac{\partial S}{\partial \pi_s}\right)\frac{\partial V}{\partial I}+S^2\frac{\partial^2 V}{\partial I^2}+S\frac{\partial V}{\partial Q_e}Q_{eS}^{''} \;-2\left(\frac{\partial S}{\partial Q_e}\frac{\partial V}{\partial I}+SV_{Ie}\right)\frac{dQ_e}{d\pi_s}+V_e^{''}\left(\frac{dQ_e}{d\pi_s}\right)^2,$$

which is a 2nd-order polynomial in terms of $\frac{dQ_e}{d\pi_s}$. The solution to $\partial^2 V_{jk}{}^{m}/\partial(\pi_{Sjk})^2 = \frac{d^2U^e}{d\pi_s^2} > 0$ is

$$\max\left(0,\ \frac{-b+\sqrt{b^2-4ac}}{2a}\right) < \frac{dQ_e}{d\pi_s} < \frac{-b-\sqrt{b^2-4ac}}{2a},\ a = V_e^{''} < 0,\ b = -2\left(\frac{\partial S}{\partial Q_e}\frac{\partial V}{\partial I}+SV_{Ie}\right),$$

$$c = \left(S\frac{\partial S}{\partial I}-\frac{\partial S}{\partial \pi_s}\right)\frac{\partial V}{\partial I}+S^2\frac{\partial^2 V}{\partial I^2}+S\frac{\partial V}{\partial Q_e}Q_{eS}^{''}. \tag{A2}$$

Finally we use the numerical example in Iannaccone (1992) to illustrate the parameter values for which conditions (A1) and (A2) hold. The setting is identical to Iannaccone (1992): utility from the club good is $(S^d + K^d)^{1/d}$, $K = R^{\alpha}Q^{1-\alpha}$, $Q = \bar{R}$, α and d are constants between 0 and 1, and a congregant's income is I. We use the same parameter values as Iannaccone (1992); i.e. $I = 1$, $\pi_R = 1$, $\alpha = 0.3$, and $d = 0.8$. Applying the results in Iannaccone (1992), $V = \frac{[(\pi_S)^{d(\rho-1)} + (\delta_R)^{-\rho d}]^{1/d}}{(\pi_S)^{\rho} + (\delta_R)^{-\rho}}$,

where $\rho = d/(1-d)$ and $\delta_R = \alpha^{1/d}$. Figure X1 plots V against π_S, and it shows that V is a convex function of π_S when $\pi_S \leq 4.2$ and that V is an increasing convex function of π_S when $\pi_S \in [2.6, 4.2]$. Figure A1 is similar to Figure 1 in Iannaccone (1992), except that the latter has log(V) and log(π_S) on the axes.

2. Proposition 1

Since $\pi_{Sjk} = \pi_{Sj} + \pi_{hk} + \pi_{dk}$, $\dfrac{\partial^2 \ln G_{jk}^O}{\partial(\pi_{hk})\partial(\pi_{Sj})} = \dfrac{\partial^2 \ln G_{jk}^O}{2\partial(\pi_{Sjk})^2} = \dfrac{a\partial^2 V_{jk}^O}{2\partial(\pi_{Sjk})^2} > 0$, $G = X, n$ and O = D, C, where the last inequality is by equation (3). The proof for is analogous.

3. Proposition 2

We first show that $\partial[\ln \dfrac{G_{jk}^D}{G_{jk}^C}]/\partial\alpha_{jk} > 0$ if $\beta > 0.22$ or $\dfrac{\alpha}{h} > 0.77$, where $G = X, n$. By equation (16), $\partial[\ln \dfrac{G_{jk}^D}{G_{jk}^C}]/\partial\alpha_{jk} > 0$ if and only if $\partial[\ln \dfrac{\mu_{jk}^D}{\mu_{jk}^C}]/\partial\alpha_{jk} > 0$. In the derivations below we drop the subscripts j and k. By equations (12) and (14), $\partial[\ln \dfrac{\mu_{jk}^D}{\mu_{jk}^C}]/\partial\alpha_{jk} = e^D - e^C + \alpha(\dfrac{\partial e^D}{\partial\alpha} - \dfrac{\partial e^C}{\partial\alpha}) + (\dfrac{\partial V^D}{\partial p^D}\dfrac{\partial p^D}{\partial\alpha} - \dfrac{\partial V^C}{\partial p^C}\dfrac{\partial p^C}{\partial\alpha})$. By equations (3), (6) and (8), $\partial V^D/\partial p^D = -\beta$, $\dfrac{\partial p^D}{\partial\alpha} = 2c'(e^D)\dfrac{\partial e^D}{\partial\alpha}$, and $\dfrac{\partial p^C}{\partial\alpha} = 0$. Equations (5) and (6) imply that $c'(e^D) = \dfrac{\alpha}{2\beta}$, and so $\dfrac{\partial V^D}{\partial p^D}\dfrac{\partial p^D}{\partial\alpha} = (-2\beta)\dfrac{\alpha}{2\beta}\dfrac{\partial e^D}{\partial\alpha} = -\alpha\dfrac{\partial e^D}{\partial\alpha}$. Therefore, we have

$$\partial[\ln \frac{\mu_{jk}^D}{\mu_{jk}^C}]/\partial\alpha_{jk} = e^D - e^C - \alpha\frac{\partial e^C}{\partial\alpha} \qquad \text{(A3)}$$

To see the intuition for equation (A3), suppose α_{jk} increases. Then under the D structure, both effort level and price increase, but the effect of effort level dominates, and the term e^D reflects the net effect of effort level on $\ln\mu^D$. Under the C structure, however, effort level increases but price does not (since the denomination ignores pastor effort in pricing), and the terms $e^C + \alpha\dfrac{\partial e^C}{\partial\alpha}$ reflect the total effect of effort level on $\ln\mu^C$. Using equations (7) and (9) we can show that the effects on $\ln\mu^D$ and $\ln\mu^C$ both increase with $\dfrac{\alpha}{h}$, but the effect on $\ln\mu^D$ increases faster with $\dfrac{\alpha}{h}$. Therefore, when $\dfrac{\alpha}{h}$ is large the effect on $\ln\mu^D$ dominates and $\partial[\ln \dfrac{\mu_{jk}^D}{\mu_{jk}^C}]/\partial\alpha_{jk} > 0$. To be rigorous,

by equations (9) and (X3), $\alpha \frac{\partial e^C}{\partial \alpha} = \frac{1}{h+\alpha}$ and so $\partial[\ln \frac{\mu_{jk}^D}{\mu_{jk}^C}] / \partial \alpha_{jk} = \frac{1}{h}(\ln \frac{h+\alpha}{h} - \frac{h}{h+\alpha})$, which is positive if $\frac{\alpha}{h} > 0.77$. In addition, since $e^C = \frac{1}{h}\ln \frac{\alpha}{2\beta(h+\alpha)} > 0$, we implicitly assume $\frac{\alpha}{2\beta(h+\alpha)} > 1$, or $\frac{\alpha}{h} > \frac{2\beta}{1-2\beta}$, which implies that $\frac{\alpha}{h} > 0.77$ if $\beta > 0.22$.

