The Long-Term Effects of Christian Activities in China

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August 2012

Does culture, and in particular religion, exert an independent causal effect on long-term economic performance, or is it merely a reflection of the latter? We explore this issue by studying the experience of Christianity in China during the late 19th and early 20th century. Despite of the arduous process, the fast spread of Christianity, especially among the less developed and isolated regions of China, open a new window for the local people to see the outside world, and encourage them to become more open-minded. Such cultural interactions generate persistent and profound impacts on regional development. Using county-level datasets on Christian activities in 1920 and socioeconomic indicators in 2000, we find a robust positive relationship between the intensity of Christian activities and today's performances. To better understand if the relationship is causal, we review historical documents on the location pattern of missionaries' selection and use instrumental variable (IV) approach. Our IV estimates confirm and enhance the OLS results. Together the empirical evidence suggests that increased Christian activities had a positive effect on long-term socioeconomic development. We further investigate the transmission channels between history and today, and find that Christian activities affect today's performances through accumulation of human capital, openness to foreign direct investments, as well as other unobserved mechanisms.

Keywords: Christianity, Economic Growth, Education, Foreign Direct Investment, China

JEL Classification Numbers: I20, N15, N35, O11, O43, Z12

Preliminary; For Seminars and Conferences only; No Dissemination or Citation Please

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

--- President William McKinley, 1900[1]

I. **Introduction**

Does culture, and in particular religion, exert an independent causal effect on politics and the economy, or is it merely a reflection of the latter? This question is the subject of a long-standing debate in social science, with Karl Marx and Max Weber among its most famous proponents. The former famously opined that while the economy did influence culture, the reverse was not true. The latter, on the other hand, rejected that view and insisted that causality runs both ways. In particular, in "*The Protestant ethic and the Spirit of Capitalism*", Weber claims that Reformed Protestantism, by nurturing stronger preferences for hard work and thriftiness has led to greater economic prosperity. Empirical test of the relationship between religious beliefs, with their impacts on moral reasoning and the related behavioral incentives, and economic growth is intimidating. Indeed, religions, formal institutions, and economic performance are often entangled with each other in one society. As a result, it is very challenging to examine the causal effects among these socioeconomic variables.

In recent years, scholars begin to use unique historical examples to examine the causal effects of religion on long-run economic developments and provide empirical tests for the theories of Marx and Weber. Using county-level data from late 19th century Prussia, Becker and Woessman (2009) exploit the initial concentric dispersion of the Reformation and use distance to Wittenberg as an instrument for Protestantism. They find that Protestantism led to higher level of economic prosperity. But the channel of this causal effect was not work ethic or religious ideology, but rather education and literacy thanks to reading the Bible. Taking German Lands of the Holy Roman Empire as an example, Cantoni (2009) provides another test for Weber's hypothesis. Using German population figures in a dataset comprising 272 cities in the period of 1300 to 1900, his OLS and IV estimations find no effects of Protestantism on economic growth. Other studies also obtain mixed results on the role of religion on long-run economic performances (e.g. Glaeser and Glendon, 1998; La Porta et al. 1998; Lipset and Lenz, 2000; Putnam, 2000; Stulz and Williamson, 2001; Sacerdote and Glaseser, 2001).

In this paper, we use the lens of history to better understand this fundamental question by exploiting a quasi-natural experiment in China. In particular, we want to find out how the spread of Christianity in China in the late 19th and early 20th century has affected the long-term economic performance today. The Qing government forbade Christian activities until being defeated by Britain in two opium wars and signing the *Treaty of Tianjin* and the *Treaty of Peking* in 1858 and 1860 respectively.

[1] The president address for the Ecumenical Missionary Conference in the Carnegie Music Hall, New York City, April 21, 1900.

The widespread of Christian activities after 1860 caused serious conflicts with the Chinese central and local governments, the elite class and ordinary people. Such conflicts culminated in the Boxer Rebellion in 1900, when hundreds of Christian missionaries and thousands of Christian converts were killed. This rebellion led to a war between the Qing government and the Eight Powers. The Qing government was defeated again and was forced to sign the humiliating *Boxer Protocol* in 1901. Since then, Christian activities in China have been well protected.

There are two reasons why China's experience is important for testing the role of religion on long-run economic performance. First, China provides a perfect example to study within-country variations in religious activities and economic performances. Many existing studies have already compared the outcomes of religious activities in different countries. These cross-country studies are illuminating. However, formal and informal institutions as well as natural endowments could vary a lot across different countries. Consequently, the internal mechanisms of religion and economic growth in these studies are sometimes murky. Despite of this, due to data availability, few studies has explored within-country variations.[2] We contribute to the literature by using China to conduct such a study. China is a large country with relatively homogenous culture and consistent political system but quite heterogeneous economic performances. This setting provides variations large enough to conduct a clean empirical test in order to examine the role of religion on long-run economic performances.

Second, China was dominated by Confucianism for thousands of years. Christianity was illegal and marginal in most periods of the ancient Chinese society. It became legalized and wide-spread in China since the late 19th century as a result of foreign pressures. Since then, foreign missionaries came to spread the God's gospel in different places of China, and their location choices were influenced by various factors and historical randomness. Therefore, the spread of Christianity in China was to a large extent a quasi-natural experiment. This feature allows us to examine the long-lasting effects of a sudden and exogenous historical event on the variations of economic performances eighty years later. On this regard, our research contributes to the large body of literature of the effects of historical events on current economic developments, such as Acemoglu, Johnson and Robinson (2002; 2005) and Nunn (2009).

