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29 January 2014

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January 2014

Does culture, and in particular religion, exert an independent causal effect on long-term economic growth, or do culture and religion merely reflect the latter? We explore this issue by studying the case of Protestantism in China during the late nineteenth and early twentieth centuries. Combining county-level data on Protestant presence in 1920 and socioeconomic indicators in 2000, we find that the spread of Protestantism has generated significant positive effects in long-term economic growth, educational development, and health care outcomes. To better understand whether the relationship is causal, we exploit the fact that missionaries purposefully undertook disaster relief work to gain the trust of the local people. Thus, we use the frequency of historical disasters as an instrument for Protestant distribution. Our IV results confirm and enhance our OLS results. When we further investigate the transmission channels over the long historical period between 1920 and 2000, we find that although improvements in education and health care outcomes account for a sizable portion of the total effects of missionaries' past activities on today's economic outcomes, Protestant activities may have also contributed to long-term economic growth through other channels, such as through transformed social values. If so, then a significant amount of China's growth since 1978 is the result not just of sudden institutional changes but of human capital and social values acquired over a longer historical period.

Keywords: Protestantism, Economic Growth, Education, Health Care, China

JEL Classification Numbers: I25, N15, N35, O11, O43, Z12

* We thank Steve Broadberry, Hongbin Cai, James Fenski, Phil Hoffman, Chang-tai Hsieh, Ruixue Jia, James Kung, Naomi Lamoreaux, Debin Ma, Steve Nafziger, Jean-Laurent Rosenthal, as well as seminar and conference participants at Australian National University, Chinese University of Hong Kong, the 2012 Econometric Society Asia Meeting, the 2013 Econometric Society China Meeting, HKUST, LSE, National University of Singapore, New Economic School, Peking University, Tsinghua University, SHUFE, and the ASSA, BREAD, NEUDC, and World Cliometrics Conference for helpful comments and suggestions. All errors are ours.

The missionaries . . . have been among the pioneers of civilization.

—William McKinley, 1900[1]

1. Introduction

One of the most contentious issues with respect to the effects of religion on economic growth is the role of Protestantism. Much of the debate has focused on whether the rise of Protestantism has had any causal effect on long-term economic growth in predominantly Christian nations. In *The Protestant Ethic and the Spirit of Capitalism*, Max Weber (2001) suggested that Reformed Protestantism, by promoting stronger societal preferences for hard work and thrift, has led to greater economic prosperity in Western societies. Recent empirical studies of the role of Protestantism in the economic growth of the Western world have found mixed results. Cantoni (2013) argues that Protestantism had no effect on economic growth for 272 cities in the Holy Roman Empire during the period between 1300 and 1900. Meanwhile, other studies find significant positive effects and have identified a few mechanisms through which religion may have contributed to economic growth. Some of these studies echo Weber's and suggest that religious beliefs may have fostered certain moral codes or social values that are conducive to economic growth (Stulz and Williamson, 2003; Barro and McCleary, 2003; McCleary and Barro, 2006a, 2006b; Arruñada, 2010). But other studies emphasize that it is not religious practices per se but rather by-products that accompanied these practices (e.g., the accumulation of human capital that may result from reading the Bible) that have contributed to economic growth (Glaeser and Sacerdote, 2008; Becker and Woessmann, 2009).

An equally interesting question revolves around how the expansion of Protestantism has affected economic growth in peripheral nations and, more specifically, in non-Christian societies. Throughout their history, Christian missionaries have attempted to transplant Protestantism—together with Western science, technology, culture, and institutions—into peripheral nations, many of which have had long-established indigenous religions, cultures, and institutions of their own. Despite countless clashes and compromises, Protestantism has deeply transformed some of these societies and generated persistent, significant impacts to their economic growth.

[1] The U.S. president addressed the Ecumenical Missionary Conference at Carnegie Music Hall in New York City on April 21, 1900.

Yet the prospect of conducting an empirical examination of the effects of Protestantism on long-term economic growth in peripheral nations can be daunting because of the scarcity of within-country data on nations that are suitable for such study.[2] Consequently, scholars conduct cross-country studies to examine the effects of religion on economic growth in both Western and peripheral nations. These cross-country studies are illuminating. They are also fraught with questions of causality, however, as the effects of religion are often inextricably related to other factors that have been shown to contribute to economic prosperity, such as geography and the establishment of formal and informal institutions, which vary from one country to another. Identifying the internal mechanisms of the correlations between religion and economic growth in these studies thus remains a somewhat murky proposition.

Even when within-country data are available, establishing causality between Protestantism and long-term economic growth is difficult because of the issue of endogeneity. It is possible, for example, that more developed regions attracted more Protestant activity in the past, and that they continue to perform better in the present. A few existing studies use the instrumental variable method to tackle this problem. In their study of nineteenth-century Prussia, Becker and Woessmann (2009) use distance to Wittenberg—the city in which the Reformation originated—as an exogenous predictor of Protestantism.[3] However, this identification strategy is hard to adapt for use in peripheral nations. Protestantism was transplanted to these countries, usually through easily accessible places such as seaports. The locations at which Protestantism initially emerged frequently coincide with economic centers, thus making the distances to these locations invalid instruments for studying the causal effects of Protestantism on long-term economic growth. Therefore, the issue remains an enigma, and resolving it is important for, as we shall see, its resolution helps explain China's rapid growth since 1978 and the enormous variation in contemporary income levels across China.

In this study, we assemble historical and contemporary data to investigate whether the spread of Protestantism in the late nineteenth and early twentieth centuries had a persistent impact on China's recent economic growth, educational development, and health care outcomes and, if it did, what mechanisms were involved. To our knowledge, this paper provides the first empirical evidence for the long-term effects of religious activities on socioeconomic outcomes in

[2] Bai and Kung (2012) explore the within-China variations to examine the effects of Christianity's spread on educational development in different Chinese counties in the early twentieth century.
[3] This identification is adopted by Cantoni (2013), as well.

China today.

Studying the long-term effects of Protestantism in China is valuable for two reasons. First, China provides an ideal setting for studying within-country variations in religious activities and socioeconomic development. Throughout its history, China has been a large country with a relatively homogeneous culture and a uniform political system, yet its socioeconomic development has been quite heterogeneous. The Chinese setting thus provides variations large enough to conduct clean empirical tests and thereby examine the role of religion on long-term socioeconomic development. Second, the transplantation of Protestantism to a vast peripheral nation such as China has been, to some extent, a quasi-natural experiment. Chinese culture was dominated by Confucianism for thousands of years. Christianity was prohibited until late in the nineteenth century, when China was defeated by Western powers and forced to open its doors to foreign trade and influences. Thereafter, foreign missionaries self-selected to go to different Chinese counties and evangelize Chinese people. Yet missionary activities turn out to have constituted a largely external and exogenous intervention, both in China's economy and in its society. This feature allows us to examine the long-lasting effects of a sudden and exogenous historical event on socioeconomic development eighty years later. In this regard, our research contributes to a large body of literature on the effects of historical events on current economic developments that includes the works of Acemoglu, Johnson, and Robinson (2001, 2005), Nunn (2008), and Dell (2010).

In this paper, we marshal county-level data on the numbers of Protestant converts, missionaries, and churches in 1920 from original historical survey materials, and then match these data with county-level data on developments in the economy, education, and health care outcomes in 2000. Our OLS results show that diverse socioeconomic developments across counties in 2000 are positively correlated with the intensity of Protestant presence 80 years ago.

By themselves, however, these correlations do not prove that Protestantism caused China's subsequent socioeconomic development; they may simply reflect it. It might be possible that more developed counties attracted more Protestant activities in the past, and that they continue to perform better at present. We tackle the endogeneity issue in three ways. First, we investigate the historical record, which suggests missionaries were usually more inclined to go to less developed areas. Second, we proxy historical economic prosperity by population density and land tax

revenues of Chinese counties, and we find no positive correlation between historical economic prosperity and Protestant presence. Third, in light of the fact that missionaries purposefully undertook disaster relief work to gain the trust of Chinese people, we use the frequency of severe droughts and floods in the early twentieth century as the instrument for the intensity of Protestant presence across counties. Our IV coefficients are positive and significant, suggesting that more Protestant activities in 1920 produced better economic, educational, and health care outcomes in 2000.

We then investigate the precise channels through which the impacts of Protestant activities in 1920 have survived China's political turbulence and managed to persist into the present. Our investigations of historical facts and our empirical tests suggest that a greater Protestant presence results in better education and health care outcomes in 1920, and that these effects persisted into the present and contributed to economic growth in 2000. While proselytizing in remote inland counties, missionaries also worked to help local people build modern educational and health systems and to diffuse Western science and technologies. Such efforts accelerated modernization in many Chinese counties, contributed to the accumulation of human capital, and reshaped the social values of local people. The transformation of Chinese society was permanent. Although missionary work was suppressed during the Cultural Revolution in the 1960s and 1970s, Protestantism rapidly resurged at the end of the 1970s when China began to open up and reform. In this market-oriented environment, the human capital and social values that had been transformed by historical Protestant activities began to contribute substantially to improvements in education and health care outcomes. Our further empirical tests corroborate that while education and health care outcomes have accounted for a significant part of the effects of Protestantism on economic development in 2000, missionaries' undertakings have also affected economic outcomes through other channels. This finding is not surprising. Historical Protestant activities have affected Chinese society in very complex ways. Many of those effects are difficult to quantify, but they might have played an indispensable role in enhancing long-term economic growth, such as by transforming social values and work ethics.

If we are correct, our conclusions have important implications for understanding China's spurt of economic growth since 1978. This growth, the so-called Chinese miracle, is usually attributed entirely to the Reform and Open-up, a series of radical institutional changes that began in the late 1970s. Our findings imply that (1) China's Reform and Open-up was to a large extent

a continuation of a modernization movement that started in the mid-nineteenth century but was disrupted by wars and political turbulence, and (2) Protestant missionaries pioneered that modernization movement by introducing Western-style education, health care, science, technology, and social values to China. Missionaries disseminated Western science, technology, and social values to even the most remote parts of China, and they fostered the accumulation of certain types of human capital that have been conducive to modern economic growth. The historical legacies of human capital and social values that were acquired from missionaries' undertakings almost a century ago continue to promote radical institutional changes and rapid economic growth at the present time. Therefore, we concur with Brandt, Ma, and Rawski (2013) when they attribute "China's recent economic success to a combination of beneficial historic legacies, recent accumulations of capital, skill, and policy expertise, and important economic and political changes that facilitated the realization of old and new potentials."

In the next section, we provide some historical background on the spread of Protestantism during the late nineteenth and early twentieth centuries. Section 3 describes the data we use to study the long-term effects of Protestantism. Section 4 establishes the causal relationship between historical Protestantism and contemporary economic development. Section 5 explores the causal effects of Protestantism on educational development, both historically and currently. Section 6 explores the causal effects of Protestantism on medical development, both historically and at present. Section 7 examines the channels through which historical Protestantism has contributed to contemporary economic growth, such as through improved education and health care outcomes or through transformed social values and work ethics. The final section discusses the implications of our findings.

2. Historical Background

Christianity has never been a major religion in China, a Confucianism-dominated country. It began to spread in China as early as in the seventeenth century. In 1704, Pope Clement XI forbade Chinese Christians to engage in Confucius-related activities. This outraged Emperor Kangxi, who consequently banned all Christian practices in 1720. This ban was upheld by successive emperors. In the early nineteenth century, trade between Europe and China reached a historically high record, and Christian missionaries renewed their efforts to penetrate China. As Christian activities continued to be banned by the Qing court, however, the Christian presence

remained negligible until the 1840s.

China was forced to open its doors to Western powers when in 1842 it was defeated by Britain in the First Opium War. As a result, missionaries and other foreigners were allowed to take residence in China. After the Second Opium War and another defeat in 1860, the Qing government signed the *Convention of Peking*, which granted freedom of religion in China and allowed missionaries to own land and build churches. This led to a rapid expansion of Protestantism throughout China. In 1860 there were 198 foreign Protestant missionaries and 2,000 converts; those numbers increased to 473 and 13,035 respectively by 1876. By the end of the nineteenth century, there were 1,500 missionaries and more than 80,000 Protestant converts (Wang, 1991). The first two decades of the twentieth century witnessed the fastest expansion of Christianity in Chinese history. In 1905 3,445 foreign Protestant missionaries arrived in China, more than double the number that had arrived in 1900. This number climbed to 8,000 in 1927. There were 130,000 Protestant converts in 1904, and this number soared to 402,539 in 1922. By 1920 there were more than 120 Protestant denominations in China, and church activities had penetrated nearly 70% of Chinese counties (Wang, 1991). Roman Catholicism also enjoyed a rapid expansion during the same period.

Christianity's expansion throughout China was a far from smooth process. On the contrary, it generated a great deal of mistrust and hostility between foreign missionaries and local Chinese residents. Mistrust and hostility led to frequent—and increasingly violent—confrontations, culminating in the Boxer Rebellion in 1900. More than 20,000 Christians were killed and three-quarters of churches were destroyed in this tragic xenophobic conflict.