The proof for $\partial[\ln \frac{G_{jk}^D}{G_{jk}^C}] / \partial h_k < 0$, where $G = X$, n, is similar. Again, by equation (16), $\partial[\ln \frac{G_{jk}^D}{G_{jk}^C}] / \partial h_k$ has the same sign as $\partial[\ln \frac{\mu_{jk}^D}{\mu_{jk}^C}] / \partial h_k$, and we again drop the subscripts j and k in the derivations below. By equations (12) and (14), $\partial[\ln \frac{\mu_{jk}^D}{\mu_{jk}^C}] / \partial h = \alpha(\frac{\partial e^D}{\partial h} - \frac{\partial e^C}{\partial h}) + (\frac{\partial V^D}{\partial p^D}\frac{\partial p^D}{\partial h} - \frac{\partial V^C}{\partial p^C}\frac{\partial p^C}{\partial h})$. By equations (3), (6) and (8),. $\partial V^D/\partial p^D = -\beta$, $\frac{\partial p^C}{\partial h} = 0$, and $\frac{\partial p^D}{\partial h} = 2c'(e^D)\frac{\partial e^D}{\partial h} + 2\frac{\partial[c(e^D)]}{\partial h}$, where $\frac{\partial[c(e^D)]}{\partial h}$ shows how much $c(e^D)$ shifts following a change in h, holding e^D constant. Again, $c'(e^D) = \frac{\alpha}{2\beta}$ and so $\frac{\partial V^D}{\partial p^D}\frac{\partial p^D}{\partial \alpha} = -\alpha\frac{\partial e^D}{\partial h} - 2\beta\frac{\partial[c(e^D)]}{\partial h}$. Therefore,

$$\partial[\ln \frac{\mu_{jk}^D}{\mu_{jk}^C}] / \partial h = -\alpha\frac{\partial e^C}{\partial h} - 2\beta\frac{\partial[c(e^D)]}{\partial h} \qquad \text{(A4)}$$

The intuition for equation (A4) is similar to (A3). Using equations (7), (9) and (A4), we have $\partial[\ln \frac{\mu_{jk}^D}{\mu_{jk}^C}] / \partial h = \frac{\alpha}{h^2}(\ln \frac{\alpha}{2\beta} + \ln \frac{1}{h+\alpha} + \frac{h}{h+\alpha} - \ln \frac{\alpha}{2\beta h}) = \frac{\alpha}{h^2}(\ln \frac{h}{h+\alpha} + \frac{h}{h+\alpha})$, which is negative if and only if $\ln \frac{h+\alpha}{h} - \frac{h}{h+\alpha} > 0$. Therefore, $\partial[\ln \frac{\mu_{jk}^D}{\mu_{jk}^C}] / \partial h < 0$ if $\frac{\alpha}{h} > 0.77$ or $\beta > 0.22$.

4. Approximation for the Indirect Utility Function, Equation (17)

To minimize notation we drop the subscripts *j, k* and the superscript *m* below. Suppose that utility from the club good is $U(.) = \frac{1}{d}\ln(S^d + K^d)$, where S is consumption of the secular good, $K = R^{\alpha}Q^{1-\alpha}$, R is participation, Q is the quality of the club good, and α and d are constants between 0 and 1. Assume that Q equals $\bar{R}$, average participation. A congregant's income is I, and his disposal income, conditional on participation, equals $I - p$, where p is the monetary participation charge per congregant. This case is a simple variation of the numerical example in Iannaccone (1992), and we can plug the solutions for S, R and $Q = \bar{R}$ derived there (equation (14) in Iannaccone (1992)) into $U(.)$ to obtain an expression for the indirect utility function:

$$V = c + \ln(I - p) - \ln \Pi + \frac{1}{d} \ln D,$$

$$\Pi = (\frac{\pi_S}{\delta_S})^{\rho} + (\frac{\pi_R}{\delta_R})^{\rho}, D = (\delta_S)^{-d\rho}(\pi_S)^{(\rho-1)d} + (\delta_R)^{-d\rho}(\pi_R)^{(\rho-1)d}, \quad \text{(A5)}$$

where $\rho = d/(d-1)$, $\delta_S = 1$, $\delta_R = \alpha^{1/d}$, π_S is the price for the secular good, and π_R is the marginal cost for participation. Since V is linear in $\ln(I - p)$, the second order derivatives of V that involve $\ln(I - p)$ are 0. Therefore, the second-order Taylor approximation for V is a polynomial with the terms $\ln(I - p)$, π_S, π_R, π_S^2, π_R^2, and $\pi_S\pi_R$. We can further approximate the term $\ln(I - p)$ by its first-order Taylor approximation, $d_0 + \beta(I - p)$, where $\beta = -\partial V/\partial p > 0$. This gives us the following approximation for V

$$V = M - \beta p, M = c_0 + c_1 I + c_3\pi_S + c_4\pi_R + c_5\pi_S^2 + c_6\pi_R^2 + c_7\pi_S\pi_R, \quad \text{(A6)}$$

where the c's are constants. Equation (A6) corresponds to equation (17) in the text.