Our paper provides the first empirical evidence on Christian activities on long-run economic development in China. We construct a dataset mapping the historical Christian activities and current economic indicators at the county level and find that the diverse socioeconomic performances across different counties in 2000 are positively correlated with the degree of Christian activeness at the beginning of the 20th century. However, such correlation might be subject to endogeneity issue due to unobservable county level heterogeneities. It is possible that those more economically and socially developed counties that managed to attract more Christian activities in the past tend to continue to perform better in the present. In this case, we

[2] Becker and Woessman (2009) and Cantoni (2009) are exceptions.

might obtain a positive correlation between past Christian activities and present economic outcomes, even though the former do not have any causal effect on the latter.

We pursue a number of strategies to better understand the reason behind the relationship between Christian activities and current socioeconomic development. First, we review the evidence from historians on the nature of selection into Christian activities. Historical archival evidence shows that it was actually less developed areas of China that tended to be the hotbed for more intensive Christian activities. We then discuss the logics behind this seemingly paradoxical relationship in detail. Second, we use instruments to estimate the causal effect of Christian activities on subsequent economic development. The instruments are the frequency of floods and droughts between 1900 and 1920. Like the OLS coefficients, the IV coefficients are positive and significant, suggesting that increased intensity of Christian activities leads to better subsequent socioeconomic performances.

We further explore the precise channels of causality underlying the relationship between Christian activities and socioeconomic development. Using historical evidence as a guide, we manage to confirm that higher intensity of Christian activities results in more active foreign direct investments and better education and health conditions today. However, there might still be other unobserved channels between Christian activities and today's socioeconomic development that are not explained by FDI and human capital stories.

In the next section, we provide some historical background on the spread of Christianity during the late 19th and early 20th century. Section III describes the data we use to study the long-term effects of the spread of Christianity. Section IV provides OLS estimations to assess the relationship between the spread of Christianity and today's economic performances and then use an instrumental variable approach to address the issue of causality. Section V explores the possible mechanisms for the long-term effects. The final section discusses the implications of our findings and concludes.

II. Historical Background

Christianity came to China as early as in the 17th century, but was never a major religion in this Confucianism-dominated country. It was recorded that missionaries came to China since 635 AD. As Europe –China's bilateral connections became more active, Roman Catholic Church expanded unprecedentedly in China. It was estimated that more than a hundred thousand Christian converts in China in the mid 17th century. However, Pope Clement XI forbade Chinese Christians to engage in Confucius-related activities in 1704, which irritated Emperor Kangxi. As a result, he completely banned Christian activities in 1720. This policy was extended and reinforced by the successive emperors. Since the early 19th century, the trade between Europe and China reached a historical record, and Christian missionaries attempted to penetrate China

again. But the Christian activities were still banned by the Qing court, and the missionary presence was still negligible up to the 1840s.

China was forced to open up to the western powers as China was defeated by Britain in 1842. As a result, Christian missionaries were allowed to work in China in 1846. Both the Roman Catholics and the Protestants began to revive slowly in China. China was defeated again by Britain and France in 1860. The 1858 the *Treaty of Tianjin* permitted foreigners to travel in the internal regions of China, which had been formerly banned. The *1860 Convention of Peking* granted freedom of religion in China and allowed the missionaries to own lands and build churches. Since then Christian missionary activities became legal, and a large number of missionaries came to China from Europe and America, spreading across many provinces in China. By 1900, there were more than 80 thousand Protestant converts and 720 thousand Roman Catholic converts (Wang, 1991).

The rapid expansion of Christianity led to a great number of cultural conflictions among Chinese societies. There are three reasons why Christianity was seriously opposed in China. First of all, the monotheism of Christianity was not accepted by the polytheism and ancestor worship of Chinese culture. Second, the egalitarian tradition of Christianity clashed with the entrenched hierarchical culture of China. More generally, Western customs accompanying the expansion of Christianity were drastically different from Chinese customs. Mistrust between Chinese people and Western missionaries accumulated, leading to a number of cultural conflicts. Such conflicts culminated in the Boxer Rebellion in 1900. In this tragic xenophobic conflict, more than 20 thousand Christians were killed. This rebellion led to a war between the Qing government and the Eight Powers. The Qing government was defeated again and was forced to sign the humiliating *Boxer Protocol* in 1901. Since then, Christian activities in China was very well protected.

The first two decades of the 20th century witnessed the biggest expansion of Christianity in China. 1500 foreign Protestant missionaries arrived in China in 1900. The number climbed 3445 in 1905 and 8000 in 1927, more than half of which were from the US. There were about 80 thousand Protestant converts in 1900, and 130 thousand in 1904. In 1922 this number soared to 402,539., and this number more than doubled in 1920. For Catholics, 886 missionaries were present in China, and this number climbed to 2068 in 1930. There were 742 thousand Catholic converts in 1900. This number reached 1 million in 1907, 2 million in 1921, and 2.6 million in 1932. By the time of 1920, there were more than 120 Protestant denominations in China, and church activities penetrated nearly 70 percent of the counties (Wang, 1991).