Frequent and serious conflicts that accompanied the diffusion of Christianity compelled missionaries to reflect on the deep reasons behind these conflicts. Learning from the conflicts of the late nineteenth century, in particular the Boxer Rebellion, many Christian organizations came to realize that the hostility with which many Chinese regarded Christianity was a response to condescending missionaries who all too often refused to respect local cultures. For example, missionaries forbade ancestor worship among their Chinese converts, and missionaries' egalitarian beliefs clashed with Chinese society's entrenched hierarchical traditions. As a result, a growing number of missionaries began to seek new strategies for building trust and promoting mutual understanding.

China is a nation that is frequently afflicted by natural disasters. Over its long history of coping with disasters, the Chinese government developed a set of sophisticated relief mechanisms. However, when the central empire began to collapse in the late nineteenth century, those mechanisms gradually fell into disarray. Noticing the absence of government support, many missionaries actively engaged in disaster relief work and purposefully sought to build trust and diffuse Christianity through those efforts. Timothy Richard, for example, explicitly stated that disaster relief was "an ideal way to reduce prejudices and prepare the ways for the Chinese to accept Christianity" (Gu, 2010), and "the Chinese might not receive written evidences of the truth of Christianity, but help rendered to them in distress would afford unanswerable evidence of the motives of religion" (Richard, 1916, p125). While engaged in relief work in 1877, Presbyterian missionary Arthur Smith reported to his superiors, "It seems to me the grandest opportunity in all the history of China to demonstrate the spirit of our religion. We can show that Christianity teaches us to love our neighbors as ourselves and to recognize all men as brethren" (Eshrick, 1987, p78). Another American missionary, John L. Nevius, concurred: "The people in the famine region were very appreciative and grateful, and I believe this work will have a strong influence in removing prejudices and preparing the way for the reception of Christianity" (Nevius, 1895, p329).

Protestant missionaries' organized disaster relief efforts began in the late 1870s, in the wake of the most severe famine in modern Chinese history. Between 1876 and 1879, a catastrophic drought hit Shandong and five other provinces in North China, and the resulting famine killed over ten million people. Missionaries who had been stationed all over China responded, gathering in disaster-stricken areas to help people in need. In 1877 Protestant missionaries set up an aid agency, the Shandong Disaster Relief Commission, to coordinate their relief work. By 1879 the commission had raised over 200,000 silver taels (US$300,000) and had eased the suffering of millions of Chinese people (Gu, 2004, p289). Since then, missionaries have provided emergency humanitarian responses to almost all of China's large disasters. When another severe drought hit Shandong Province in 1888, the English Baptist Mission and the American Presbyterian Church worked together to raise over 300,000 silver taels (US$450,000) and help over 300,000 drought-affected people (North China Famine Relief Committee, 1889, p25). Missionaries became even more active and organized during the disasters of the early twentieth century, such as the 1906 north Jiangsu flood, the 1910–1912 Anhui flood, and the 1917–1918

Zhejiang drought. When North China was struck by severe drought yet again in 1920, missionaries established the China International Famine Relief Commission, a nationwide organization that coordinated international disaster relief efforts and raised over 20 million U.S. dollars (Gu, 2004, p294).

Lacking both modern medical knowledge and a functioning public health system, thousands of people were decimated by cholera, plague, and other epidemics that accompanied China's natural disasters. Missionaries responded by trying to control disease and save life, putting forth great efforts to establish hospitals and public health systems in the afflicted regions. As Christian missionaries became more deeply engaged in local communities and in their disaster relief work, they reported that while many government officials and gentry elites were experts in Confucian classics, they were largely ignorant of modern science and technology. This institutional ignorance impeded effective disaster relief efforts. As a result, the missionaries worked even harder to persuade the Chinese government to improve its educational system. Moreover, many missionaries put into practice the idea of education reform and established elementary schools, middle schools, and even universities throughout China. Many of these Christian schools soon became exemplary models that secular schools learned from. These educational achievements increased the human capital of the local people and may also have changed their social values, such as their work ethic and their attitudes toward Western culture.

Christianity reverted to its previous, unwelcome status when the People's Republic of China was established in 1949. The central government regarded missionaries as a form of "Western imperialism."[4] Consequently, it established a set of state-endorsed religious organizations and severed all connections with foreign denominations. By 1952, all foreign missionaries had been ordered to leave China. During the Cultural Revolution (1966–1976) all religious activities, including those of the government-regulated churches, were prohibited. Christian schools and hospitals were taken over by the government. Yet many of these schools continued to function much as they had under missionary control, training large numbers of students and persistently contributing to local economic development. Similarly, most of the formerly Christian hospitals continued to benefit local communities as they had in the past. Furthermore, the missionaries' endeavors before 1949 had so thoroughly promoted consciousness of education and public health

[4] This point was stressed many times by former Chinese Premier Zhou Enlai in meetings with Chinese Christian leaders.

among Chinese people that they permanently transformed Chinese society. Such effects were suppressed but not exterminated during the Cultural Revolution. When Christianity was legalized in China during the Reform and Open-up in 1978, the suppressed effects of Protestantism revived rapidly and began to persistently contribute to improvements in economic growth, education, and health care outcomes. These improvements, coupled with other complex long-lasting effects of Protestantism such as changed social values and work ethics, generated a significant boost to economic growth—particularly in counties with a history of more intense Protestant activity.

3. Data

To examine the impact of Protestant activities on long-term socioeconomic development, we assemble three county-level data sets: Protestant activities and socioeconomic conditions in 1920, socioeconomic conditions in 2000, and the geophysical conditions of all counties in our data set. Our examination is complicated, however, by the geopolitical reality that many of those counties' borders have changed over time. Therefore, we address the issue of changing borders by using GIS methods to match historical data with contemporary data. This section explains those details.

3.1 Historical Data

Our data of Protestant activities in China in 1920 are obtained from a statistical report that was compiled and published by the China Continuation Committee, the central organization of Protestant churches in China at the time. One of the committee's main tasks was to coordinate and promote more effective evangelization in China. For that purpose, beginning in 1918, the China Continuation Committee conducted a three-year county-level survey on the status of Protestant activities in China. The committee published its results in a statistical report entitled *The Christian Occupation of China: A General Survey of the Numerical Strength and Geographical Distribution of the Christian Forces in China* (*COC*). The *COC* reports on various measures of Protestant activities such as numbers of Protestant missionaries, converts, churches, schools, and hospitals in Chinese counties. It also collects and publishes other important socioeconomic information, such as political orientation, population, and educational attainment, obtained from county gazetteers and various local government surveys. The China Continuation Committee strove to ensure the quality of its survey data in order to deliver reliable and objective

descriptions of the extent of Protestant influence in Chinese counties. Therefore, the *COC* is generally accepted as a good source of information for studying the socioeconomic conditions in Chinese counties in the early twentieth century.

[Table 1 about here]

In this paper, we measure the intensity of Protestant activities in each county by three indicators: the numbers of Protestant converts, churches, and missionaries for every 1,000 people. The summary statistics are reported in Table 1. On average there were 0.74 converts, 0.016 churches, and 0.024 missionaries per 1,000 people in each Chinese county in 1920. Figure 1 shows the density of Protestant converts across counties in our sample. Darker shading indicates counties with higher densities of Protestant converts. Although many coastal counties had a high density of Protestant converts, the figure also depicts an active Protestant presence in a number of inland counties. Therefore, our data suggest that the different intensity levels of Protestant activities were not simply driven by the distances of these counties to the coastline.

[Figure 1 about here]

3.2 Contemporary Data

To study the long-term impacts of Protestant activities, we assemble contemporary socioeconomic indicators of Chinese counties. We obtained county-level data on economic development and local government budgets in 2000, including aggregate GDP, GDP by sector, infrastructure expenditures, and government subsidies, from the *Statistical Materials of Public Finance of Cities and Counties*; maps of and information on primary and secondary highways in 2000 from the China Data Center at the University of Michigan; and data on population, mortality rates, and years of schooling from the Fifth National Population Census (2000). Our main dependent variable is GDP per capita in 2000, with a mean of 5,584 *yuan* (about 800 U.S. dollars). Figure 2 reports the GDP per capita of all the counties in our data set, and each region on the map represents a county; the darker the shading, the higher the county's GDP per capita. Similar to Figure 1, it is evident that not all rich counties are coastal ones. Quite a number of inland counties also have high GDP per capita.

[Figure 2 about here]

3.3 Climate Data

Our historical climate data are drawn from the *Distribution Gallery of Droughts and Floods in the Past Five Hundred Years of China*, which was compiled by the Institute of Synoptic Meteorology and Climatology under the administration of the China Meteorological Administration (CMA). The original sources of historical climate data are county gazetteers and official archives. Combining historical and contemporary climate data, this gallery allows us to build a data set of droughts and floods for 120 meteorological stations from 1470 to 2000. For each year, the gallery uses a five-point scale to assign a Drought/Flood Index (DF-index) number that categorizes the local disaster status at each station: 1, severe flood; 2, light flood; 3, moderate conditions; 4, light drought; and 5, severe drought.[5] The CMA's data set has been widely used in previous studies, and its consistency and reliability have been carefully examined and confirmed by a number of meteorologists (e.g., Yao, 1982; Ronberg and Wang, 1987, Zhang and Crowley, 1989).

In our study, we count the frequency of serious droughts and floods (DF-index=1 or 5) over our sample periods and use this total as a measure of disaster frequency. To convert station-level information into county-level variables, we use a conventional approach called the inverse-distance-weighted (IDW) method. The IDW method assumes that a county's climate is an average of the climates at all nearby stations, weighted by the distances between the county and the nearby stations (see the Appendix for further details on how the climate data were calculated). For one of the periods on which our paper focuses, 1880–1920, the frequency of serious droughts and floods among our sampled counties is 0.19 per year on average.

3.4 Geophysical Data

Our study makes use of county GIS data in 2000 (including longitudes, latitudes, and surface areas) obtained from the Australian Consortium for the Asian Spatial Information and Analysis Network Data Center at Griffith University in Brisbane, Australia, and SRTM 90m digital elevation data on average county altitudes obtained from the CGIAR Consortium for Spatial Information (Jarvis et al., 2008). We calculate distances between the coordinates of different locations by using the haversine formula, which takes into account the curvature of the

[5] See Zhang and Crowley (1989) for a detailed description of this method of categorization.

earth.[6]

In our multivariate analyses, we also control for county-level geophysical characteristics by drawing from the Surface Meteorological Database, which was constructed by the CMA. The database contains annual precipitation and average temperatures for 754 meteorological stations between 1990 and 2000. As with our climate data, we use the IDW method to convert station-level variables to the county level.

3.5 County Matching

One of the challenges our study faced was the long historical period over which political regimes changed and the territorial borders of many counties shifted. We address this challenge by first comparing the GIS data for both 1920 and 2000 and then converting county-level variables in 1920 to those in 2000 using overlapping area as weights. To achieve those ends, we obtain historical GIS data from the China Historical Geographic Information System (CHGIS) project.[7] Then we construct a data set that combines historical Christian intensity data, historical and contemporary climate data, contemporary socioeconomic data, and geophysical data for 1,743 counties in China proper.

4. The Long-term Economic Effects of Protestantism

In this section we study the long-term economic effects of Protestant activities that took place in 1920. We use county-level GDP per capita in 2000 as the indicator of contemporary economic development. We begin our study with a correlation analysis. Then we use both historical evidence and the instrumental variable method to establish the causal effects of Protestantism on long-term economic development. We also scrutinize our results with instrument validity tests and robustness checks.

[6] The haversine formula is used to calculate the spherical distance between any two points (Sinnott, 1984):

$$dist_{A-B} = 6371.004 \cdot 2\sqrt{\sin^2\left(\left(A_{long} - B_{long}\right)\cdot pi \cdot 0.5\right) + \cos(A_{long}\cdot pi)\cdot\cos(B_{long}\cdot pi)\cdot\sin^2\left(\left(A_{lat} - B_{lat}\right)\cdot pi\cdot 0.5\right)}$$

where pi=π/180 and X_{long} and X_{lat} stand for longitude and latitude of point X, respectively.

[7] The historical county-level GIS data can be downloaded at http://www.fas.harvard.edu/~chgis/.

4.1 Baseline Correlations

Figure 3 shows the correlation between log of converts per 1,000 people in 1920[8] and log per capita GDP in 2000 for all these counties. It is evident that the two variables have a strong positive correlation.

[Figure 3 about here]

We further examine this relationship with OLS regressions controlling for other county-level characteristics. The baseline specification is given by

$$\ln(\text{pcGDP}_i) = \alpha + \beta \cdot \ln(\text{Converts/Pop1920}_i) + \boldsymbol{X_i}' \cdot \gamma + \varepsilon_i, \qquad (1)$$

where $\ln(\text{pcGDP}_i)$ is the natural log of GDP per capita in county i in 2000; $\ln(\text{Converts/Pop1920}_i)$ is the natural log of Protestant converts per 1,000 people in 1920; X_i is a vector of control variables including county locations, climates, and other geophysical characteristics; and ε_i is the error term.