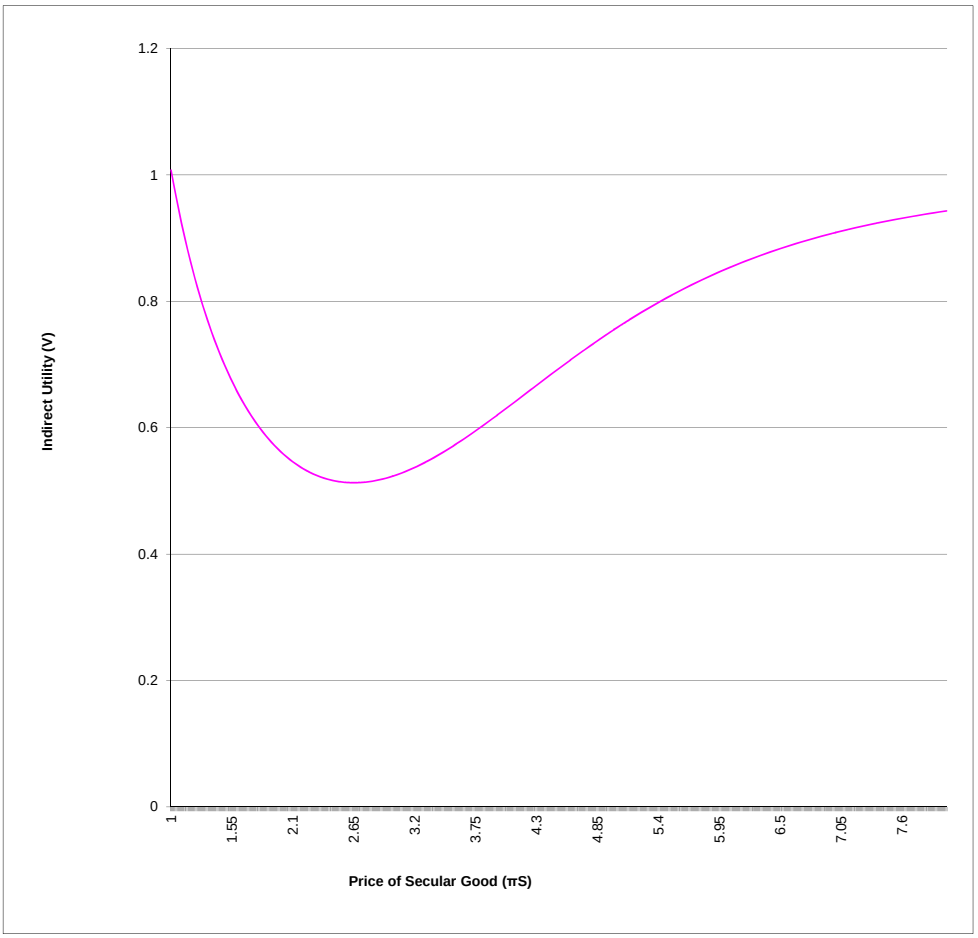

Figure A1: Numerical Example for V and π_S

Table A1 First stage results for Heckman and nonparametric estimation

Model	Linear Pr	Probit	Logit	Linear Pr	Probit	Logit
	(1)	(2)	(3)	(4)	(5)	(6)
Presence 1970	0.887***	25.60***	76.57***	0.878***	25.97***	73.84***
	(0.005)	(0.764)	(1.718)	(0.006)	(0.866)	(1.901)
Ave. Presence 1970, Similar Denom.				-0.131***	-2.899*	-6.070*
				(0.049)	(1.582)	(3.115)
Strict*Natural disasters	0.00295	0.0882	0.153	0.00148	0.0516	0.094
(1st principal component)	(0.003)	(0.090)	(0.179)	(0.003)	(0.129)	(0.239)
Strict*Disease outbreaks	-0.00261	-0.069	-0.182	-0.00348	-0.145	-0.313
(1st principal component)	(0.004)	(0.104)	(0.205)	(0.004)	(0.124)	(0.240)
Strict*Health services	0.00107	-0.184	-0.36	0.00188	-0.205	-0.431
(1st principal component)	(0.006)	(0.193)	(0.388)	(0.007)	(0.244)	(0.471)
Decentralized*Infrastructure	-0.0146*	-0.0866	-0.219	-0.0184**	-0.232	-0.438
(1st principal component)	(0.008)	(0.243)	(0.470)	(0.009)	(0.296)	(0.553)
Adjusted R squared	0.812	--	--	0.82	--	--
Observations	9,660	9,292	9,292	9,660	9,292	9,292

The dependent variable is the dummy variable for a denomination being present in a country in 2005. Columns 1, 3, 4 and 6 are the first stage estimation for columns 3, 5, 6 and 8 of Table 6, respectively. Column 2 is the first stage for columns 1 and 4 of Table 6. Column 5 is the first stage for columns 2 and 7 of Table 6.

Table A2 Additional results for OLS and nonparametric estimation

Estimation method	OLS	Nonparametric		
1st stage estimation	--	Linear Pr	Probit	Logit
Strict*log(GDP per capita)	-0.140	-0.062	-0.050	-0.044
	(0.173)	(0.187)	(0.180)	(0.177)
Strict*State Religion 1970	0.0082	0.060	0.106	0.122
	(0.182)	(0.181)	(0.186)	(0.184)
Strict*(Mean % primary education)	0.0031	0.0033	0.0029	3.45E-03
	(0.010)	(0.009)	(0.009)	(0.009)
Strict*(Mean % secondary education)	-0.002	-0.002	-0.006	-0.006
	(0.010)	(0.010)	(0.010)	(0.010)
Strict*(Mean % tertiary education)	-0.021	-0.038***	-0.043***	-0.042***
	(0.013)	(0.013)	(0.013)	(0.014)
Strict*log(Population)	-0.0714	-0.116	-0.0839	-0.0801
	(0.072)	(0.076)	(0.079)	(0.079)
Strict*Share of Urban Population	2.281***	2.007**	1.848*	1.816*
	(0.827)	(0.963)	(0.950)	(0.935)
Strict*log(Life Expectancy)	2.676	3.190*	3.522*	3.434*
	(2.064)	(1.863)	(1.982)	(1.953)
Strict*Fertility rate	0.125	0.145	0.136	0.127
	(0.165)	(0.183)	(0.179)	(0.179)
Strict*log(Distance to U.S.)	-0.419	-0.255	-0.121	-0.127
	(0.288)	(0.282)	(0.284)	(0.282)
Strict*English language	0.261	0.185	0.295	0.307
	(0.268)	(0.232)	(0.261)	(0.255)
Strict*Share of Immigrant Population	-0.223	-0.957	-1.459	-2.303
	(9.404)	(7.607)	(8.408)	(8.167)
Strict*Islam dominant religion	0.0929	0.454	0.242	0.243
	(0.387)	(0.404)	(0.409)	(0.407)
Strict*Catholicism dominant religion	-0.153	0.0443	0.100	0.102
	(0.296)	(0.252)	(0.287)	(0.283)
Strict*Orthodox dominant religion	0.398	0.758	1.144**	1.153**
	(0.592)	(0.550)	(0.528)	(0.521)
Strict*Judaism dominant religion	0.158	0.525	0.29	0.291
	(0.391)	(0.385)	(0.374)	(0.375)
Strict*Buddhism Hinduism dominant relig.	0.567	0.53	0.351	0.348
	(0.387)	(0.403)	(0.405)	(0.399)
Strict*Regulation of religion index	-0.0163	-0.009	-0.028	-0.026
	(0.054)	(0.050)	(0.055)	(0.054)
Strict*Rule of law index	0.311	0.412**	0.369*	0.367*
	(0.187)	(0.197)	(0.188)	(0.187)
Strict*Ethnic fractionization index	-0.0583	-0.135	0.0454	0.0421
	(0.462)	(0.479)	(0.508)	(0.503)

Decent*log(GDP per capita)	-0.859***	-0.630***	-0.547***	-0.546***
	(0.209)	(0.205)	(0.203)	(0.198)
Decent*State Religion 1970	0.157	0.245	0.208	0.228
	(0.178)	(0.165)	(0.162)	(0.161)
Decent*(Mean % primary education)	-0.007	-0.009	-0.011	-0.009
	(0.009)	(0.010)	(0.010)	(0.010)
Decent*(Mean % secondary education)	-0.009	-0.012	-0.017	-0.016
	(0.011)	(0.010)	(0.010)	(0.010)
Decent*(Mean % tertiary education)	-0.008	-0.018	-0.025	-0.022
	(0.013)	(0.016)	(0.015)	(0.015)
Decent*log(Population)	-0.021	-0.039	-0.049	-0.039
	(0.076)	(0.076)	(0.075)	(0.075)
Decent*Share of Urban Population	2.644***	1.841**	2.015**	2.016**
	(0.865)	(0.922)	(0.939)	(0.904)
Decent*log(Life Expectancy)	2.937*	2.751*	3.054*	2.818*
	(1.734)	(1.493)	(1.626)	(1.653)
Decent*Fertility rate	0.216	0.206	0.204	0.205
	(0.201)	(0.160)	(0.156)	(0.159)
Decent*log(Distance to U.S.)	0.305	0.345	0.539**	0.522**
	(0.243)	(0.224)	(0.221)	(0.228)
Decent*English language	-0.123	0.102	0.028	0.0433
	(0.283)	(0.254)	(0.240)	(0.243)
Decent*Share of Immigrant Population	12.76	9.616	12.12	11.57
	(10.030)	(9.391)	(8.038)	(7.958)
Decent*Islam dominant religion	0.335	0.285	0.243	0.254
	(0.422)	(0.394)	(0.392)	(0.397)
Decent*Catholocism dominant religion	-0.359*	-0.161	-0.208	-0.219
	(0.213)	(0.218)	(0.203)	(0.203)
Decent*Orthodox dominant religion	1.071	1.560**	1.838***	1.863***
	(0.778)	(0.681)	(0.634)	(0.647)
Decent*Judaism dominant religion	-0.0142	0.44	0.169	0.146
	(0.377)	(0.422)	(0.404)	(0.410)
Decent*Buddhism Hinduism dominant relig.	0.0982	0.00644	0.00601	-0.000702
	(0.346)	(0.406)	(0.379)	(0.378)
Decent*Regulation of religion index	-0.0238	-0.0332	-0.0413	-0.0372
	(0.052)	(0.052)	(0.052)	(0.052)
Decent*Rule of law index	0.0966	0.147	0.0872	0.0829
	(0.173)	(0.184)	(0.177)	(0.175)
Decent*Ethnic fractionization index	-0.375	-0.229	-0.414	-0.422
	(0.422)	(0.476)	(0.484)	(0.465)
Instrument set	--	B	B	B
Adjusted R squared	0.633	0.675	0.671	0.672
Observations	1,602	1,415	1,415	1,415