The tragedy in the Boxer Rebellion compelled the churches to reflect the methods of preachment in China. In particular, many denominations came to realize that the hostility toward Christianity was largely caused by Chinese people's ignorance of Western civilization and mistrust of foreigners in general. As a result, the missionaries began to take measures to build trust between foreigners and Chinese, and disseminate Western civilization to all walks of life in Chinese society. An important method to build mutual trust was disaster relief. Timothy Lee, a famous missionary in

China in the late 19th century, once said that disaster relief was "an ideal way to reduce prejudices and prepare the ways for the Chinese to accept Christianity" (Gu, 2010).

China is one of the countries mostly affected by natural disasters. For a long time, it has developed rather sophisticated relief policies. However, the gradual collapse of central empire in the late 19th century caused such policies insufficient and even sometimes completely absent. Between 1876 and 1879, one of the most severe droughts in Chinese history hit five provinces of China, It was estimated that about one million people died of hunger during this unprecedented drought. Noticing the tragic situation in northern China, Christian missionaries began to raise fund and provide food and other resources to people in drought-stricken areas. More than 100 missionaries went to those areas and helped those in need (Gu, 2004, p289). On Jan 26, 1878, they even set up a disaster-relief funding committee to coordinate all the Christian relief activities. This was the first Christian relief organization in China.

Since the big drought in 1870s, Christian missionaries began to actively engage in almost every natural disaster in China. In 1888, a major flood and the subsequent cholera struck millions of people in northern China, and missionaries relieved hundreds of thousands of people in the flood. In the Yellow River flood in 1899, missionaries hired thousands of flood-hit workers to build river banks, bridges and roads. Christian disaster relief became even more active in the early twentieth century. In 1920, northern China was struck by a severe drought again. In order to coordinate international disaster relief efforts, missionaries set up a nation-wide organization, China International Famine Relief Commission, in 1921, and raised over 30 million US dollars for the famine.

In the efforts of saving life in the disaster-hit areas, missionaries realized that tremendously lagged-behind science, technology and infrastructure in China were the key impediments for disaster relief. In order to better relieve and prevent disasters, missionaries actively disseminated knowledge of modern science and technology in China. Since the late nineteenth century, they organize translating a large number of western books on science and technology into Chinese. In fact, many of the Chinese translators became famous scientists later on. In addition, missionaries who travelled to disaster-struck areas found that primitive infrastructure severely prevented timely relief efforts. Thus they actively persuaded Chinese government and business elites to build modern infrastructure system. For example, Shanxi province, a landlocked less-developed region, pioneered in railroad construction in China. A 250-km railroad was completed in 1907, connecting Taiyuan city, the mountain-surrounded capital city of Shanxi, with the neighboring Zhili province. This railroad contributed tremendously to subsequent economic development of this inland province. Timothy Lee, one of the most famous missionary in modern China, advocated the building of this railroad for decades. Without his advocacy this railroad would not be possible.

Due to the lack of modern medical knowledge and proper public health services, cholera and plague usually killed numerous people in the disaster-hit area. For this reason, missionaries were particularly enthusiastic in establishing hospitals and

promoting medical knowledge in those areas. By 1937, over 300 Christian hospitals were established in China, providing more than 20 thousand beds. These hospitals were not only located in coastal provinces, but more in inland areas. Many hospitals offered free medical services to the poor and the needed. Furthermore, the missionaries made efforts to spread knowledge of public health in those areas, and they even set up medical and nurse schools in those areas to train local doctors and nurses.

As Christian missionaries became more deeply engaged in Chinese society, they gradually found out that the underdeveloped education system was the fundamental source of all the problems they found in disaster reliefs. Many missionaries reported that even highly educated local government officials and gentry elites knew very little knowledge about civil engineering and other related science and technology, and the main reason of that was traditional Confucius education system did not cover any basic science training. As a result, they called for fundamental education reform in China, trying to persuade Chinese government to give up the outdated Confucius education system and focus on natural science. Moreover, many missionaries put the idea of education reform in practice, and established a number of elementary schools, middle schools, and universities across China. Many of these Christian institutions soon became quite prestigious, and some survived the political turmoil in the ensuing years and were still active even today. In fact, education was the most successful Christian undertakings in modern China. By 1918, over 13 thousand Christian schools were established, accounting for one sixth of total schools in China.

The status of Christianity overturned since the People's Republic of China (PRC) was established in 1949. The government then was highly concerned that Christian missionaries were representatives of "western imperialism".[3] Consequently, the central government established the official Christian church system and severed their connections with foreign Christian organizations. By 1952, all foreign missionaries left China. The government took over all of the Christian schools and hospitals, and regulated all Christian activities since then. As the revolution progressed, Christianity, along with other religions in China, was smashed to the bottom. All religious activities, including the government-regulated churches, were banned during the Cultural Revolution (1966-1976). Christianity revived in China since the Reform and Open-up in 1978. Government-regulated Christian churches began to active again, and expanded rapidly in China. Christianity is now among the five biggest religions in China. Despite rapid growth, Christianity is still under tight regulation by the Chinese government. Religious services can only be practiced in the government-sanctioned churches, and these churches do not maintain any official connection with foreign churches. Family fellowships are considered illegal, and can only practice services underground.