Table 2 reports the results. Column 1 reports the estimate of β without control variable X_i. This result reflects the relationship shown in Figure 3. Column 2 includes a set of regional fixed effects.[9] While the magnitude of the marginal effect is reduced, the coefficient of Protestant convert density remains positive and significant at the 1% level. We further control for a set of county geophysical variables, including longitudes, latitudes, and distances to provincial capitals (column 3), altitudes (column 4), and a set of climate variables such as precipitation and temperature (column 5). Table 2 shows that the coefficients of the convert densities remain significantly positive.

[Table 2 about here]

[8] For counties with zero converts (272 such counties in our data), natural logs are not defined. For these counties, we use $\ln(1/\text{Pop1920}_i)$, pretending that they each had one convert. We also use alternative methods for dealing with the logarithmic transformation of the zeros, including (1) assuming $\text{Converts/Pop1920}_i = 0.001$ for zero-convert counties (choosing 0.001 because it is the lowest value for $\text{Converts/Pop1920}_i$ among the non-zero sample), and (2) excluding the zero-convert counties from our analyses. The main results remain robust.

[9] We follow the conventional method and divide China proper into seven regions: North China includes Beijing, Tianjin, Hebei, and Shanxi; East China includes Shanghai, Jiangsu, Zhejiang, Shandong, and Anhui; Northeast China includes Liaoning, Jinlin, and Heilongjiang; Middle China includes Hubei, Hunan, Henan, and Jiangxi; Southern China includes Guangdong, Guangxi, Hainan, and Fujian. Southwest China includes Sichuan, Chongqing, Guizhou, and Yunnan. Northwest China includes Shanxi, Gansu, Xinjiang, Qinghai, and Ningxia.

4.2 Establishing Causality: Instrumental Variables Results

The positive correlation between the density of Protestant converts in 1920 and contemporary economic outcomes in 2000 reported in Table 2 does not guarantee a causal relationship. One major concern for causality is that selection of counties for evangelization in 1920 was not random. It is possible that missionaries preferred to serve in richer counties in 1920, and that these counties remain more affluent today. In this subsection we study the location choices of Protestant evangelization prior to 1920 from a few different perspectives.

First, historical records indicate that a large number of missionaries actively worked in the less developed inland regions of China, and that many of them actually preferred to work in those regions. The British missionary Hudson Taylor believed that people in poor and remote regions were more likely to respond to God's call during times of hardship (Wang, 1997). Taylor founded the China Inland Mission (CIM) in 1865 and aimed to serve all of China's provinces. For that purpose, the CIM sent many groups of missionaries to serve in less developed regions such as Shanxi (since 1876), Sichuan (since 1877), Guizhou (since 1877), and Yunnan (since 1877) (Broomhall, 1901). As other missionaries came to share similar views and volunteered to work in poor and isolated counties, the CIM became China's largest Protestant denomination by the early twentieth century. More than 1,000 missionaries joined the CIM and spread the Gospel to remote villages. Other denominations followed the CIM's lead, and together they left a lasting influence on almost every part of this big country.

An empirical examination of whether missionaries were more active in less developed counties (and, conversely, less active in more developed counties) requires the economic indicators of those counties in 1920. Because direct measures of county-level economic development in 1920 are unavailable, we use two proxies for historical economic conditions: population density and per capita land tax revenue. Population density is a commonly used (if arguably crude) proxy for historical economic prosperity.[10] Per capita land tax revenue can also largely reflect local economic conditions.[11] Since both of these measures are relatively crude, we should consider the results here merely suggestive. Figure 4 plots these two measures against the

[10] See Acemoglu, Johnson, and Robinson (2002) for example. The data on county-level population density are also obtained from the *COC*.

[11] Prefecture-level land tax data in 1820 were obtained from Liang (2008). Land taxes during the Qing dynasty were calculated based on the size and quality of arable lands multiplied by a fixed tax rate. After normalized by population, land tax revenues reflect the development of local agriculture sector, which to a large extent indicates the overall economic conditions in a traditional society.

numbers of churches and missionaries per 1,000 people for Chinese counties in 1920.[12] All of the panels show significant negative correlations, suggesting higher Protestant presence in less developed regions. Given this evidence, it is unlikely that the observed positive relationship between Protestant densities and current economic growth is completely driven by selection. In fact, selection tends to bias the OLS results toward zero.

[Figure 4 about here]

In order to rigorously establish the causality between historical Protestant activities and contemporary economic growth, we use the instrumental variable method. As described in Section II, starting in the late 1870s, Protestant organizations purposefully undertook disaster relief work to gain the trust of Chinese people. In light of this fact, we construct the county-level frequency of severe droughts and floods between 1880 and 1920 (DF index = 1 or 5) and use it as the instrument for Protestant densities. The results are reported in Table 3.

[Table 3 about here]

Panel B of Table 3 presents the first-stage results. It includes the same set of specifications as in Table 2. The coefficients on disaster frequencies are significantly positive, indicating higher densities of Protestant activities in the counties that experienced the most disasters. The F-statistics of the instrumental variable, which are higher than the critical value suggested by Stock and Yogo (2005), rule out weak instrument concern.

We report our second-stage regression results in Panel A. Instrumented by disaster frequencies from 1880 to1920, the coefficients on *ln(Converts/Pop1920)* remain significantly positive for all columns and vary around 0.15. These results are significant not only statistically but also economically. Take column 5 with the full set of controls as an example. The coefficient reveals that a 1 standard deviation increase in convert density leads to a 0.42 standard deviation increase in GDP per capita, or 1,892 *yuan*. This amounts to a 34% increase in income per person for our sampled counties. Moreover, the 2SLS estimates of β in Table 3 are significantly higher than the OLS estimates in Table 2, which confirms the underestimation of impacts of historical Protestant activities in our OLS regressions.[13]

[12] Here we use the number of missionaries and the number of churches in each county to capture missionaries' location choices before 1920. As a robustness check, we also use the number of converts and find similar results.
[13] In an unreported regression, we regress convert population density in 1920 on disaster frequencies (DF index = 1 or 5) in

4.3 Validity of the Instrument

The validity of our 2SLS results in Table 3 rests on the assumption that historical disasters only affect current economic growth through the channel of past Protestant missionary activities. In this subsection we further substantiate this assumption by directly controlling for other factors that could plausibly be correlated with both historical missionary activities and current economic outcomes. We consider five such factors and report the results in Table 4. Column 1 of Table 4 reports the results without additional controls, which are copied from Column 5 of Table 3. Other columns in Table 4 report the results of various validity checks. It is evident that these results are quite robust.

[Table 4 about here]

First, we consider the possibility of China's climate exhibiting persistent regional patterns (Man, 2009). If past and present disasters were correlated, historical disasters would adversely affect today's economic outcomes directly and would, in turn, jeopardize the validity of our IV results. We find this channel unlikely. The correlations between disasters in different periods are weak in our data set when the two periods are reasonably far apart. In particular, the correlation coefficient of severe disasters between 1880–1920 and 1980–2000 is only 0.06. Therefore, as reported in column 2 of Table 4, the effect of historical Protestant activities remains almost unchanged when we control for recent disaster frequencies.[14]

Second, we consider whether a county's proximity to waterways could jeopardize the exclusivity of our instrumental variable. Although counties with major waterways within their borders are more likely to experience flooding, access to navigable waterways provides decided advantages in developing industry and commerce and contributing to economic growth. To address this concern, we create a variable indicating whether a county has a major river passing through it.[15] As shown in column 3, counties with rivers passing through them are 10% richer than other counties. Nevertheless, controlling this river dummy does not affect our estimate of the coefficient on Protestant densities at all.

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different periods simultaneously, including 1840–1880, 1880–1920, 1920–1940, and 1980–2000. Only the coefficient on period 1880–1920 appears to be positively significant. Coefficients on the other periods are both small in magnitude and insignificant.

[14] We should also keep in mind that, different from 100 years ago, the Chinese economy today relies more on manufacturing and is thus less vulnerable to weather shocks. In addition, with new technologies in communication, transportation, and weather forecasting, the impacts of extreme weather on economic outcome today are much smaller.

[15] Major rivers include the longest 40 rivers in China.

Third, we consider infrastructure. Frequent disasters may induce local societies to put more emphasis on infrastructure construction, which may benefit long-term economic growth. We use two variables to proxy local infrastructure conditions: road density in column 4 and local government expenditures on infrastructure in column 5. Once again, our estimates remain robust even after we control for local infrastructure conditions.

Fourth, we consider whether disaster-prone regions might shift toward industrially oriented development strategies and away from agriculture. In order to test this hypothesis, in column 6 we add in the share of agricultural sector in each country's GDP in 2000. Again, the result barely changes.

Fifth, we consider the possibility that the central government provides more subsidies to disaster-prone regions. This might be another reason frequent drought- and flood-prone counties can enjoy certain advantages in economic development. To rule out this possibility, we include subsidies (normalized by population) obtained by each county in column 7, and again we find the estimate unaffected.

In column 8, we simultaneously control all the additional variables from columns 2 through 7. We find that our results remain robust.

As another check of our instrumental variable, we separate our disaster instrument into two measures, severe flood (DF index = 1) and severe drought (DF index = 5). One advantage of this specification is that we now have more instruments than the endogenous variable so that the over-identification test is feasible. Column 8 shows that the result is unchanged. Based on the p-value of the Sargan statistics reported in Panel A, our specification passes the over-identification restriction at conventional statistical levels.

4.4 Robustness Checks

In Table 5 we conduct a number of robustness checks for our estimates. Column 1 of Table 5 shows the result of our baseline specification in column 5 of Table 3.

[Table 5 about here]

In column 2 we add historical land tax revenues (normalized by population) to control for

historical economic heterogeneities across counties.[16] The effect of Protestant activities becomes slightly larger than the result in the main specification in column 1. This increase is reasonable, given the selection bias we discussed in Subsection 4.2.

Before 1920, China's coastal counties were more easily accessible than its inland counties. Today, those coastal regions may enjoy more preferred economic policies. Therefore, one might wonder whether the observed long-term effects of Protestant activities are driven by coastal factors. In our study, we partially address this issue by controlling county longitudes. In column 3 we consolidate the results by adding an indicator of whether a county is in a coastal province. As expected, the coefficient of the coastal dummy is positive, large, and significant.[17] However, including this control reduces the coefficient of Protestant activities by only 0.02.

One might also worry that our results are merely driven by urban-rural differences. Like coastal regions, cities are easier to access and may enjoy preferable economic policies. Therefore, we have to consider whether urbanization could be positively correlated with both past Protestant activities and present economic growth. In column 4 we add a control variable indicating whether a county is urban. Our estimations are barely changed.

Catholic missionaries were also quite active in China during the period we study. However, reliable and detailed data on Catholic activities are simply unavailable. As a result, we focus on the effects of Protestantism instead of Catholicism in this paper. Nevertheless, as a robustness check, we include the number of prefecture-level Catholics mission stations per 1,000 people as a control variable to rule out the possible effects of Catholic activities.[18] The results are reported in column 5 of Table 5. The coefficient on the Protestant converts is reduced but remains positively significant.

In columns 6 through 8 of Table 5, we estimate equation (1) with alternative measures of economic growth and Protestant activities. In column 6 we switch the dependent variable from GDP per capita in 2000 to that in 2005. The effect becomes even more pronounced. In the main

[16] Using population density in 1920 as a proxy for economic development yields similar results.
[17] The coefficient on the coastal province dummy is not significant in the first stage when controlling for a county's longitude. However, it becomes positively significant once the longitude variable is excluded from the regression.
[18] We thank Ying Bai and James Kung for generously providing the data on Catholic mission stations. In China, prefectures are subsidiary regions below provinces, and counties are subsidiary regions below prefectures. The original information was depicted in a crude map included in Stauffer's appendix (1922) and contained no information on prefecture boundaries. Bai and Kung (2012) locate the data to all the prefectures by their relative positions in the original map. Given the way the data were constructed, the results obtained with this measure of Catholic activities are only suggestive.

specification we use the number of converts to measure the density of Protestant presence in each county. We do so because the number of converts captures the effectiveness of Protestant evangelization, whereas the numbers of churches and missionaries captures the inputs. As robustness checks, in columns 7 and 8 of Table 5 we report the 2SLS results using numbers of churches and missionaries respectively, and we find the results unaffected.

5. The Long-term Effects of Protestantism on Education

As we explain in Section 2, missionaries made tremendous efforts to promote education and health care while diffusing Protestantism in China throughout the late nineteenth and early twentieth centuries. Such efforts generated persistent effects in educational and health care development that have played an important role in long-term economic growth in the past century. In this section, we empirically examine the causal relationship between Protestantism and educational development both historically and at present.