Column 1 has the additional regressors for column 3 of Table 5. Columns 2, 3 and 4 have the additional regressors for columns 6, 7 and 8 of Table 6, respectively.

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Table 1: The 35 largest Protestant denominations, 2005

Denomination	Headquarters country	Global adherents (millions)	Share of global Protestants	Number of countries present
Anglicans	Britain	74.4	0.103	140
Assemblies of God	US	42.4	0.059	149
Seventh-day Adventist Church	US	16.7	0.023	216
Southern Baptist Convention	US	11.9	0.017	110
Jehovah's Witnesses	US	11.1	0.015	214
SIM Church	US	11.0	0.015	14
New Apostolic Church	Switzerland	7.4	0.010	149
Church of God (Cleveland)	US	7.0	0.010	124
Ch of Jesus Christ of Latter-day Saints	US	6.7	0.009	146
American Baptist Churches in the USA	US	5.7	0.008	11
SFM/NPY/FFFM	Swed/Norw/Finl	4.0	0.006	37
Church of the Foursquare Gospel	US	3.7	0.005	59
United Methodist Church (USA)	US	3.7	0.005	44
Presbyterian Church (USA)	US	3.4	0.005	20
Africa Inland Church	Britain/US	3.2	0.004	7
Christian and Missionary Alliance	US	3.2	0.004	50
Methodist Church of Great Britain	Britain	2.9	0.004	18
Pentecostal Assemblies of God (Canada)	Canada	2.9	0.004	29
United Pentecostal Church	US	2.4	0.003	90
Christian Aviation Ministries	US	2.1	0.003	7
Christian Brethren (Open)	US	1.9	0.003	43
Baptist Unions/BWA	US	1.9	0.003	44
PEMS France	France	1.9	0.003	6
Pres Ch of East Africa (Ch of Scotland)	Britain	1.8	0.003	3
Evangelical Alliance Mission	US	1.6	0.002	28
Salvation Army	US	1.6	0.002	86
Apostolic Church Missionary Movement	Britain	1.5	0.002	7
OMS International	US	1.4	0.002	11
Church of the Nazarene	US	1.2	0.002	102
Evangelical Lutheran Ch in America	US	1.1	0.002	19
Church of God of Prophecy	US	1.0	0.001	81
Churches of Christ (Instrumental)	US	1.0	0.001	31
Zion Christian Church	South Africa	0.9	0.001	5
Former AUCECB	Russia	0.9	0.001	13
Moravian Church	US	0.9	0.001	31

This table is based on the global membership of denominations outside of the US.

Table 2: Presence of US denominations abroad in 1970 and 2005

		Denomination present in 1970		
		0	1	Total
Denomination present in 2005	0	9,891	2	9,893
				(0.865)
	1	305	1,242	1,547
				(0.135)
	Total	10,196	1,244	11,440
		(0.891)	(0.109)	

This table shows the number of cases in which a US denomination (N = 130) is present in a country (N = 88) 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 > .5)	0.446	0.499
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

The sample is 130 US Protestant denominations.

Table 4: Summary statistics for country variables

Variable	Mean	St. Dev.
log GDP per capita	7.63	1.60
log population	16.33	1.39
mean % primary education (Barro & Lee)	33.00	13.85
mean % secondary education (Barro & Lee)	33.12	19.07
mean % tertiary education (Barro & Lee)	10.46	8.48
urban population/total population	0.40	0.22
log life expectancy	4.16	0.16
total fertility rate	3.74	1.69
log distance to US	8.93	0.45
= 1 if English official language	0.18	0.39
Immigrants in US/total population	0.01	0.01
= 1 if Islam dominant religion	0.22	0.41
= 1 if Catholicism dominant religion	0.40	0.49
= 1 if Orthodox dominant religion	0.07	0.25
= 1 if Judaism dominant religion	0.01	0.11
= 1 if Buddhism, Hinduism dominant religion	0.07	0.25
regulation of religion index (Grim & Finke)	2.68	2.65
= 1 if country had state religion in 1970	0.42	0.50
rule of law index (Freedom House)	0.00	0.98
ethnic fractionalization index (Alesina et al.)	0.39	0.25
annual incidence of landslides (>1000 affected)	0.02	0.04
annual incidence of eruptions (>1000 affected)	0.03	0.09
annual incidence of wind storms (5+ days)	0.01	0.02
annual incidence of earthquakes (>7 Richter)	0.03	0.09
annual incidence of military conflict	0.20	0.29
annual incidence of cholera (>1000 affected)	0.02	0.74
annual incidence of dengue fever (>1000 affected)	0.01	0.33
annual incidence of flu/SARS (>1000 affected)	0.003	0.18
annual incidence of meningococcal (>1000 affected)	0.01	0.32
log hospital beds	0.98	0.98
medical personnel per 1,000	3.81	3.86
public health expenditure/GDP x 100	3.87	2.10
dentists per 1,000	0.37	0.35
fixed mainlines per 1,000	16.59	19.52
cellular subscriptions per 1,000	15.70	15.87
passenger cars per 100	13.44	16.22
roads paved (%)	49.72	32.69
log road network per square km	-1.30	1.44
log annual air carrier departures	10.14	1.82
log annual air passengers carried	14.10	2.15

Table 5: Baseline results

	Dependent variable					
	Log adherents			Log congregations		
Regressors	(1)	(2)	(3)	(4)	(5)	(6)
Strict*Natural disasters	0.218***		0.228***	0.126**		0.132***
(1st principal component)	(0.056)		(0.056)	(0.050)		(0.050)
Strict*Disease outbreaks	0.215***		0.217***	0.187**		0.188**
(1st principal component)	(0.073)		(0.077)	(0.079)		(0.081)
Strict*Health services	-0.400***		-0.367***	-0.313**		-0.282**
(1st principal component)	(0.143)		(0.138)	(0.135)		(0.130)
Decentralized*Infrastructure		0.531***	0.531***		0.531***	0.420***
(1st principal component)		(0.120)	(0.192)		(0.120)	(0.151)
Adjusted R squared	0.615	0.606	0.633	0.593	0.606	0.612
Observations	1,613	1,980	1,602	1,613	1,980	1,602

The dependent variable is either the log number of adherents (columns 1-3) or the log number of congregations (columns 4-6). Regressions include country dummies, denomination dummies, and interactions between Decentralized and Strict and other country characteristics (see appendix). Standard errors clustered by country. *** p<0.01, ** p<0.05, * p<0.10.