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

III. Data and Descriptive Statistics

3.1. Basic Observation Unit

Table 1 reports summary statistics of our sample. To match the historical church information with the current economic development data, we use counties in 2000 as our basic geographical units. Notice that counties in 1920 typically do not have a one-to-one mapping with counties in 2000 due to administrative changes such as merging and splitting of counties, as well as adjustments in county boundaries. By using the overlapping area of 1920 and 2000 counties as weights, we convert Christian activity variables at the 1920 county level into those at 2000 county level. Refer to the Data Appendix for details of this procedure. In the end, our data contains 1585 counties covering nearly the entire area of China's proper.

3.2. Historical Christian Activities

Our 1920 Christian activity measures mainly come from the book: *The Christian Occupation of China: A General Survey of the Numerical Strength and Geographical Distribution of the Christian Forces in China*. It was compiled by the China Continuation Committee, the top administrative organization of Christian churches in China. The purpose of the book was to conduct a throughout research on the development status of Christian churches in China in order to better promote and spread Christianity among the Chinese society. Leaders and directors of all Christian missionary bodies in China were involved in the project. The survey started from 1918 and took three years to finish. Besides its religious contents, it also provided a general picture of the Chinese society in the early 20th century.

The survey documents the number of churches, vicars, and converts at the county level. We normalize these variables by the population counts reported in the survey, and use them as intensity measures of Christian activities in 1920. According to Table 1, there are 7.62 converts, 0.17 churches, and 0.25 vicars per 10,000 people in each county on average. Figure 1 presents the distribution of converts in our sample, with darker polygons representing counties with higher convert population densities. It should be noted that the places with relatively dark color are spread out all over the map, suggesting that Christian activities are not only concentrated along the coastal area in the early 20th century as one would normally expect.

[INSERT FIGURE 1 HERE]

3.3. Economic Development

Our economic development measures in 2000 are drawn from different products of the National Bureau of Statistics of China. County level GDP and educational expenditure data comes from the Public Finances Statistical Materials of City and County. Information on demographics (e.g., population and death rate) and education level (e.g., years of schooling and literacy rate) comes from the Fifth National Population Census. The key dependent variable - GDP per capita in the year of 2000

is 5445 yuan (about $778) on average in our sample. Figure 2 reports its distribution.

[INSERT FIGURE 2 HERE]

FDI variables are constructed from Survey on Manufacturing Industrial Enterprises above Designated Size. For each firm, we know its location, number of employees, value of asset, and revenue in one fiscal year. A firm's nationality is identified based on the information of its main shareholders. We calculate the share of foreign firms as a measure of the prevalence of FDI in a given location.

3.4. Climate

Most climate information, including precipitation, temperature, and the frequency of flood and drought, is collected by China Meteorological Administration at station level. The former two variables come from the Surface Meteorological Data, available for 753 meteorological stations over the period of 1990 to 2005. The last one comes from the Gallery of Drought and Waterlogging Distribution in Past Five Hundred Years China, available for 120 stations over the period of 1470 to 2000. The data reports, for a given station in any given year, the degree of flood/drought in 5 scales: 1 stands for flood; 3 stands for ordinary weather; 5 stands for drought; 2 and 4 stand for intermediate status between 1 and 3, 3 and 5, respectively. We count the incidence rate of flood and drought over certain periods and use them as measures of natural disaster frequency for a given location.

To convert the station level measures into the county level variables, we use an inverse-distance-weighted method based on the assumption that a county's climate condition should be influenced the greatest most by the most nearby stations and relatively less by stations further away. Refer to the Data Appendix for detailed description of the method and formula.

3.5. Geographical Characteristics

We use the latitude–longitude coordinates of the geographical centroid of each county to calculate its distance to the capital cities, and meteorological stations. We use spherical distance to take into account the curvature of the earth.[4]

Average altitude for each county is available in the SRTM 90m Digital Elevation Data (Jarvis et al., 2008) obtained from Consortium for Spatial Information (CGIAR-CSI) of the Consultative Group for International Agricultural Research (CGIAR).

[4] Spherical distance between any two points is calculated using the haversine formula (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} stands for longitude and latitude of point X, respectively.

IV. Empirical Results

4.1. Baseline Correlations

We begin by showing the relationship between a county's Christian activity in 1920 and its modern economic performance. Figure 3 shows the raw correlation between the log number of converts per 10,000 people in 1920 and the log per capita GDP in 2000. It is clear that there is a strong and positive relationship between these two variables.

[INSERT FIGURE 3 HERE]

We further examine this relationship with Ordinary Least Squares (OLS) regressions controlling for other county level characteristics. The baseline model is:

$$\ln(\text{per capita GDP 2000})_i = \alpha + \beta \ln(\text{Christian activity}_i) + \boldsymbol{X_i}'\gamma + \varepsilon_i \qquad (1)$$

where $\ln(\text{Christian activity}_i)$ is the logarithm of 1920 Christian converts per 10,000 people. X_i is a vector of control variables including county location, climate, and other geographical characteristics. ε_i is the error term. β is the parameter of interest.

The OLS results for equation (1) are reported in Table 2. Column (1) only contains the variables of interest. This result reflects the relationship shown in Figure 4. In Column (2), we include a set of regional fixed effects. While the magnitude of the marginal effect is slightly reduced, the correlation between Christian activities and GDP per capita remains positive and significant at 1% level.