5.1 Causality between Historical Protestantism and Contemporary Education

Similar to the GDP analysis in the previous section, we first run an OLS regression of educational development in 2000 on the density of Protestantism in 1920. Then, using the frequency of severe droughts and floods (DF index = 1 or 5) as our instrumental variable, we run a 2SLS regression. The indicator of educational development in 2000, which is the dependent variable in our OLS and 2SLS regressions, is the log of years of schooling. We report the results in columns 1 through 4 of Table 6. The 2SLS estimates are reported in Panel A, and corresponding OLS estimates without the instrument are reported in Panel B.[19]

[Table 6 about here]

In column 1 of Table 6, we control for the basic set of geographical and climate controls as in column 5 of Table 3. The 2SLS estimate of the coefficient on convert density is 0.03, which confirms that past Protestant activities generated significant positive effects on long-term educational outcomes. When evaluated at the sample mean, a 1 standard deviation increase in converts per 1,000 people in 1920 leads to a 0.46 standard deviation increase in average years of schooling in 2000, which is equivalent to 0.46 years or a 6.4% increase relative to the mean

[19] We do not report the first-stage results here because they are exactly the same as the first-stage results of the regressions in Table 3, 4, and 5 with the same set of controls.

value. OLS delivers a coefficient that is positive and significant as well, but its magnitude is much smaller than that of the 2SLS. This confirms the downward bias of OLS estimates caused by the selection issues in Protestant activities.

To evaluate the validity of our instrument in the education regression, we control for the same set of variables as in Table 4. The results are reported in column 2 of Table 6. The coefficient on convert density is unchanged. In column 3, we also examine the robustness of our estimates by adding in the same variables as in Table 5. And in column 4, we add in all variables from columns 2 and 3 simultaneously. Our results are remarkably robust in all specifications.

5.2 Protestant Missionaries' Efforts to Promote Education

The causal effects of historical Protestantism on contemporary educational achievement that we observe in Table 6 are the result of missionaries' painstaking efforts to promote education in China during the late nineteenth and early twentieth centuries. As John K. Fairbank noted, "in the end the Christian influence was probably strongest in education" (Fairbank, 1974, p13).

China completely rebuilt its educational system in the early twentieth century, and missionaries played a critical role in this radical transformation. Protestant missionaries gradually realized the fundamental flaw of traditional Confucian education after they arrived in China in the early nineteenth century.[20] During their disaster relief efforts, missionaries found that a major obstacle to their work was a lack of understanding of modern science and technology among many Chinese people, including among some elites. The main cause was believed to be traditional Confucian education. Therefore, building a modern educational system became imperative. For instance, when missionary Timothy Richard wrote a proposal to the governor of Shanxi Province while he was overseeing disaster relief efforts in 1884, he emphasized the importance of reforming China's educational system. He said, "Education is the first priority for China. As the Western countries keep developing their education day-to-day, China will lose her chance to overtake them in ten years. In conclusion, education is the most significant and urgent thing for China" (Richard, 1889).

Protestant missionaries were determined to build new school systems in China for the purpose of not only educating Chinese people, but also converting them. Overwhelmingly,

[20] E. C. Bridgman is believed to have been the first American missionary to work in China. As early as in 1830, he criticized the drawbacks of traditional education and its examination system, and he called for the establishment of a modern educational system (Barnett and Fairbank, 1985, p. 100).

missionaries were convinced that Western education was crucial to dissipating Chinese people's mistrust of and hostility toward Christianity. Alvin Pierson Parker, chairman of the Educational Association of China, explicitly expressed this opinion in 1896: "as a Christian educators' association, we should play a dominating role in China's education reform and satisfy the interests of Christianity" (Educational Association of China, 1896).

Driven by the twin motives of educating and converting the Chinese, missionaries made great achievements in revamping China's educational system. The number of Protestant schools rose sharply from 347 in 1877 to 7,382 in 1922, almost tripling every twenty years (Gregg, 1946, p.16–17). Among these Christian schools, 6,599 (86%) were elementary schools, 291 (7%) were middle schools, 16 (0.2%) were colleges, and 75 (1%) were vocational schools (China Educational Commission, 1922, p. 416).[21]

Primary schools form the foundation of modern mass education. To empirically test the effects of Protestant activities on the development of modern primary schools, we regress, at the county level, the number of Protestant primary school students per 1,000 people on the density of Protestant converts.[22] We report the results in column 1 of Table 7. Because our dependent variable is censored at zero, our estimate uses a Tobit model instead of OLS.[23] The coefficient shows a statistically and economically significant relationship between Protestant activities and Protestant primary school enrollment rates: when evaluated at the sample mean, a 1 standard deviation increase in convert per 1,000 people is associated with a 1.4 standard deviation increase in the enrollment rate of Protestant primary schools.

[Table 7 is about here]

Protestant missionaries built not only more schools but, critically, different schools. They introduced new curricula that emphasized both the natural sciences, such as mathematics, physics, and chemistry, and the social sciences, such as law and business. Protestant schools also offered practical subjects, such as foreign language studies and engineering. For example, 58% of students had taken English by the 4th or 5th grade (Stauffer, 1922, p. 1075). Class lectures were combined with practicums and laboratory experiments. Such teaching methods were vastly

[21] The rest are special institutions, including orphanages and schools for the blind or deaf.
[22] If one assumes that portion of school-aged children is constant across counties, then this result can be viewed as clear evidence for the causal effects of Protestant activities on the enrollment rate of the school-aged children in Protestant elementary schools.
[23] The OLS results are not significantly different from the Tobit results.

different from traditional education, which typically featured rote learning of Confucian classics. As a result, Protestant schools enjoyed a decided advantage over traditional schools in training students who would be qualified to work in China's booming industrial and commercial sectors.

Another big advantage of Protestant schools was funding. According to one report on the status of Protestant schools in China, over half of the funding for Protestant schools came from foreign Protestant organizations (Stauffer, 1922, p. 1094). Such funding was usually quite stable and sufficient. In sharp contrast, because of frequent civil wars and political turbulence, public schools often lacked sufficient financial support from the government. In 1911, for example, education accounted for merely 1.5% of total government spending (Stauffer, 1922, p.1068).[24] The Chinese government's chronic underfunding of public education even extended to educators' salaries. In the early twentieth century, wage arrears frequently provoked protests among teachers, administrators, and even Ministry of Education staff members (China Educational Commission, 1922, p.22).

Better schools educate tend to produce better students. Take student promotion rates as an example. In 1920, 21% of the students in Protestant junior elementary schools entered senior elementary schools (as opposed to 10% of public school students), and 10% of the students in Protestant senior elementary schools entered middle schools (as opposed to 3.4% of public school students) (Stauffer, 1922, p. 404). Moreover, Protestant schools educated a large number of professionals whose skills were urgently needed by society. According to a survey published in the *COC*, among 5,500 high school graduates in 1918, 30% continued their studies and went on to college; 30% worked for churches; 20% became teachers; and 20% went into business or other professions such as medicine and law (Stauffer, 1922, p. 409). In contrast, 70% of public middle school graduates had difficulty finding jobs (China Educational Commission, 1922, p. 19).

5.3 Spillover Effects of Protestant Education

As Protestant schools became demonstrably successful, they became exemplars for Chinese public schools. Wang (1997) documents three spillover effects of Protestant schools in China's educational system. First, the missionaries so effectively customized their textbooks to suit the needs of Chinese students that those textbooks—and the teachings therein—were widely adopted

[24] 60% of government spending was diverted to military purposes and war indemnification.

in the public schools, as well (Wang, 1997, p223. See also Elman, 2006, p103 and p116). Second, a large number of graduates from Protestant schools went on to become public school teachers and to teach subjects that were in demand at those schools.[25] Third, both the teaching and the organizational methods of Protestant schools greatly influenced Chinese officials and educators, who would later put similar models into practice.[26] A missionary education association expressed this point explicitly in one of its documents: "by perfecting and strengthening this arm of the service [Protestant schools], we increase the probability that the future governmental educational system of China will be largely influenced and molded by such superior examples" (Silby, 1902, p 621).

Empirically, we corroborate the spillover effects of Protestant schools in China with two pieces of statistical evidence. First we investigate whether more intensive Protestant activities in a given county were associated with higher enrollment rates in that county's public elementary schools. The results in column 2 of Table 7 support this hypothesis. When evaluated at the sample mean, our Tobit coefficient implies that a 1 standard deviation increase in convert density increases the public elementary school enrollment rate by a standard deviation of 0.24. This is the equivalent of a 0.18% increase in the enrollment rate, the mean value of which is 1.19%.

Next we examine, across counties, whether the public elementary school enrollment rate in one county was influenced by the Protestant activities in nearby counties. Specifically, we consider the following specification,

$$\ln(\text{Students/Pop1920}_i)=\alpha+\beta_1\ln(\text{Converts/Pop}_i)+\beta_2\ln(\text{Converts/Pop\_contiguous}_i)+\boldsymbol{X_i}'\gamma+\varepsilon_i, \quad (2)$$

where the public elementary school enrollment rate in county i ($\text{Students/Pop1920}_i$) is regressed on both the Protestant activities within county i (Converts/Pop_i) and the Protestant activities in neighboring counties ($\text{Converts/Pop\_contiguous}_i$), all in logarithm. The latter variable is constructed by averaging the convert densities in all counties contiguous to county i, weighted by the distance of each of these counties to county i. The instrument for this variable, which is the average frequency of severe droughts and floods in nearby counties, can be constructed in a

[25] For example, graduates from Tengchow College, a school established by the American missionary Calvin Mateer to train teachers, were highly sought by Chinese schools (Wang, 1997, p224).
[26] For example, when Zhang Zhidong, the Huguang Governor, planned to establish modern schools in the early 1900s, he sent many of his officials to Boone Memorial School, a Protestant academy established by American Episcopal Church in 1871, to study its educational and management models (Wang, 1997, p224).

similar fashion.

Column 3 of Table 7 reports our estimations of β_1 and β_2. Both are positively significant, and the fact that β_1 is greater than β_2 is as expected: the within-county effects of Protestant activities on the development of modern primary education are more pronounced than the cross-county effects of Protestant activities. We further investigate this geographic spillover effect in column 4 by focusing on a subsample in which there are no converts. The results suggest that more intense Protestant activities in neighboring counties positively affected a county's public elementary school enrollment rate, even when that county had no Protestant converts.

6. The Long-term Effects of Protestantism on Health Care Outcomes

As discussed in previous sections, missionaries actively promoted the establishment of Western medical and public health systems, particularly in poorer and less developed counties. Their efforts benefited a large population and might have generated persistent effects on health outcomes. In this section, we investigate the causal effects and transmission channels through which historical Protestant activities affect current health care outcomes.

6.1 Causality between Historical Protestantism and Contemporary Health

In this subsection, we investigate whether historical Protestant activities have generated long-term impacts on current health care outcomes. The results are reported in columns 5 through 8 of Table 6. These columns are organized much as are columns 1 through 4, with one difference: the dependent variable is the child mortality rate in 2000.

Column 5 of Table 6 reports the results of our estimates with the same set of control variables as in our baseline specification, column 5 of Table 3. The coefficient on convert density is -0.44, once instrumented by historical disaster frequency (DF index = 1 or 5). This estimate is highly significant with a standard error of 0.16. It is in fact larger in magnitude than the corresponding OLS estimate reported in Panel B. To interpret this result, we find that a 1 standard deviation increase in converts per 1,000 people decreases the child mortality rate by 0.17 standard deviations, which amounts to a 36% decrease in the child mortality rate relative to the sample mean.

As before, we add in more controls and find in column 6 of Table 6 that the exclusion

restriction of our instrument is not likely to be violated in the child mortality rate regression. Columns 7 and 8 introduce another series of controls and further demonstrate the robustness of our results. In summary, our results confirm that historical Protestant activities have generated long-term effects on improving local health care outcomes.

6.2 Hospitals and Clinics

As John K. Fairbank, a renowned Chinese historian, observed, "Modern Western medicine in China was to an important degree a consequence of missionary demonstration and instruction" (1983). Herbal therapy was the predominant form of medical treatment in China until Western medicine was introduced during the nineteenth century. Christian missionaries played a critical role in introducing Western medicine to China. Peter Parker, an American missionary, founded China's first Western hospital in 1837. More than 2,000 patients received treatment in its first year of operation (Bush, 1879). Thereafter, Western medicine came to flourish throughout China. By 1889, 61 Protestant hospitals and 44 clinics were operating in China (General Conference of the Protestant Missionaries of China, 1890). These numbers increased during the first two decades of the twentieth century, reaching 326 and 244 respectively (Stauffer, 1922, p96). Annual numbers of patients treated soared to nearly 150,000 inpatients and over one million outpatients (Stauffer, 1922, p623). By 1937, over 300 Christian hospitals had been established in China, providing more than 20,000 beds. Endowed with strong support from Protestant organizations, Protestant hospitals were generally well financed and technologically advanced. Dr. Harold Balme, the dean of the School of Medicine at Shandong Christian University, surveyed conditions at 165 Protestant hospitals in 1919 and found that most housed medical laboratories, 75 were able to perform laparotomies, and 24 were equipped with X-ray machines (Balme and Stauffer, 1920). These hospitals were located not only in coastal provinces but also, notably, in remote inland regions. Moreover, many hospitals offered free medical services to the needy.

Figure 5 presents the correlation between Protestant activities and numbers of hospitals and pharmacies at the province level.[27] The positive correlations are very strong: a 1% increase in the number of converts is associated with a 1% increase in the number of modern hospitals as well as a 0.4% increase in the number of modern pharmacies.

[27] We conduct this analysis at the province level because county-level data on the number of hospitals in 1920 are unavailable.