Table 6: Heckman and nonparametric estimation

Estimation procedure	Heckman		Nonparametric			Nonparametric		
1st stage estimation	Probit	Probit	Linear Pr	Probit	Logit	Linear Pr	Probit	Logit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Strict*Natural disasters	0.197***	0.227***	0.185***	0.196***	0.191***	0.239***	0.216***	0.219***
(1st principal component)	(0.076)	(0.084)	(0.050)	(0.054)	(0.052)	(0.062)	(0.063)	(0.064)
Strict*Disease outbreaks	0.189**	0.251**	0.204**	0.158*	0.164**	0.268***	0.227**	0.231**
(1st principal component)	(0.093)	(0.098)	(0.083)	(0.084)	(0.082)	(0.092)	(0.088)	(0.089)
Strict*Health services	-0.341**	-0.376**	-0.336**	-0.340***	-0.325**	-0.353**	-0.341**	-0.342**
(1st principal component)	(0.167)	(0.177)	(0.129)	(0.126)	(0.124)	(0.155)	(0.151)	(0.151)
Decentralized*Infrastructure	0.586**	0.621**	0.450**	0.373*	0.386**	0.466**	0.382**	0.394**
(1st principal component)	(0.233)	(0.251)	(0.185)	(0.192)	(0.188)	(0.190)	(0.185)	(0.181)
Instrument set	A	B	A	A	A	B	B	B
Adjusted R squared	--	--	0.664	0.661	0.661	0.675	0.671	0.672
Observations	11,960	9,660	1,602	1,602	1,602	1,415	1,415	1,415

The dependent variable is the log number of adherents. Regressions include country dummies, denomination dummies, and interactions between Decentralized and Strict and other country characteristics (see appendix). Columns 1-2 use a Heckman estimator, with a probit model used to estimate the first stage probability of a denomination being present in a country; columns 3-8 use a nonparametric estimator, with a linear probability, probit, or logit model used to estimate the first stage probability of a denomination being present. The instrument set refers to the additional variables used in the first stage estimation, with set A including lagged denomination presence in 1970 and set B including set A plus the average of lagged presence in 1970 for denominations with a similar size in the US. Standard errors are clustered by country. *** p<0.01, ** p<0.05, * p<0.10.

Table 7: Placebo tests for health services and transportation infrastructure

Estimation method	OLS	Nonparam.		OLS		Nonparametric	
Regressors	(1)	(2)	Regressors	(3)	(4)	(5)	(6)
Strict*Natural disasters	0.236***	0.214***	Strict*Natural disasters	0.206***	0.179**	0.179***	0.204***
(1st principal comp.)	(0.063)	(0.070)	(1st principal comp.)	(0.056)	(0.068)	(0.067)	(0.057)
Strict*Disease outbreaks	0.280***	0.299***	Strict*Disease outbreaks	0.226***	0.237***	0.241***	0.224***
(1st principal comp.)	(0.083)	(0.093)	(1st principal comp.)	(0.075)	(0.087)	(0.086)	(0.075)
Strict*Dentists per capita	**0.122**	**-0.037**	Strict*Health services	-0.410***	-0.342**	-0.374**	-0.404***
	(0.344)	**(0.384)**	(1st principal comp.)	(0.138)	(0.161)	(0.157)	(0.140)
Decentralized*Infrastructure	0.659***	0.472**	**Decentralized*Log**	**-0.145**	**-0.069**	**-0.125**	**-0.171**
(1st principal comp.)	(0.201)	(0.197)	**Air transport**	**(0.110)**	**(0.123)**	**(0.125)**	**(0.106)**
Air transport measure	--	--		Passengers	Carriers	Passengers	Carriers
Adjusted R squared	0.629	0.669		0.626	0.664	0.665	0.625
Observations	1,606	1,418		1,579	1,420	1,395	1,607

The dependent variable is the log number of adherents. Regressions include country dummies, denomination dummies, and interactions between Decentralized and Strict and other country characteristics. In columns 1 and 2, dentists per capita serve as a placebo for health services; in columns 3-6, air transport serves as a placebo for land transportation and communication infrastructure. Except for the boldfaced regressors above, the specifications in columns 1, 3, and 4 correspond to that in column 3 of Table 5 and the specifications in columns 2, 5 and 6 correspond to that in column 7 of Table 6. Standard errors are clustered by country. *** p<0.01, ** p<0.05, * p<0.10.

Table 8 Placebo tests for doctrinal strictness of denominations

Estimation method	OLS		Nonparametric	
1st stage estimation	--	--	Probit	Probit
	(1)	(2)	(3)	(4)
Communion*Natural disasters (1st principal component)	**-0.044 (0.091)**	**-0.094 (0.094)**	**-0.046 (0.086)**	**-0.085 (0.088)**
Communion*Disease outbreaks (1st principal component)	**0.006 (0.120)**	**0.008 (0.114)**	**0.029 (0.111)**	**0.043 (0.109)**
Communion*Health services (1st principal component)	**-0.022 (0.137)**	**0.029 (0.143)**	**0.040 (0.131)**	**0.105 (0.142)**
Decentralized*Infrastructure (1st principal component)		0.635*** (0.206)		0.423* (0.216)
Instrument set			B	B
Adjusted R squared	0.612	0.633	0.656	0.674
Observations	1,531	1,520	1,367	1,357

The dependent variable is the log number of adherents. Regressions include country dummies, denomination dummies, and interactions between Decentralized and Strict and other country characteristics. The frequency of communion serves as a placebo for the strictness of religious doctrine. Except for the boldfaced regressors above, the specifications in columns 1 and 2 correspond to those in column 3 of Table 5 and the specifications in columns 3 and 4 correspond to those in column 7 of Table 6. See notes to Table 6 on the definition of the instrument set. Standard errors are clustered by country. *** p<0.01, ** p<0.05, * p<0.10.

Table 9: Extended results for strictness interactions with natural disasters

	log adherents			
(a) OLS	Landslides	Volcanic Eruptions	Wind Storms	Earthquakes
Strict*Disaster incidence	**6.915*** **	**2.509*** **	**-0.317**	**1.782***
	(2.401)	**(0.517)**	**(4.016)**	**(0.921)**
Strict*Disease outbreaks	0.228***	0.211***	0.183**	0.199***
(1st principal component)	(0.079)	(0.076)	(0.085)	(0.075)
Strict*Health services	-0.361***	-0.396***	-0.375**	-0.379***
(1st principal component)	(0.136)	(0.137)	(0.152)	(0.142)
Decentralized*Infrastructure	0.536***	0.556***	0.549***	0.525***
(1st principal component)	(0.195)	(0.195)	(0.202)	(0.198)
Adjusted R squared	0.633	0.633	0.631	0.632
Observations	1,602	1,602	1,602	1,602
(b) Nonparametric (Instr. Set B)				
Strict*Disaster incidence	**7.200*** **	**2.615*** **	**-3.864**	**1.901** **
	(2.310)	**(0.602)**	**(4.162)**	**(0.935)**
Strict*Disease outbreaks	0.283***	0.261***	0.238**	0.260***
(1st principal component)	(0.090)	(0.093)	(0.091)	(0.087)
Strict*Health services	-0.358**	-0.380**	-0.390**	-0.372**
(1st principal component)	(0.151)	(0.155)	(0.154)	(0.157)
Decentralized*Infrastructure	0.481**	0.498**	0.454**	0.440**
(1st principal component)	(0.191)	(0.194)	(0.204)	(0.194)
Adjusted R squared	0.675	0.674	0.673	0.673
Observations	1,415	1,415	1,415	1,415

Regressions include country dummies, denomination dummies, and interactions between Decentralized and Strict and other country characteristics. Except for the boldfaced regressors above, the specifications in panel (a) correspond to those in column 3 of Table 5 and the specifications in panel (b) correspond to those in column 7 of Table 6. See notes to Table 6 on the instrument set. Standard errors are clustered by country. *** p<0.01, ** p<0.05, * p<0.10.