[INSERT TABLE 2 HERE]

Although the first two regressions report a positive relationship between Christian activities and current GDP per capita, this relationship could be a result of other factors affecting these two variables simultaneously. For example, counties that are geographically more accessible tend to have more Christian activities in 1920; at the same time, they have more favorable transportation conditions which would contribute to better economic performance in modern times. To separate this effect out, in column (3), we control for a set of variables characterizing a county's geographic location, which includes the longitude and latitude of the county centroid, distance to the provincial capital, and the average latitude.[5] We further control for county climates by adding in precipitation and temperature in column (4), and current frequency of extreme weather (1978-2004) in column (5). The coefficients on the Christian activities stay positively significant across different specifications, remaining around the periphery of 0.05.

4.2. Establishing Causality: Instrument Variables Results

Although we have established the relationship between Christian activity in 1920

[5]The coefficients of these variables are expected: The terrain of China is high in the west and low in the east, therefore higher land tend to be further away from the coast line, therefore lower value of longitude means higher altitude and further away from the coast line, which in turns means less economic development.

and current economic performance, it remains unclear whether the Christian activity has a causal impact on the current foreign investment. One potential challenge for the causal interpretation is that missionaries and churches may self-select themselves into more developed counties in 1920 to expand their religious activities, and these counties tend to be richer today. Certain strategy has to be taken in order to address this endogeneity issue.

First, we want to point out that although selection might be an important issue, nevertheless, as shown by the historical evidence in Section II, the adjusted working strategy of Christian churches since the early 20th century implies that missionaries were more likely to go to less developed regions rather than more developed ones. In this sense, the positive relationship between Christian activities and economic performance is unlikely to be driven completely by selection. In fact, should there be any bias, the OLS regression will underestimate the true effect of Christian activities.

In the absence of the 1920 economic development data at the county level, directly testing the above argument is hard. Instead, we follow Acemoglu, Johnson and Robinson (2002) to use population density in 1920 (population divided by geographical area) as a proxy for the economic prosperity and plot it against the intensity of Christian church activities. Figure 4 shows the results. There is a strong negative correlation between these two variables, indicating that Christianity was more active among less prosperous regions.

[INSERT FIGURE 4 HERE]

Next, we use instrument variable (IV) to formally address the potential selection issue and estimate the causal effects of Christian activities on long-run economic development. As described in Section II, since the beginning of the 20th century, Christian churches have pursued a "disaster relief" strategy to gain trust and preach the word among Chinese communities. In light of this, we construct county level historical incidental rate of natural disaster and use them as instruments for intensity of Christian activities. More specifically, the two instrument variables being constructed are (1) the frequency of flood, defined by the number of years that a county takes value of 1 or 2 in the Gallery of Drought and Waterlogging Distribution dataset from 1900 to 1920, and (2) the frequency of drought, defined by the number of years that a county takes value of 4 or 5 in the above dataset in the same period.

[INSERT TABLE 3 HERE]

The 2-stage Least Squares (2SLS) estimates are reported in Table 3. Column (1) reports results without any control variables; Column (2) controls for regional fixed effects; Column (3) adds in the geographic location controls; Column (4) and column (5) further include current climate measures.

The first stage results are reported in the Panel B of the table. Coefficients on both flood and drought frequency are significantly positive, suggesting that counties more likely to suffer from climate disasters tend to induce more intense Christian activities. The F-statistics of instrument variables remains higher than the critical value suggested by Stock and Yogo (2005), which rules out the concerns of weak

instruments.

The validity of our instruments relies on the assumption that the extreme weather about one hundred years ago does not directly affect current economic development. Reasonable as this assumption appears to be (both intuitively and statistically[6]), one might still worry its potential violation due to the persistency of a location's climate over time. Regions easy to flood in the past might also be easy to flood today, which in turns might affect current economic activities. Column (5) in Table 3 deals with this concern by directly controlling for measures of contemporary climate disasters. Compared with other specifications, this regression delivers a much higher P-value in the Sargan over-identification test, showing strong supports for the exclusive restriction of our instruments. At the same time, the coefficient on log(convert/population) is barely affected.

Estimates of the second stage are reported in panel A. Coefficients on log(convert/population) remain positive and significant across different columns, ranging from 0.13 to 0.17. These results are not only statistically, but also economically significant. According to Column (5) in Table 3, one standard deviation change in log(convert/10,000 persons) would coincide with 0.48 standard deviation change in log per capita GDP. For a country with the mean level of income at 5444 yuan, one more convert per 10,000 people implies a 114.5 yuan (about 17.1 US dollars) increase in per capita GDP. In addition, magnitudes of the 2SLS coefficients are significantly higher than those of OLS, which confirms our conjecture on the bias direction due to selection issues.

4.3. Robustness Checks

We conduct in Table 4 a series of exercise to confirm the robustness of our estimates. Column (1) takes out observations with Cook's distance greater than 4/N, where N is the sample size. Compared with our preferred specification in table 3, coefficient on convert density is unaffected without these potentially influential observations.

[INSERT TABLE 4 HERE]

Given that coastal areas that are easier to access in the past and are enjoying more open policies in present, one might suspect that our estimated effects on Christian activities are merely driven by China's coast-hinterland disparities. Column (2) and (3) in Table 4 rule out this possibility. Column (2) adds in a dummy variable indicating whether a county belongs to a coastal province or not. The coefficient on this variable is significantly positive as expected. However, including this variable does not change our coefficient on convert density. In Column (3), we drop the counties in the coastal provinces and use only the hinterland sample. The effects of Christian activities on long-run economic performance become even stronger.