[Figure 5 about here]

6.3 Public Health

Missionaries brought with them not only the Western hospital system but, more importantly, the Western idea of public health. Whenever outbreaks of disease occurred in disaster-stricken areas, missionaries were usually at the forefront in organizing effective remedial and preventive measures. Over the course of their periodic disaster relief and disease control efforts, Protestant missionaries found that a general lack of public health knowledge led to epidemic outbreaks that exacerbated the situation and contributed to the large death tolls that typically came in the aftermath of disasters. Disseminating knowledge of infection control thus became a priority during disaster relief efforts. Such knowledge included preventive measures such as sterilizing medical instruments, sanitizing food and drinking water, controlling flies and mosquitoes, and, critically, quarantining disaster-stricken areas to control the spread of communicable diseases. According to one study in the early twentieth century, 69 Protestant hospitals (42% of the total) were equipped with quarantine facilities (Balme and Stauffer, 1920). Such measures, when taken by missionaries, were very effective in controlling outbreaks of disease. A good example is control of leprosy. Wherever the disease emerged, local governments and missionaries collaborated to enforce quarantines. As a result, the number of leprosy cases in China declined drastically in the early twentieth century (Stauffer, 1922, p437–438).

Missionaries also focused on improving the health of women and children. Female missionaries, in particular, played a vital role in disseminating knowledge of obstetrics and gynecology among Chinese women. Among the services they offered, they paid regular visits to pregnant women and provided medical treatment in cases of necessity.[28] These female missionaries also trained obstetricians, midwives, and nurses throughout China. Their tremendous efforts produced significant declines in mortality rates for women and infants in the early twentieth century.

6.4 Medical Education

Missionaries were also pioneers in promoting modern medical education in China. They

[28] For example, in 1888, seven Canadian missionaries conducted a comprehensive survey of the overall health of women and children in Zhangde Prefecture, Henan Province. With funds they raised in their home country, they subsequently set up gynecological clinics and provided free medical services to local women and children. They also offered monthly training classes on obstetrics and gynecology. See Gryma (2008, p. 31) for details.

believed that "scientific medicine in China must not continue indefinitely to be a 'foreign doctrine'" and "the medical profession of China must become national if it is to be universally accepted" (Mac Alister, 1921). Holding firmly to this belief, Protestant organizations established 116 medical education institutions by 1920. Among these institutions were 10 medical colleges, which accounted for one-third of all medical colleges in China at the time (Stauffer, 1922, p.425). Today most of these colleges remain operational and continue to train a large number of excellent doctors. The other 106 medical education institutions were schools of nursing (China Educational Commission, 1922, p. 416). These Protestant medical schools, which were usually larger and better equipped than public medical schools, offered an advanced model of medical education that public schools could only try to follow.

Setting up schools was not the sole means by which missionaries promoted medical education. They also published medical textbooks and translated a large number of Western works into Chinese. John Glasgow Kerr, a Presbyterian medical missionary, published China's first journal of medicine in 1868.[29] A few years after that, in 1888, the Medical Missionary Association of China published its own journal with a focus on transmitting Western medical information to the Chinese. In 1908 missionaries published the first Chinese pharmaceutical dictionaries and in so doing standardized Chinese drug terminology (China Mission Year Book, 1912, pp. 267–268).

7. Possible Channels of Causality

What are the mechanisms behind the long-term effects of Protestantism? In this section we empirically examine whether there are any other channels, aside from education and health care outcomes, through which their undertakings have persistently affected today's economic outcomes. When we control for current education and health care outcomes in our GDP regression and examine whether the effects of Protestant activities persist, we would like to be able to estimate the following model:

$$\ln(pcGDP_{2000}) = \alpha_2 + \beta_2 \ln(Converts/Pop_{1920}) + \chi_2 Edu_{2000} + \delta_2 Health_{2000} + X\gamma_2 + \varepsilon_2 \qquad (3)$$

[29] Kerr (1824–1901) arrived in China with the American Presbyterian Mission in 1854 and soon thereafter became the head of the Ophthalmic Hospital in Canton and later the Guangzhou Boji Hospital (The Canton Hospital). He worked there for 47 years and treated about 1 million patients. Besides his outstanding contributions in medical care, he was also known for his student, Dr. Sun Yat-sen, the founder of Kuomingtang (Chinese Nationalist Party) and the Republic of China.

In Table 8, we report estimation results of equation (3) using, in columns 2 through 4, OLS and, in columns 6 through 8, 2SLS, where ln(Converts/Pop) is instrumented by historical disaster frequency (DF index = 1 or 5) from 1880 to 1920. The coefficients on years of schooling are positive and significant. Although the coefficients on child mortality rates are negative and significant in columns 2 through 4, they are insignificant in columns 6 through 8. To interpret the magnitude of coefficients on education and health, column 8 in Table 8 reveals that a 1% increase in years of schooling is associated with a 0.83% increase in GDP per capita, while a 1% decrease in child mortality rate is associated with a 0.04% increase in GDP per capita. These results are comparable to those found by existing studies that explore cross-country variations.[30]

[Table 8 about here]

Most importantly, column 8 in Table 8 shows that, compared to our baseline results (column 5 of Table 3), the coefficient on convert density is reduced by 25% (i.e., [0.16-0.12]/0.16) once both education and health care outcomes are controlled for. This suggests that effects on education and health care outcomes account for 25% of the total effects of Protestant activities on long-term economic growth.

A potential concern raised by the above argument is that current education and health care outcomes may also be endogenous. Unobservable county-level characteristics that affect education and health status can also affect economic outcomes, and there is no instrumental variable for them in our context. In this case, their coefficient could be biased and the estimation of the coefficient on convert density could be contaminated as well.

In order to address the possibility of endogeneity, we follow Becker and Woessmann (2009) and bound the effect of Christian activities on GDP per capita net of contemporary education and health outcomes. The bounding procedure involves two steps. In the first step, we run an OLS regression with equation (3). The results of this auxiliary regression are reported in column 4 of Table 8. In the second step, we subtract the contribution of education and health improvements and estimate the net effects of historical Protestant intensity on today's GDP in the following specification:

[30] For example, a cross-country analysis conducted by Mankiw et al. (1992) found that a 1% increase in years of schooling is associated with a 0.66% increase in GDP per capita.

$$\ln(pcGDP_{2000}) - \bar{\chi} Edu_{2000} - \bar{\delta} Health_{2000} = \alpha_2 + \beta_2 \ln(Converts / Pop_{1920}) + X\gamma_2 + \varepsilon_2, \quad (4)$$

where $\bar{\chi}$ and $\bar{\delta}$ are based on the estimated values of χ_2 and δ_2, obtained from the first step and adjusted for potential biases that have been reported in other studies.

Table 9 reports the bounding results. Each cell contains an estimate of β_2 in equation (4), where Protestant activities in 1920 are instrumented by historical disaster frequencies. The row and column headings indicate the values we choose for $\bar{\chi}$ and $\bar{\delta}$. In cell [1,1], when both $\bar{\chi}$ and $\bar{\delta}$ are set to 0, we obtain the point estimate of Protestant effect in the baseline regression. Informed by our review of the extensive literature on return to education, we bound the range of estimates of the economic return to years of schooling ($\bar{\chi}$) from 80% to 140% of its OLS estimate (χ_2).[31] As for the effects of child mortality rates on GDP per capita ($\bar{\delta}$), the related literature is less conclusive. Therefore, we opt for a more conservative approach and consider values for $\bar{\delta}$ ranging from 80% to 200% of its OLS estimate (δ_2).[32]

[Table 9 about here]

Column 1 reports the results we obtain when we remove only the education channel in the dependent variable of the regression in equation 4. The coefficients on Protestant activities range from 0.12 to 0.13, depending upon the values chosen for $\bar{\chi}$, and they are significant both statistically and economically. Such results suggest that educational improvements account for 19–25% of the total effect of Protestant activities. Row 1 reports the results yielded when we take out only the health channel. With the wide range of $\bar{\delta}$ we choose, the coefficients on Protestant activities vary from 0.12 to 0.14 and are also statistically significant. Such results suggest that long-term health improvements contribute 12–25% of the total effects of Protestant

[31] Card (1999) reviews the literature on the return to education and concludes that the upward bias due to ignorance of ability accounts for about 10% of the OLS estimates. Moreover, studies using institutional changes to create exogenous variation in schooling have actually yielded estimates 20–40% higher than those of OLS. The main reason is that institutional improvements usually affect people with low educational outcomes, who tend to have higher marginal return to schooling. Similar downward biases may apply to the OLS estimates in our context, as well.

[32] Studies that evaluate the effects of health improvement on economic growth based on regional variation have been somewhat inconclusive (Jack and Lewis, 2009). They always suffer from omitted variable bias and reverse causality (Mankiw, 1995, p303–304). Gallup and Sachs (2001) and Bloom et al. (2004) are examples of the very few studies that construct instrumental variables to solve these issues of endogeneity. But their identification strategies continue to be debated, and their 2SLS results are not significantly different from their OLS results.

activities on GDP per capita today.[33]

When we estimate equation (4), through different combinations of $\overline{\chi}$ and $\overline{\delta}$, the coefficients of education and health in Table 9, the effects of Protestant activities range from 0.08 to 0.14. Insignificant results appear only when the true effect of return to education is 40% higher than that of the OLS estimate and when the true effect of return to health is more than 120% of the OLS estimate. Even in these cases, the magnitudes of β_2 continue to have significant economic meanings.

Based on the above analysis, we draw two conclusions that help us understand the effects of missionary work on long-term economic outcomes. First, improvements in education and health care outcomes account for a considerable proportion (up to 50%) of the long-term effects of Protestantism on economic outcomes. Second, there are other, unquantifiable channels through which historical Protestantism affects today's GDP per capita. Our study finds that they may contribute at least another 50% of the total effects. Indeed, aside from the channels of education and health care outcomes, Protestantism may have generated a variety of profound effects on Chinese society. For example, Protestant activities may have promoted more open attitudes toward new ideas and technologies, better work ethics, and increased entrepreneurship.

One implication of the second argument is that the long-term impact of Protestantism may have become most evident only after China's Reform and Open-up in 1978. Although most of Protestantism's effects on social values and work ethics were suppressed during the Cultural Revolution, their subsequent revival has boosted economic growth in an increasingly market-oriented environment. To test this, in Figure 6 we plot average GDP per capita between 1950 and 2010 for two groups of our sample provinces. One group consists of the eleven provinces with the lowest measures of ln(Converts/Pop) in 1920, and the other group consists of the twelve provinces with the highest measures of ln(Converts/Pop) in 1920.[34]

[Figure 6 about here]

Two patterns are worth noticing here. First, provinces with a higher intensity of Protestant

[33] In fact, it is possible to calculate the threshold values of $\overline{\chi}$ and $\overline{\delta}$ beyond which β becomes insignificant. The $\overline{\chi}$ value for β to lose significance at the 5% level is 2 times that of χ_2, and the corresponding $\overline{\delta}$ value is 3.1 times that of δ_2.

[34] We obtained our province-level GDP data from *China Compendium of Statistics 1949–2008*. We use province-level data because county-level GDP data before 1993 are not available.

activities are, on average, richer than those with lower intensities. Second, and more interestingly, the gap between these two groups widened rapidly in the late 1970s. The GDP per capita in the first group almost doubled that of the second.

We consolidate the above finding by determining whether provinces with higher intensities of historical Protestant activities are associated with higher GDP per capita growth rate. Table 10 reports the results. During the pre-Reform period (1952–1978), the coefficient on converts per 1,000 people is small and insignificant in columns 1 through 3. In contrast, during the Reform period (1978–2008), the coefficient becomes large and significant in columns 4 through 6.

[Table 10 about here]

In summary, these patterns are consistent with our hypothesis. The unquantifiable effects of Protestantism, such as the reshaping of social values and work ethics, might have mattered in a centrally planned economy, yet they have come to matter much more in the years since the Reform and Open-up in 1978.

8. Conclusion

In this paper we construct a data set mapping Protestant activities in 1920 at China's county level with county-level data on socioeconomic developments in 2000. Our OLS results show that diverse socioeconomic developments across counties in 2000 are positively correlated with the intensity of Protestant presence 80 years ago. To better understand whether the relationship is causal, we exploit the fact that missionaries purposefully undertook disaster relief work to gain the trust of the local people. Thus, we use the frequency of historical disasters as an instrument for Protestant distribution. Our IV results confirm and enhance our OLS results. To our knowledge, this paper provides the first empirical evidence for the long-term effects of religious activities on socioeconomic outcomes in China today.

We then investigate the channels through which the effects of missionaries' work have persisted over time. While spreading Protestantism throughout China, missionaries took an active role in building modern educational and medical systems. They set up a large number of Western-style schools and hospitals, and they helped build China's public health system. Tens of millions of Chinese people have benefited from their pioneering work. Such efforts might have contributed substantially to the accumulation of human capital in China over the past century.

However, we realize that the effects of the spread of Protestantism could be complex and profound. It is possible that missionaries' work induced the changes in social values, work ethics, and attitudes toward Western culture, entrepreneurship, and so on. Such changes might also have boosted long-term economic growth. Our empirical results suggest that improvements in education and health care outcomes account for less than half of the total effects of missionaries' work on today's economic outcomes, and that the rest of the effects may be attributed to changes in culture and social values.