Table 10: Extended results for strictness interactions with disease outbreaks

	log adherents			
(a) OLS	Cholera	Dengue Fever	Flu/SARS	Meningo-coccal
Strict*Disease incidence	**0.224***	**0.036**	**0.860*****	**-0.096**
	(0.117)	**(0.189)**	**(0.299)**	**(0.420)**
Strict*Natural disasters	0.207***	0.200***	0.204***	0.205***
(1st principal component)	(0.053)	(0.057)	(0.053)	(0.053)
Strict*Health services	-0.445***	-0.410***	-0.323**	-0.413***
(1st principal component)	(0.144)	(0.144)	(0.143)	(0.144)
Decentralized*Infrastructure	0.539***	0.539***	0.525***	0.540***
(1st principal component)	(0.187)	(0.185)	(0.192)	(0.185)
Adjusted R squared	0.632	0.632	0.632	0.632
Observations	1,602	1,602	1,602	1,602
(b) Nonparametric (Instr. Set B)				
Strict*Disease incidence	**0.193**	**-0.086**	**1.085*****	**0.021**
	(0.138)	**(0.208)**	**(0.318)**	**(0.610)**
Strict*Natural disasters	0.217***	0.228***	0.206***	0.225***
(1st principal component)	(0.060)	(0.067)	(0.060)	(0.060)
Strict*Health services	-0.422***	-0.392**	-0.288*	-0.395**
(1st principal component)	(0.154)	(0.152)	(0.156)	(0.152)
Decentralized*Infrastructure	0.479**	0.467**	0.471**	0.450**
(1st principal component)	(0.190)	(0.186)	(0.185)	(0.193)
Adjusted R squared	0.672	0.672	0.675	0.673
Observations	1,415	1,415	1,415	1,415

Regressions include country dummies, denomination dummies, and interactions between Decentralized and Strict and other country characteristics. Except for the boldfaced regressors above, the specifications in panel (a) correspond to those in column 3 of Table 5 and the specifications in panel (b) correspond to those in column 7 of Table 6. See notes to Table 6 on the instrument set. Standard errors are clustered by country. *** p<0.01, ** p<0.05, * p<0.10.

Table 11: Extended results for strictness interactions with health expenditures

	log adherents				
(a) OLS	Hospital beds	Nurses, Midwives	Health Expend.	Physicians	Financial Develop.
Strict*Health services	**-0.475*** **	**-0.089** **	**-0.050**	**0.010**	**-0.737** **
	(0.181)	**(0.039)**	**(0.054)**	**(0.151)**	**(0.333)**
Strict*Natural disasters	0.191***	0.247***	0.228***	0.226***	0.251***
(1st principal component)	(0.059)	(0.055)	(0.057)	(0.060)	(0.056)
Strict*Disease outbreaks	0.192**	0.176**	0.252***	0.237***	0.286***
(1st principal component)	(0.077)	(0.085)	(0.077)	(0.078)	(0.077)
Decentralized*Infrastructure	0.618***	0.548***	0.629***	0.658***	0.611***
(1st principal component)	(0.200)	(0.180)	(0.197)	(0.195)	(0.196)
Adjusted R squared	0.627	0.633	0.626	0.626	0.625
Observations	1,635	1,602	1,635	1,635	1,631
(b) Nonparametric (Instr. Set B)					
Strict*Health services	**-0.456** **	**-0.087** **	**-0.048**	**0.089**	**-1.052*** **
	(0.197)	**(0.041)**	**(0.056)**	**(0.159)**	**(0.342)**
Strict*Natural disasters	0.191***	0.262***	0.224***	0.224***	0.249***
(1st principal component)	(0.066)	(0.059)	(0.062)	(0.067)	(0.062)
Strict*Disease outbreaks	0.246***	0.218**	0.294***	0.280***	0.303***
(1st principal component)	(0.088)	(0.105)	(0.088)	(0.094)	(0.089)
Decentralized*Infrastructure	0.585***	0.477**	0.601***	0.638***	0.452**
(1st principal component)	(0.198)	(0.185)	(0.198)	(0.194)	(0.196)
Adjusted R squared	0.671	0.675	0.670	0.670	0.667
Observations	1,444	1,415	1,444	1,444	1,441

Regressions include country dummies, denomination dummies, and interactions between Decentralized and Strict and other country characteristics. Except for the boldfaced regressors above, the specifications in panel (a) correspond to those in column 3 of Table 5 and the specifications in panel (b) correspond to those in column 7 of Table 6. See notes to Table 6 on the instrument set. Standard errors are clustered by country. *** p<0.01, ** p<0.05, * p<0.10.

Table 12: Extended results for decentralization interactions with infrastructure

	log adherents			
(a) OLS	Mainline Phones	Cell Phones	Passenger Cars	Road Network
Decentralized*Infrastructure	**0.021***	**0.031****	**0.026****	**0.279****
	(0.012)	**(0.014)**	**(0.011)**	**(0.137)**
Strict*Natural disasters	0.217***	0.216***	0.232***	0.212***
(1st principal component)	(0.057)	(0.056)	(0.055)	(0.056)
Strict*Disease outbreaks	0.220***	0.223***	0.218***	0.221***
(1st principal component)	(0.076)	(0.075)	(0.077)	(0.073)
Strict*Health services	-0.357**	-0.381***	-0.347**	-0.396***
(1st principal component)	(0.146)	(0.142)	(0.139)	(0.138)
Adjusted R squared	0.625	0.625	0.633	0.625
Observations	1,613	1,613	1,602	1,613
(b) Nonparametric (Instr. Set B)				
Decentralized*Infrastructure	**0.016**	**0.018**	**0.029****	**0.214**
	(0.012)	**(0.016)**	**(0.011)**	**(0.145)**
Strict*Natural disasters	0.214***	0.198***	0.233***	0.201***
(1st principal component)	(0.067)	(0.066)	(0.061)	(0.067)
Strict*Disease outbreaks	0.292***	0.302***	0.237***	0.268***
(1st principal component)	(0.092)	(0.091)	(0.088)	(0.084)
Strict*Health services	-0.314*	-0.340**	-0.325**	-0.329**
(1st principal component)	(0.167)	(0.164)	(0.155)	(0.159)
Adjusted R squared	0.668	0.669	0.675	0.666
Observations	1,425	1,425	1,415	1,425

Regressions include country dummies, denomination dummies, and interactions between Decentralized and Strict and other country characteristics. Except for the boldfaced regressors above, the specifications in panel (a) correspond to those in column 3 of Table 5 and the specifications in panel (b) correspond to those in column 7 of Table 6. Standard errors are clustered by country. *** p<0.01, ** p<0.05, * p<0.10.