The next two columns in Table 4 address the concern that our results just reflect

[6]All of our specifications past overidentification test at conventional statistical levels.

the urban-rural disparities. In Column (4), we add in a dummy equal to 1 if a location is a city and 0 otherwise; In Column (5), we drop the urban counties and concentrate solely on the rural ones. Our conclusion stays robust in both specifications.

We prefer the number of converts over the number of churches or vicars in our main specifications because the former captures the outcome of Christian activities, while the latter captures the input of church activities. However, our main conclusion is not affected by which one we use in the regression. Column (6) and (7) report the 2SLS results using number of churches or vicars as the measures of Christian activities respectively. The results are as expected and very intuitive. One additional church or vicar per 10,000 people corresponds to a larger positive effect on GDP per capita than one additional convert per 10,000 people does.

V. Channels of the Causal Effects

We now discuss the possible channels through which historical Christian activities influence current economic outcomes.

5.1. Effects on Human Capital Accumulation

We begin by investigating the effects of Christian activities on long-run human capital accumulation, both in terms of education achievements and public health conditions.

In Column (1) to (3) in Table 5, we use three alternative variables to measure a county's education development: educational expenditure of local government (Column 1), average years of schooling (Column 2) and literacy rate (Column 3) of the local residence. Similar with the previous section, we use the frequency of abnormal climate pattern from 1900 to 1920 as instruments for log(convert/population) in 1920.

[INSERT TABLE 5 HERE]

The first stage results are reported in Panel B. Given that we are controlling the same set of county level characteristics, the first stage results are identical across columns (and also identical to the first stage results of Column 5 in Table 3). All the instruments remain strong and significant.

Panel A reports estimates of the second stage. Same as the GDP per capita results, 2SLS delivers a higher magnitude than OLS does (reported in Panel C of the table). The conclusions we draw from Column (1) to (3) are consistent: past Christian activities have positive and significant effects on a county's long-run education achievements.

The second dimension of human capital we want to examine is public health. As discussed in Section 2, during the disaster relief, Christian churches and missionaries help local communities to build up hospitals, introduce modern medical technologies,

and improve public sanitation. In the long-run, this will be reflected in the general development of public health conditions. To test this hypothesis, we use infant mortality rate (IMR) from 2000 population census, defined as the number of deaths in children under 1 year of age per 1000 live births, as the dependent variable. IMR has been regarded as a standard measure of population health since infants are very sensitive to factors that are likely to influence health status of general population, such as general living conditions, public health services, rates of illness, and the quality of the environment. Results are reported in Column (4) of Table 5. 1 percent increase in convert density in the past implies 0.44 percent decrease in infant mortality in presence, showing a significant effect of historical Christian activities on improvements of public health.

5.2. Effects on Foreign Direct Investment

Next, we want to study if historical Christian activities promote local economic development through attracting more FDI. China has become the largest FDI recipient among developing counties, and the second largest in the world (only next the US). It is well documented in the literature that foreign investments made significant contribution to China's economic growth and it is also one of the main sources of within-China regional disparities (e.g., Cheng and Kwan, 2000).

In our case, the long term interaction with Christianity helps to narrow the cultural difference between the local Chinese residences with the outside world. One the one hand, with the appreciation of the natural disaster relief and the charity works, local communities developed friendly and intimate relationships with foreign missionaries. They also became sympathetic to Western values over time. On the one hand, during the process of preaches, missionaries learned how to get acquainted with and gain trust from the local people. They might share this unique experience with their successors, heirs, or other compatriots in general. Such improvement in cultural proximity may generate profound impacts on the business environment today, which in turns significantly lower the cost of entry for the foreign investments.

In the last three columns of Table 5, we test the above hypothesis. The dependent variable in Column (4), (5), and (6) are, respectively, the share of asset, the share of revenue, and the share of employee of foreign firms in the manufacturing industries. The 2SLS coefficients on log(convert/population) are significantly positive, showing strong evidence on the positive effects of Christian activities on current FDI.

5.3. Other Potential Channels

Becker and Woosman (2009) suggests that Protestantism does not affect current economic performance per se. It yields an effect only through increasing in literacy rate. One implication of such an argument is that, if we control for measures of current education in the GDP regression, the coefficient on the religious activities should be reduced to zero. In Table 6, we implement such a test. In particular, we want to see if the influence of historical Christian activities on current economic performance works mainly through improvement in human capital accumulation, or

attraction of FDI.

[INSERT TABLE 6 HERE]

We control for education variables in Column (1)-(3), health variable in Column (4), and FDI variables in Column (5)-(7). All of these channel controls have expected signs and are highly significant.[7] Compared with our baseline 2SLS results (0.16), adding in education controls reduces coefficients on Christian activities by about 25 percent; adding in FDI controls reduces coefficients on Christian activities by about 18 percent.

In the last column of Table 6, we add in current average years of schooling, IMR, and asset share of foreign firms simultaneously. The results using other combinations of human capital and FDI measures are very similar. The coefficient on Christian activities is reduced to 0.09, suggesting that education and FDI altogether explain about 44 percent of the total effects of Christian activities on GDP per capita.