If we are correct, our conclusions may have important implications for understanding the so-called Chinese miracle, which in the past has been entirely attributed to radical institutional changes that accompanied China's Reform and Open-up. Our findings imply that China's Reform and Open-up was, to a large extent, a continuation of a modernization movement that started in the mid-nineteenth century, was interrupted by wars and revolutions, and resumed in 1978. Our findings also imply that late-nineteenth- and early-twentieth-century Protestant missionaries pioneered that modernization movement by disseminating, along with Christianity, Western science and technology to even the most remote regions of China. Such efforts accelerated the pace of modernization, contributed to the accumulation of human capital, and reshaped the social values of local people. Although these historical legacies of missionaries' undertakings were suppressed during the Cultural Revolution, they rapidly resurged and began to contribute to socioeconomic developments when China began to open up and reform. Therefore, our findings imply that a significant amount of China's growth since 1978 is the result not just of sudden institutional change but of human capital and values acquired over a much longer historical period.

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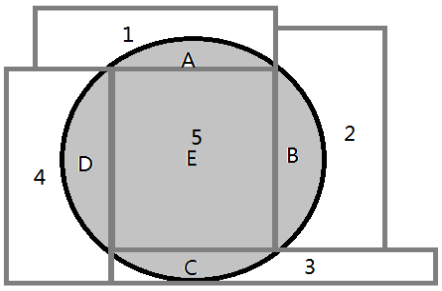
Data Appendix

1. Mapping historical information onto current administrative units

Refer to Figure A1 as an illustrative example, where squares represent 1999's county boundaries and circles represent 1920's county boundaries. The 1920 county-level measures of Christian activities (X_i^{1920}, i = 1,…,5), include number of converts, missionaries, and churches. The corresponding 2000 county-level measures (X^{1999}), shown as the grey area, is calculated by

$$x_k = \sum_{k=A\sim E} x_k^{2000} \quad \text{where} \quad x_A^{1999} = x_1^{1999} \cdot \frac{s_A}{s_1}, \ldots, x_E^{1999} = x_5^{1999} \cdot \frac{s_A}{s_5}$$

Figure A1. An illustrative map



The implicit assumption is that church activities in 1920 are equally distributed within a county.

2. Converting station-level information to the county level

Given the climate measures at the station level (Y_j, j = 1,…,J), county-level measures (Y_c) are constructed by

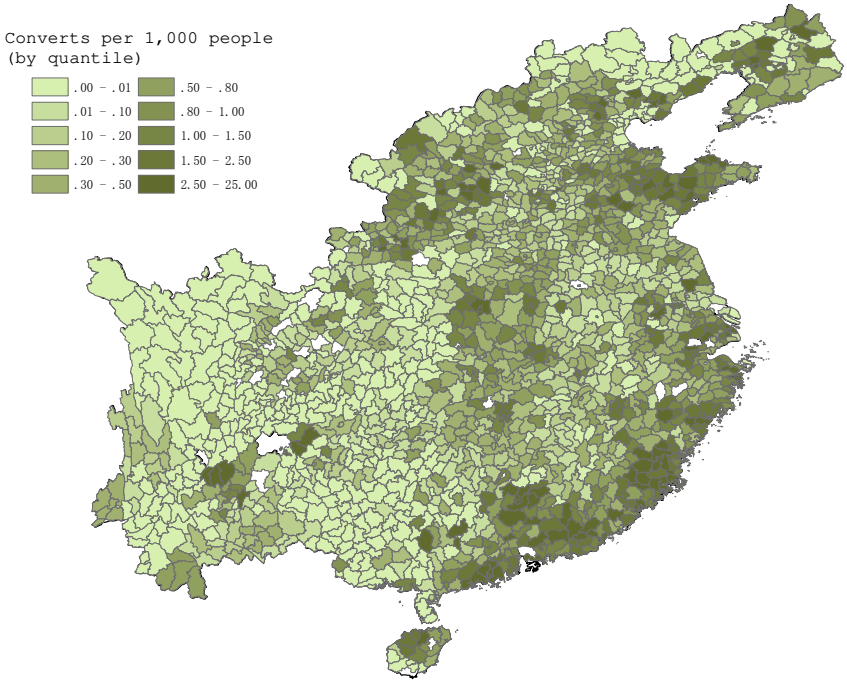
$$Y_c = \sum_{j=1,\ldots,J} Y_j \cdot w_{cj}$$

where w_{ij} is the weight, which is constructed using Shepard's method (Shepard, 1968):

$$w_{cj} = \frac{dist_{ck}^{-2}}{\sum_{k=1,\ldots,J} dist_{ck}^{-2}}$$

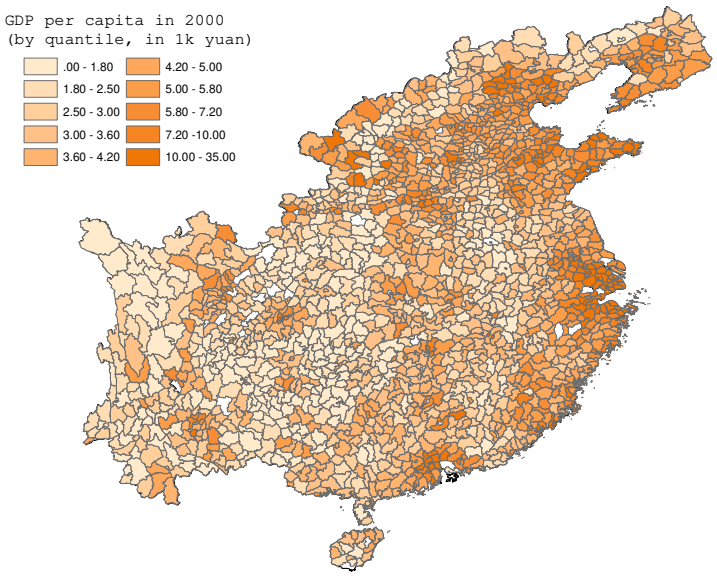
where $dist_{ck}^{-2}$ is the distance between the centroid of county c and k.

Figure 1. Protestant Converts per 1,000 people in 1920



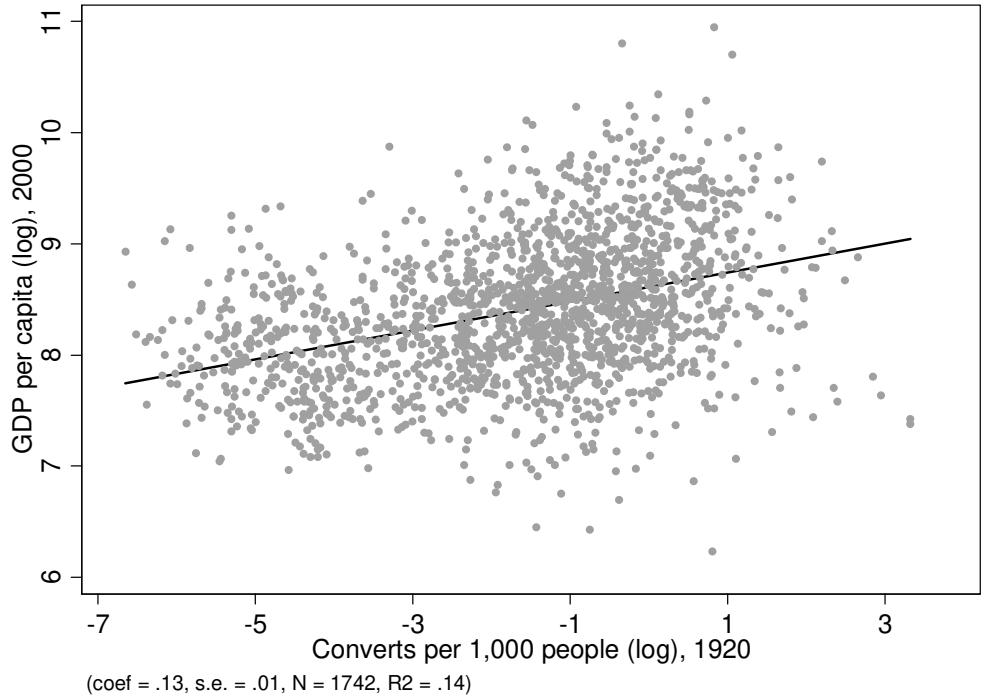
Note: This map shows the distribution of converts (normalized by population) in 1920 among counties in our sample. Darker shading indicates higher numbers of Protestant converts per 1,000 people.

Figure 2. GDP per capita in 2000



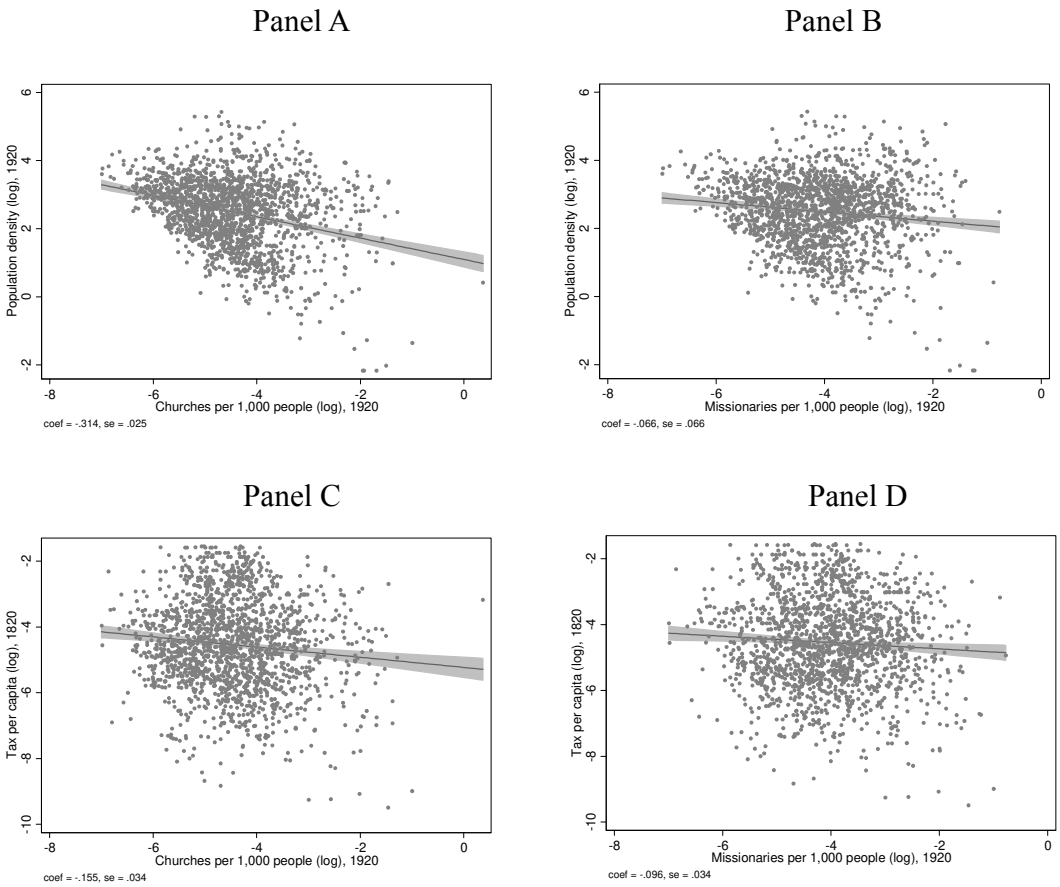
Note: This map shows the distribution of GDP (normalized by population) in 2000 among counties in our sample. Darker shading indicates higher GDP per capita.

Figure 3. Correlation between historical Protestant activities and current GDP per capita



Note: This figure plots the logarithm of converts per 1,000 people in 1920 against the logarithm of GDP per capita in 2000. Each dot represents a county. The solid line is the fitted regression line with slope equal to 0.13 and t statistics equal to 16.92. The correlation coefficient between these two variables is 0.38.

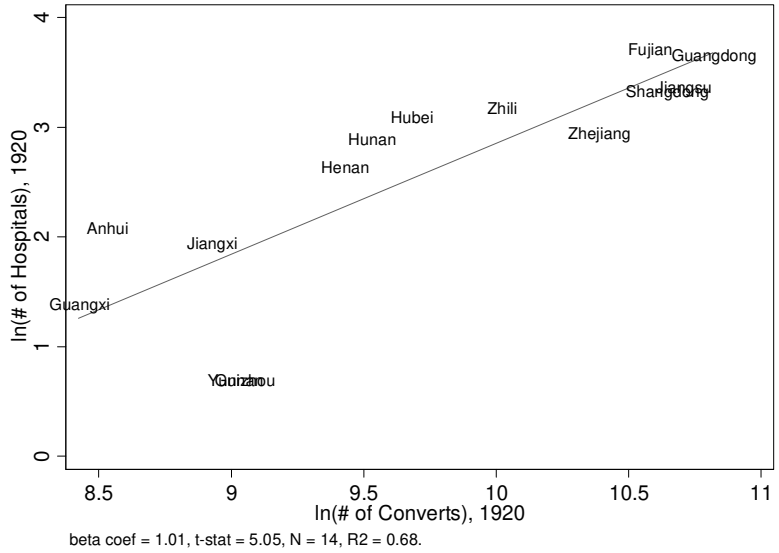
Figure 4. Selection of counties by Protestant churches and missionaries



Note: The panels in this figure plot Protestant church activities in 1920 against historical economic development. Historical economic development is measured by the population density in 1920 (normalized by geographic area) in panels A and B, and by land tax per capita in 1820 in panels C and D. Protestant church activities are measured by number of churches per 1,000 people in panels A and C, and by number of missionaries per 1,000 people in panels B and D. All values are in logarithm. In each panel, the dot represents a county. The solid lines are fitted regression lines with slope and standard error reported below. The shaded areas represent the 95% confident interval.