Figure 1: Market share of denominations by headquarter country

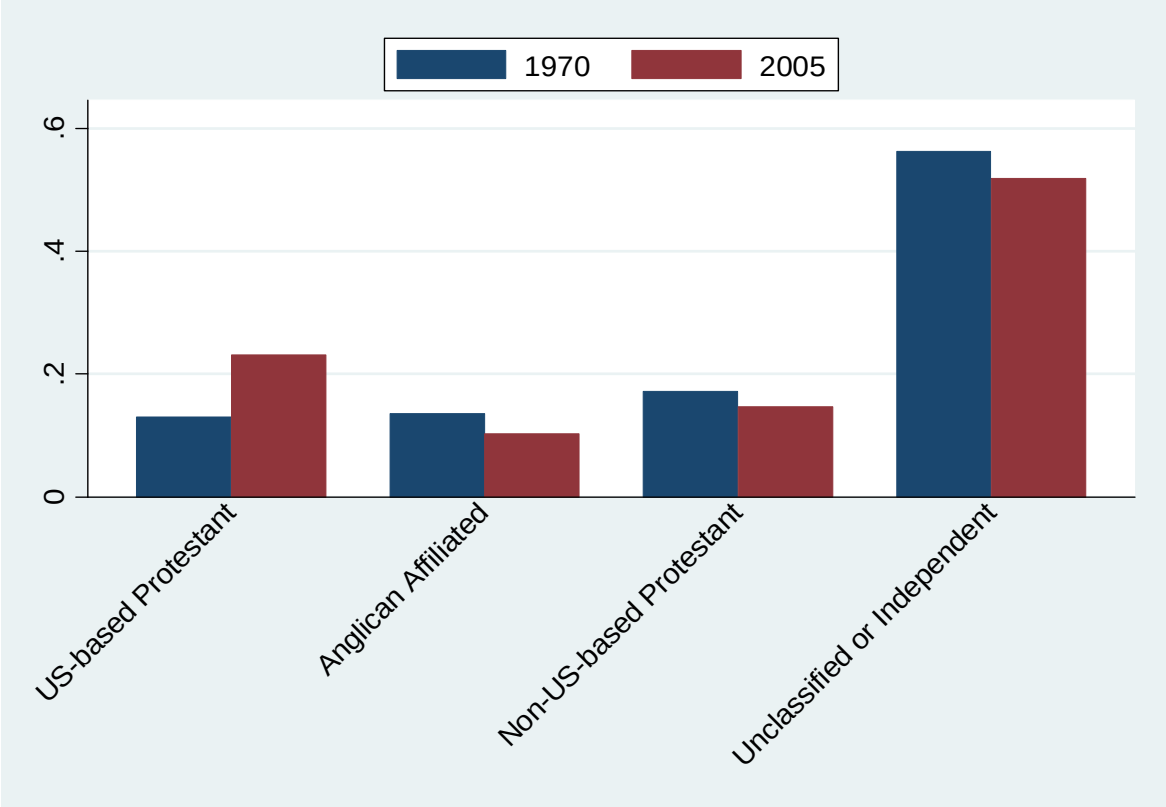

Figure 2: Share of foreign adherents of US denominations by religious tradition

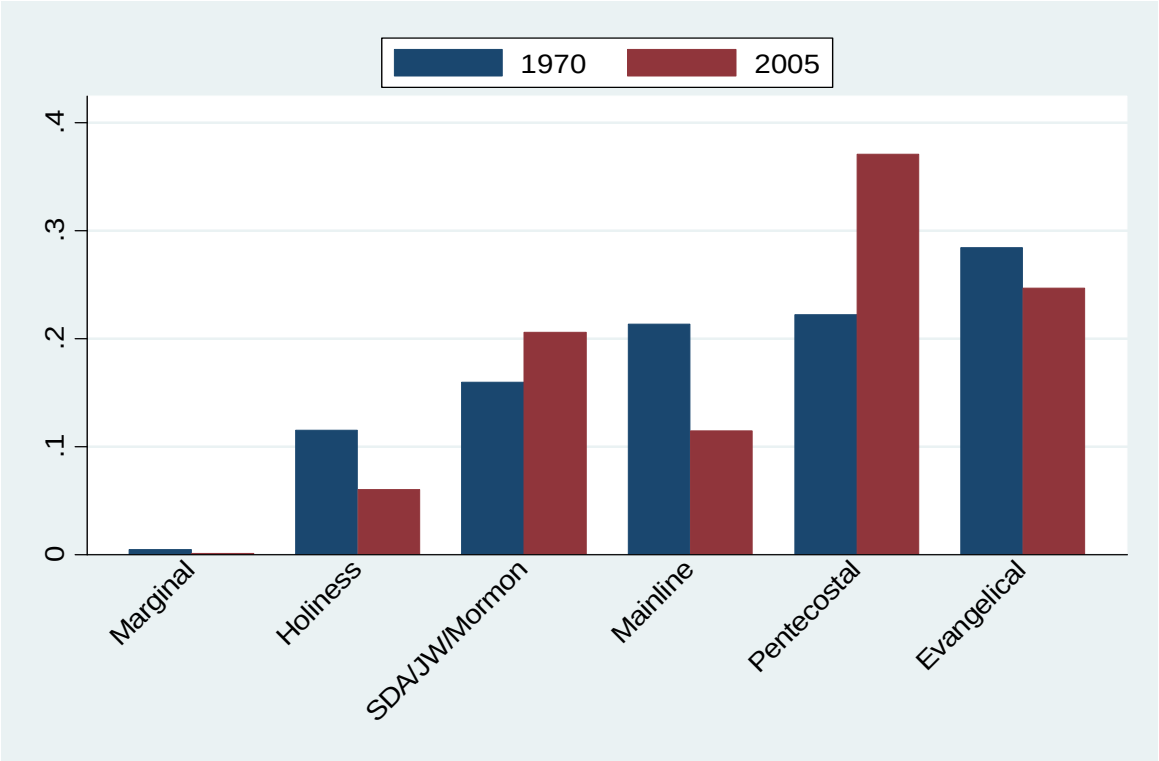

Figure 3a: Global membership and U.S. membership, 2005

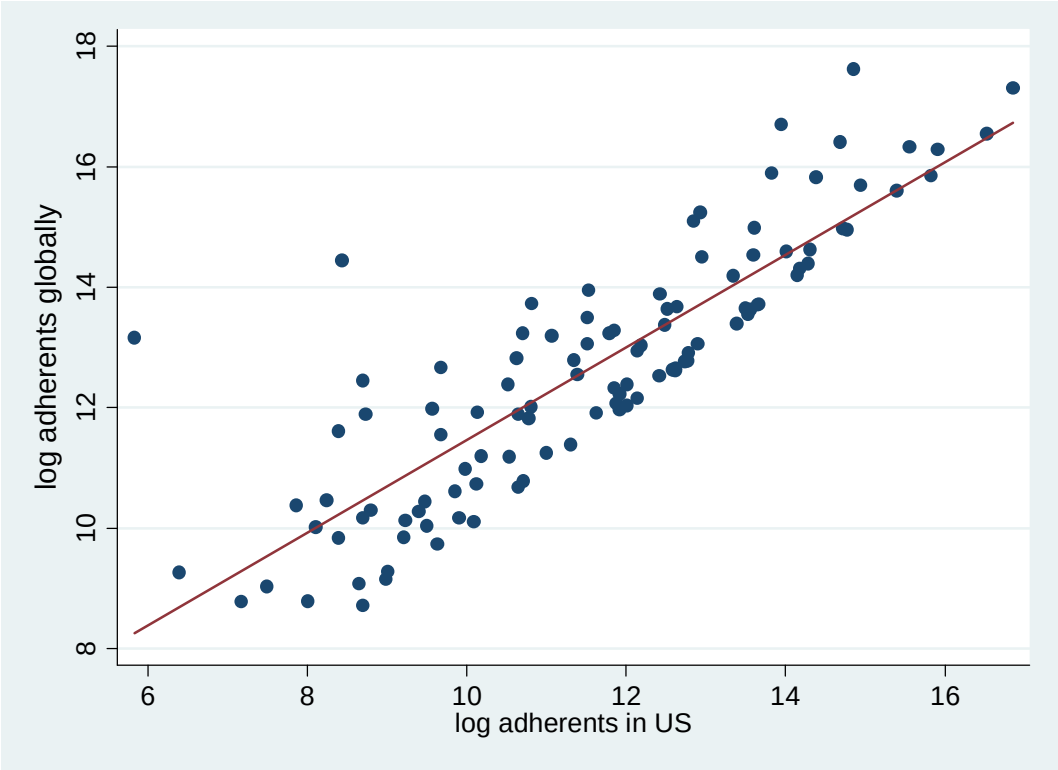