In Column (8), the coefficient on log(convert/population) is only marginally significant at 15% statistical level. However, it should be noticed that this reduction in statistical significance is mainly due to the relatively larger standard errors, which remains stable around 0.05 across all specifications. A magnitude of 0.09 still has significant economic meaning. We hereby conclude that, there are many other social and ideological aspects that Christian activities may have impacts on in Chinese communities, such as openness to new ideas, acceptance to modern technologies, or entrepreneurship. These are simply too complicated to be completely captured by the observable variables such as education, public health, or FDI. These other potential channels deserve attention for future researches.

VI. Conclusion

In this paper, we study whether the spread of Christianity in the early 20th century China, a large but closed and backward society, generates any long-run social economic influence. We construct a dataset mapping the historical Christian activities and current economic indicators at the county level. Utilizing this within-country variation, we find that Christian activities have significant positive effects in promoting long-run regional economic prosperity.

One major identification challenge is that, if counties with better geographical, social, or economic conditions were more attractive to missionaries in the past, and these counties continue to have better economic performance in the present, we might obtain a positive correlation between past Christian activities and present economic outcomes, even though the former do not have any causal effects on the latter. We pursue several strategies to establish causality. First, through historical facts, anecdotal evidence, and statistical illustrations, we argue that Christian missionaries were actually oriented towards the less developed area to preach the word. Therefore,

[7] Except IMR, which is marginally significant at 15% level.

if there is any selection effect, it should make our OLS regression under-estimate rather than over-estimate the true effects of Christian activities on economic development. Second, taking advantage of the fact that Christian churches actively involved in "disaster relief" as a way to gain mutual trust with the local communities, we use historical frequencies of extreme weather as instruments for Christian activities. Our 2SLS estimates confirm and further enhance the OLS results on the positive effects of Christian activities. Third, our findings are robust controlling for detailed geographical and contemporary climate characteristics. They are also robust among hinterland and rural counties.

We then investigate the alternative channels through which Christian activities might generate such positive effects. As an important part of their charity work, missionaries help local people to improve infrastructure, build up schools, and introduce modern technologies. For Chinese people, such interactions with the Western culture encourage them to challenge traditional norms, and to open their mind to new ideas. Empirically, we find the improvement in human capital accumulation, including education and health status, and openness to FDI account for a major part of the positive effects of the Christian activities on economic performance. However, there are still some other profound and unobservable channels that these two indicators cannot capture, which we will leave for future researches.

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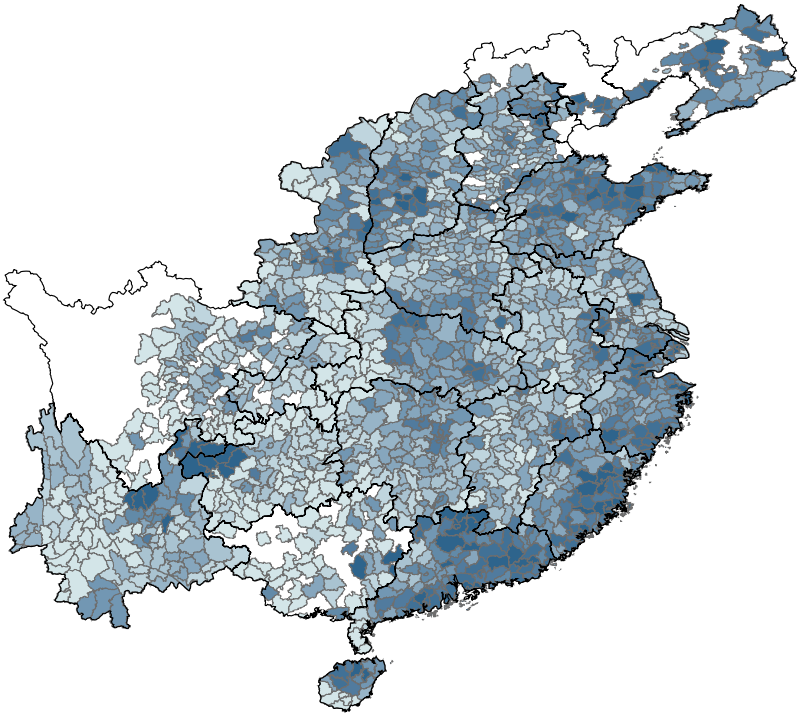