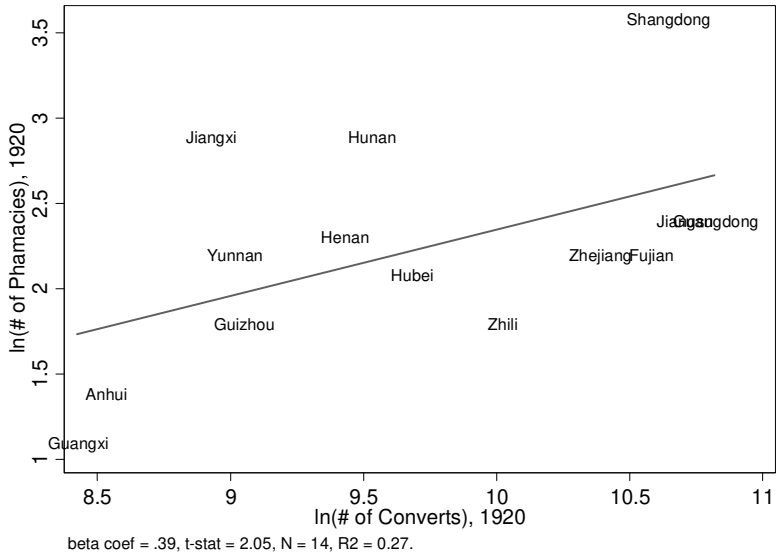
Figure 5. Correlation between historical Protestant activities and historical development of Western health care in China

Panel A. Number of Western hospitals



beta coef = 1.01, t-stat = 5.05, N = 14, R2 = 0.68.

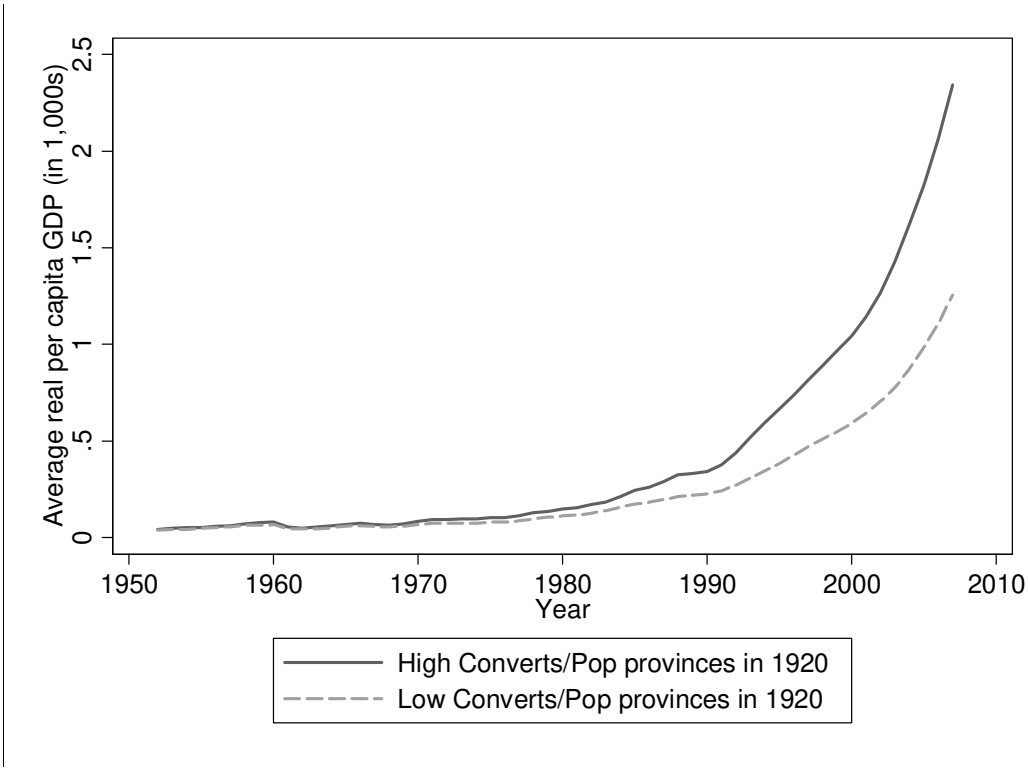
Panel B. Number of Western pharmacies



beta coef = .39, t-stat = 2.05, N = 14, R2 = 0.27.

Note: The panels in this figure plot province-level numbers of converts against historical development of Western health care in China, measured by number of Western hospitals in 1920 (Panel A) and number of Western pharmacies in 1920 (Panel B). All values are in logarithm. In each panel, the solid line is the fitted regression line with its slope and other related statistics reported below.

Figure 6. Trajectories of economic development across provinces since 1950



Note: In this figure, 23 provinces in our sample are divided into two groups: 12 provinces with higher convert density in 1920 and 11 provinces with lower convert density in 1920. The figure plots the weighted average per capita GDP across years for each group. The weights are the provincial populations in each year. Nominal values are deflated to 2000 price levels.

Table 1. Summary Statistics

	Unit	Obs	Mean	Std.	Min	Max
	(1)	(2)	(3)	(4)	(5)	(6)
I. Protestant activities (in 1920)						
Converts per 1,000 people		1742	0.76	1.61	0.0000	27.71
Churches per 1,000 people		1742	0.02	0.04	0.0000	1.45
Missionaries per 1,000 people		1742	0.02	0.04	0.0000	0.46
(Conditional on being positive)						
Converts per 1,000 people		1470	0.90	1.72	0.0021	27.71
Churches per 1,000 people		1228	0.02	0.05	0.0001	1.45
Missionaries per 1,000 people		1343	0.03	0.04	0.0010	0.46
II. Students per 1,000 people (in 1920)		1742	0.00	0.00	0.00	0.00
Protestant primary schools		1742	0.33	0.69	0.00	8.01
Public primary schools		1742	11.91	12.74	0.00	207.77
(Conditional on being positive)						
Protestant primary schools		1219	0.46	0.78	0.00	8.01
Public primary schools		1734	11.96	12.74	0.37	207.77
III. Medicine (in 1920, provincial level)						
Number of Western hospitals		16	18.38	12.38	2.00	41.00
Number of pharmacies		16	12.38	8.82	3.00	36.00
III. Socioeconomic outcomes (in 2000)						
GDP per capita	yuan	1742	5584	4463	508	57065
Year of schooling		1742	7.22	1.00	1.85	11.06
Child mortality rate	%	1742	2.33	1.89	0.00	18.65
IV. Geographical characteristics						
Longitude	°C	1742	112.68	5.75	97.78	125.27
Latitude	°C	1742	31.19	5.34	18.57	42.99
Altitude	m	1742	615.81	736.77	33.14	4518.85
Distance to provincial capital	km	1742	187.43	108.11	0.58	611.09
V. Climate characteristics						
Freq. of DF = 1 or 5 in 1880–1920		1742	0.19	0.05	0.00	0.59
Freq. of DF = 1 or 5 in 1980–2000		1742	0.26	0.06	0.00	0.66
Average temperature in 1990–2000	°C	1742	13.52	3.68	0.16	23.72
Average precipitation in 1990–2000	cm	1742	9492	3537	90	22525

Table 2. Relationship between historical Protestant activities and current economic development (OLS)

Dependent variable is log GDP per capita in 2000					
	(1)	(2)	(3)	(4)	(5)
ln(Converts/Pop1920)	0.13	0.09	0.06	0.05	0.06
	[0.01]***	[0.01]***	[0.01]***	[0.01]***	[0.01]***
Longitude			0.05	0.04	0.04
			[0.01]***	[0.01]***	[0.01]***
Latitude			0	-0.01	-0.01
			[0.01]	[0.01]	[0.01]*
Distance to provincial capital			-0.17	-0.15	-0.16
(in logs)			[0.02]***	[0.02]***	[0.02]***
Altitude				-0.1	-0.11
(in logs)				[0.02]***	[0.02]***
Temperature					-0.29
(in logs)					[0.11]**
Precipitation					0.1
(in logs)					[0.11]
Regional FE	NO	YES	YES	YES	YES
R-squared	0.14	0.26	0.34	0.36	0.36
Obs	1742	1742	1742	1742	1742

Note: This table reports OLS estimation results of equation (1). Each observation is a county in 2000. The dependent variable is the logarithm of GDP per capita in 2000. The Protestant activities variable ln(Converts/Pop1920) is the logarithm of converts in each county in 1920 normalized by population. Regional fixed effects include indicator variables for the 7 regions in China proper: North, East, Northeast, Middle, South, Southwest, and Northwest China. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.

Table 3. Relationship between historical Protestant activities and current economic development (2SLS)

	(1)	(2)	(3)	(4)	(5)
Panel A. Second Stage. Dependent variable is log GDP per capita in 2000					
ln(Converts/Pop1920)	0.10	0.23	0.17	0.15	0.16
	[0.04]***	[0.06]***	[0.06]***	[0.06]**	[0.07]**
Location Controls	NO	NO	YES	YES	YES
Altitude	NO	NO	NO	YES	YES
Climate Controls	NO	NO	NO	NO	YES
Reg. FE	NO	YES	YES	YES	YES
Obs	1742	1742	1742	1742	1742
Panel B. First Stage. Dependent is ln(Convert/Pop1920)					
Disaster Freq.	7.85	6.99	6.21	5.81	5.53
(DF = 1 or 5, 1880-1920)	[0.89]***	[1.07]***	[1.08]***	[1.07]***	[1.06]***
F-stat on IV	77.68	42.74	33.37	29.82	27.05

Note: This table reports estimation results of equation (1), where historical Protestant activities are instrumented by historical frequency of disasters. Each observation is a county in 2000. Panel A reports the second-stage results of the estimation. ln(Converts/Pop1920) is the logarithm of converts of each county in 1920 normalized by population. Panel B reports the first-stage results of the estimation. Instrument variable is the frequency of severe floods (DF index = 1) and severe droughts (DF index = 5) between 1880 and 1920. "Location Controls" include longitude, latitude, and distance to provincial capital (in logs). "Climate Controls" include average temperature and annual precipitation between 1990 and 2000. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.

Table 4. Long-term effects on economic development, validity of instrument variable (Panel A)

	Baseline	Recent disaster	Location	Infrastructure		GDP composition	Help from central gov't	All	Separate flood and drought
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A. Second Stage. Dependent variable is log GDP per capita in 2000								
ln(Converts/Pop1920)	0.16**	0.16**	0.16**	0.14**	0.14**	0.15**	0.19***	0.18***	0.18***
	[0.065]	[0.065]	[0.066]	[0.066]	[0.066]	[0.065]	[0.066]	[0.064]	[0.060]
Disaster freq.		0.02						-0.15	
(DF = 1 or 5, 1980-2000)		[0.248]						[0.245]	
Rivers			0.09**					0.06	
			[0.041]					[0.040]	
Road density				0.04				-0.03	
(in logs)				[0.035]				[0.031]	
Construction expenditure					0.04***				
(in logs)					[0.011]				
Agriculture/GDP						-0.11***		-0.12***	
(in logs)						[0.022]		[0.020]	
Subsidy/Pop2000							0.34***	0.37***	
(in logs)							[0.033]	[0.032]	
Adjusted R-squared	0.295	0.294	0.292	0.309	0.314	0.321	0.285	0.321	0.27
F-stat on IV	27.05	27.57	26.76	26.15	25.99	27.11	26.74	26.97	16.38
Sargan Test (p-value)	.	.	.	.	.	.	.	.	0.491
Obs	1742	1742	1742	1742	1742	1742	1742	1742	1742

Table 4. Long-term effects on economic development, validity of instrument variable (Panels B, C)

	Baseline	Recent disaster	Location	Infrastructure		GDP composition	Help from central gov't	All	Separate flood and drought
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel B. First Stage. Dependent is ln(Convert/Pop1920)									
Disaster freq. (DF = 1 or 5, 1880-1920)	5.53***	5.63***	5.50***	5.44***	5.42***	5.48***	5.51***	5.55***	
	[1.065]	[1.073]	[1.066]	[1.066]	[1.065]	[1.055]	[1.067]	[1.070]	
Flood freq. (DF = 1, 1880-1920)									3.46**
									[1.378]
Drought freq. (DF = 5, 1880-1920)									8.33***
									[1.592]
Panel C. OLS Results. Dependent variable is log GDP per capita in 2000									
ln(Converts/Pop1920)	0.06***	0.06***	0.06***	0.05***	0.05***	0.05***	0.06***	0.05***	0.06***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]	[0.007]	[0.008]

Note: This table reports estimation results of equation (1), where historical Protestant activities are instrumented by historical frequency of disasters. Each observation is a county in 2000. In all specifications, the unreported control variables include: longitude, latitude, distance to provincial capital (in logs), altitude (in logs), average temperature and annual precipitation between 1990 and 2000, and regional fixed effects. Panel A reports the second-stage results of the estimation. The dependent variable is the logarithm of GDP per capita in 2000. ln(Converts/Pop1920) is the logarithm of converts of each county in 1920 normalized by population. Panel B reports the first-stage results of the estimation. The dependent variable is the endogenous variable, ln(Converts/Pop1920). Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.