Figure 3b: Numbers of countries entered and U.S. membership, 2005

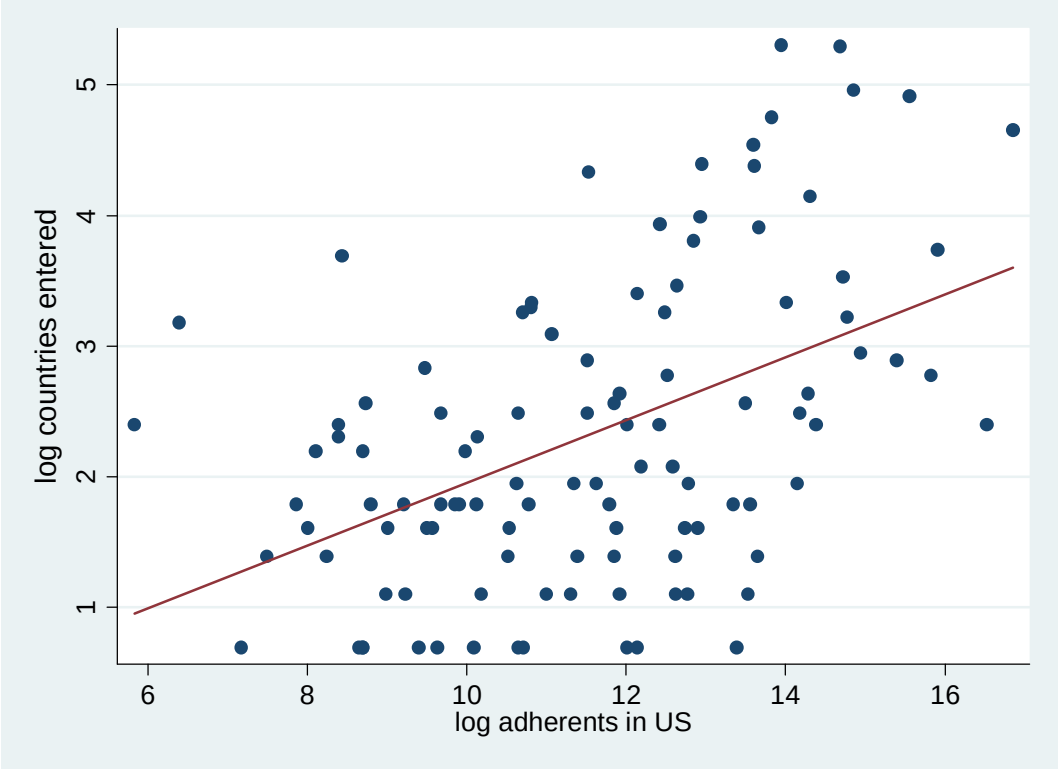

Figure 4: Distribution of doctrinal strictness across US denominations

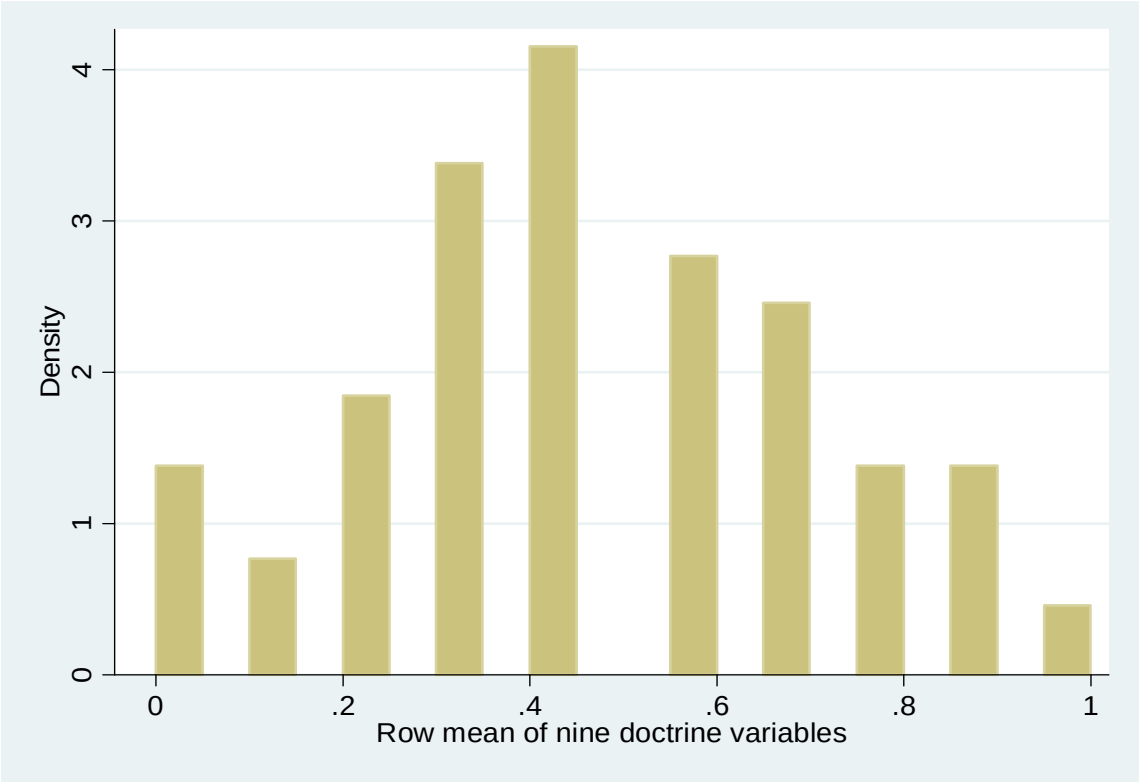

Figure 5: Global no. of adherents and congregations for US denominations, 2005