Table 5. Effects on current economic development, robustness check (Panel A)

	Baseline	Initial econ. condition	Coastal dummy	Rural dummy	Catholic stations	GDP per capita 2005	Alt. measures of Protestant activities		Add. IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A. Second Stage. Dependent Variable is log GDP per capita in 2000								
ln(Converts/Pop1920)	0.16**	0.18***	0.14**	0.15**	0.10*	0.22***			0.21***
	[0.065]	[0.071]	[0.063]	[0.064]	[0.060]	[0.075]			[0.068]
ln(Missionaries/Pop1920)							0.64*		
							[0.360]		
ln(Churches/Pop1920)								0.28**	
								[0.122]	
Land tax 1820		0.03***							
(in logs)		[0.011]							
Coastal province			0.47***						
			[0.051]						
Rural county				0.26***					
				[0.053]					
ln(Catholic stations/Pop1920)					0.41				
(Prefecture level)					[0.624]				
F-stat on IV	27.05	24.14	26.84	27.68	26.41	27.05	5.03	26.96	13.92
Sargan Test (p-value)	.	.	.	.	.	.	.	.	0
Obs	1742	1742	1742	1742	1586	1742	1742	1742	1742

Table 5. Effects on current economic development, robustness check (Panels B, C)

	Baseline	Initial econ. condition	Coastal dummy	Rural dummy	Catholic stations	GDP per capita 2005	Alt. measures of Protestant activities		Add. IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel B. First Stage									
Dependent Variable	ln(Converts/Pop1920)						ln(Missionaries /Pop1920)	ln(Churches /Pop1920)	ln(Converts /Pop1920)
Disaster freq.	5.53***	5.28***	5.51***	5.51***	6.06***	5.53***	1.32**	3.06***	5.51***
(DF = 1 or 5, 1880-1920)	[1.065]	[1.075]	[1.065]	[1.047]	[1.181]	[1.065]	[0.599]	[0.593]	[1.065]
Disaster freq.									0.45
(DF = 2 or 4, 1880-1920)									[0.508]
Panel C. OLS Estimates. Dependent Variable is log GDP per Capita in 2000									
ln(Converts/Pop1920)	0.06***	0.06***	0.05***	0.04***	0.06***	0.07***			0.06***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]	[0.009]			[0.008]
ln(Missionaries/Pop1920)							0.08***		
							[0.014]		
ln(Churches/Pop1920)								0.05***	
								[0.014]	

Note: This table reports a series of robustness checks. All specifications are estimated through 2SLS, where historical Protestant activities are instrumented by historical frequency of natural disasters. Each observation is a county in 2000. In all specifications, the unreported control variables include: longitude, latitude, distance to provincial capital (in logs), altitude (in logs), average temperature and annual precipitation between 1990 and 2000, and regional fixed effects. Panel A reports the second stage estimates. The dependent variable is the logarithm of GDP per capita in 2000. In column (1)-(5), and (9), Protestant activities are measured by logarithm of converts of each county in 1920 normalized by population, while in column (7) and (8), they are measured by logarithm of missionaries per 1,000 people and logarithm of Protestant churches per 1,000 people, respectively. Panel B reports the first stage estimates. The dependent variables are the endogenous Protestant activity variables. Panel C reports the corresponding OLS specifications of Panel A without instruments. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.

Table 6. Long-term effects on education and health care outcomes (Panel A)

	Years of schooling				Child mortality rate			
	Baseline	Validity	Robustness	All	Baseline	Validity	Robustness	All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Second Stage, Dependent Variable is log of years of schooling or childhood mortality rate in 2000								
ln(Converts/Pop1920)	0.030**	0.028*	0.029**	0.028**	-0.443***	-0.536***	-0.443***	-0.536***
	[0.015]	[0.014]	[0.015]	[0.014]	[0.164]	[0.173]	[0.165]	[0.173]
Disaster freq.		-0.124**		-0.118**		-0.814		-0.802
(DF = 1 or 5, 1980-2000)		[0.054]		[0.053]		[0.649]		[0.649]
Rivers		-0.002		-0.003		0.146		0.142
		[0.009]		[0.009]		[0.106]		[0.106]
Road density		0.035***		0.029***		0.024		0.011
(in logs)		[0.007]		[0.006]		[0.083]		[0.078]
Agriculture/GDP		-0.034***		-0.025***		0.018		0.036
(in logs)		[0.005]		[0.004]		[0.055]		[0.048]
Subsidy/Pop2000		0.008		0.006		-0.101		-0.103
(in logs)		[0.007]		[0.007]		[0.086]		[0.087]
Coastal province			-0.003	-0.002			-0.042	-0.011
			[0.012]	[0.011]			[0.131]	[0.137]
Urban county			0.078***	0.047***			0.005	0.095
			[0.012]	[0.011]			[0.137]	[0.129]
ln(Catholic stations/Pop1920)			0.029	0.04			-0.936	-0.737
(Prefecture level)			[0.145]	[0.141]			[1.640]	[1.718]
Adjusted R-squared	0.414	0.477	0.456	0.487	0.483	0.428	0.482	0.428
F-stat on IV	26.81	26.74	27.4	27.09	26.81	26.74	27.4	27.09
Obs	1742	1742	1742	1742	1742	1742	1742	1742

Table 6. Long-term effects on education and health care outcomes (Panel B)

	Years of schooling				Child mortality rate			
	Baseline	Validity	Robustness	All	Baseline	Validity	Robustness	All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel B. OLS Results, Dependent Variable is log of years of schooling or childhood mortality rate in 2000								
ln(Converts/Pop1920)	0.009***	0.005***	0.004***	0.003*	-0.080***	-0.066***	-0.067***	-0.061***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.018]	[0.018]	[0.019]	[0.018]

Note: This table examines the long-term effects of Protestant activities on current education and health care outcomes. Each observation is a county in 2000. In all specifications, the unreported control variables include: longitude, latitude, distance to provincial capital (in logs), altitude (in logs), average temperature and annual precipitation between 1990 and 2000, and regional fixed effects. Historical Protestant activities are instrumented by historical frequency of disasters. Panel A reports the second stage estimates. The dependent variable is the logarithm of years of schooling (columns [1] through [4]) and logarithm of the childhood mortality rate (columns [5] through [8]) in 2000. ln(Converts/Pop1920) is the logarithm of converts of each county in 1920 normalized by population. Panel B reports the corresponding the OLS results. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.

Table 7. Relationship between historical Protestant activities and development of modern education

Enrollment rate	Church primary schools	Public primary schools	All Primary schools	
(in logs)	(Tobit)	(Tobit)	Overall sample	Converts/Pop1920 = 0
	(1)	(2)	(3)	(4)
ln(Converts/Pop1920)	1.33	0.12	0.12	
	[0.04]***	[0.01]***	[0.01]***	
ln(Converts/Pop1920 in the neighboring counties)			0.06	0.08
			[0.02]***	[0.04]**
R-squared			0.33	0.25
Obs	1742	1742	1742	250

Note: This table examines the effects of historical Protestant activities on development of modern educational system in the early 1920s of China. Each observation is a county in 2000. In all specifications, the unreported control variables include: longitude, latitude, distance to provincial capital (in logs), altitude (in logs), and regional fixed effects. Development of modern education is measured by enrollment rate (in logs) of Church primary schools (column [1]), Public primary schools (column [2]), and primary schools in total (column [3] and [4]). ln (Converts/Pop1920) is the logarithm of converts in each county in 1920 normalized by population. The cross-county spillover effects are captured by the weighted average of Converts/Pop in 1920 in contingent neighboring counties (in logs). Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.

Table 8. Effects on current economic development: Channels

	OLS				2SLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(Convert/Pop1920)	0.06***	0.04***	0.05***	0.04***	0.16**	0.13*	0.14**	0.12*
	[0.008]	[0.008]	[0.008]	[0.008]	[0.065]	[0.068]	[0.068]	[0.069]
ln(Years of schooling)		0.16***		0.15***		0.13***		0.12***
		[0.016]		[0.017]		[0.028]		[0.027]
Child mortality rate			-0.06***	-0.04***			-0.05***	-0.03**
			[0.010]	[0.010]			[0.014]	[0.012]
Adjusted R-squared	0.358	0.391	0.369	0.395	0.296	0.348	0.325	0.362
F-stat on IV					26.89	23.81	24.07	22.27
Obs	1742	1742	1742	1742	1742	1742	1742	1742

Note: This table reports estimates of equation (1), where historical Protestant activities are instrumented by historical frequency of extreme weather. Observations are at the 2000 county level. Columns (1) through (4) report estimates of the OLS results while columns (5) through (8) report estimates of the second stage. The dependent variable is the logarithm of year of GDP per capita in 2000. The main independent variable is the logarithm of year of schooling and the child mortality rate in 2000. ln(Converts/Pop1920) is the logarithm of converts of each county in 1920 normalized by population. Panel B reports estimates of the OLS results. Instruments include the flood and drought frequency between 1880 and 1920. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.

Table 9. Effects of Protestant activities on economic development after adjusting for education and health: bounding analysis

			Child mortality rate						
			(1)	(2)	(3)	(4)	(5)	(6)	(7)
			0	80% δ_2	100% δ_2	120% δ_2	150% δ_2	180% δ_2	200% δ_2
ln(Years of schooling)	(1)	0	0.16	0.14	0.14	0.14	0.13	0.13	0.12
			[0.07]**	[0.06]**	[0.06]**	[0.06]**	[0.06]**	[0.06]**	[0.06]*
	(2)	80% χ_2	0.13	0.12	0.12	0.11	0.11	0.1	0.1
			[0.06]**	[0.06]*	[0.06]*	[0.06]*	[0.06]*	[0.06]*	[0.06]
	(3)	90% χ_2	0.13	0.12	0.11	0.11	0.11	0.1	0.1
			[0.06]**	[0.06]*	[0.06]*	[0.06]*	[0.06]*	[0.06]	[0.06]
	(4)	100% χ_2	0.13	0.11	0.11	0.11	0.1	0.1	0.09
			[0.06]**	[0.06]*	[0.06]*	[0.06]*	[0.06]*	[0.06]	[0.06]
	(5)	110% χ_2	0.12	0.11	0.11	0.1	0.1	0.09	0.09
			[0.06]*	[0.06]*	[0.06]*	[0.06]*	[0.06]	[0.06]	[0.06]
	(6)	120% χ_2	0.12	0.11	0.1	0.1	0.1	0.09	0.09
			[0.06]*	[0.06]*	[0.06]*	[0.06]	[0.06]	[0.06]	[0.06]
	(7)	140% χ_2	0.11	0.1	0.1	0.09	0.09	0.08	0.08
			[0.06]*	[0.06]	[0.06]	[0.06]	[0.06]	[0.06]	[0.06]

Note: This table reports estimates of equation (4). Each cell reports the results of a separated regression. They are the 2SLS estimates of the coefficients on ln(Converts/Pop) in 1920 that are instrumented by flood and drought frequency in 1900-1920. The dependent variable is ln(GDP per capita) in 2000. The returns to education and health care outcomes stem from OLS coefficients in an auxiliary regression of the ln(GDP per capita) on years of schooling, child mortality rate, ln(Converts/Pop), and the control variables (as reported in column (5) of Table 2). To adjust for the potential bias of the OLS estimates, the coefficient on years of schooling is multiplied by factors indicated in the stub headings, and coefficient on child mortality rate is multiplied by factors indicated in the column headings. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.

Table 10. Growth rate of GDP per capita before and after 1978

	Dep. Var.: Growth rate of GDP per capita from year t to t+1					
	1952-1977			1978-2008		
	(1)	(2)	(3)	(4)	(5)	(6)
ln (Converts/Pop1920)	0.007	0.007	0.009	0.016	0.016	0.017
	[0.012]	[0.008]	[0.008]	[0.004]***	[0.003]***	[0.003]***
GDP per capita (year t)			-0.168			-0.003
			[0.163]			[0.004]
Year FE	No	Yes	Yes	No	Yes	Yes
Obs	468	468	468	540	540	540
R-squared	0	0.62	0.62	0.03	0.55	0.55

Note: This table examines the effects of historical Protestant activities on provincial level GDP growth rate before and after 1978. The dependent variable is the GDP per capita growth rate from year t to year *t+1*. Historical Protestant activities are measured by the logarithm of provincial-level converts per 1,000 people in 1920. Other control variables include provincial-level GDP per capita at year t, and the year dummies. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.