Figure 1.Converts per 10,000 people in 1920

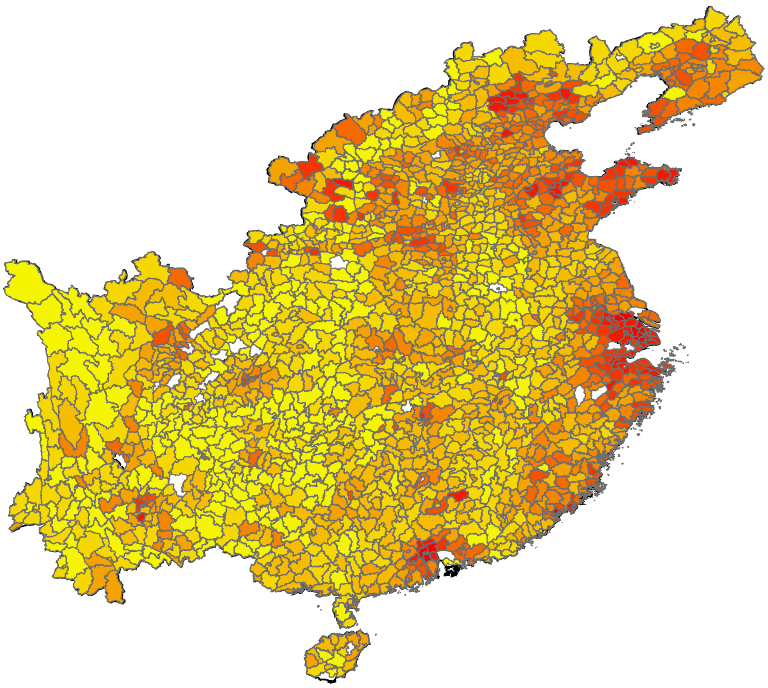

Figure 2. GDP per capita in 2000

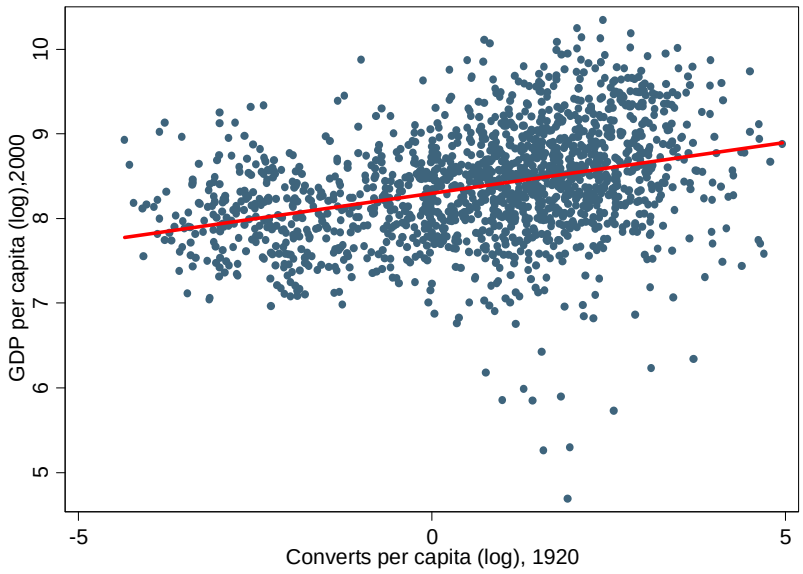

Figure 3.Correlation between convert per 10,000 people in 1920 (in logs)

and GDP per capita in 2000 (in logs)

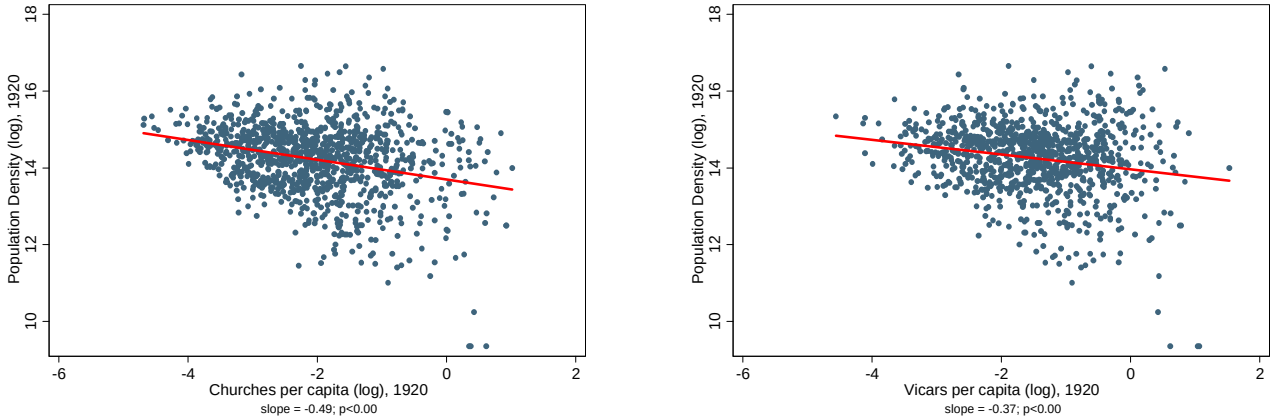

Figure 4. Correlation between population density and Christian activities

(church density on the left; vicar density on the right) in 1920

Table 1. Summary Statistics

	N	Mean	Std.	Min	Max
I. Historical Religious Activities					
Converts / 10,000 person	1585	7.62	16.87	0.00	277.11
Church / 10,000 person	1585	0.17	0.46	0.00	14.48
Vicar / 10,000 person	1585	0.25	0.37	0.00	4.62
Conditional on being positive					
Converts / 10,000 person	1332	9.06	18.04	0.02	277.11
Church / 10,000 person	1086	0.25	0.54	0.01	14.48
Vicar / 10,000 person	1212	0.33	0.39	0.01	4.62
II. Economic Performance					
GDP per capita (yuan)	1585	5445.31	3949.82	109.02	31064.16
III. Education					
Edu Exp. per capita (yuan)	1585	93.86	45.80	7.31	541.38
Year of Schooling	1585	7.25	0.86	3.45	11.06
Literacy (%)	1585	89.73	5.86	51.66	99.45
Infant Mortality Rate (%)	1585	2.33	1.87	0.00	17.86
IV. Foreign Firms					
Asset Share (%)	1585	11.85	17.59	0.00	95.66
Revenue Share (%)	1585	11.88	17.79	0.00	96.83
Employee Share (%)	1585	11.64	16.69	0.00	92.93
V. Control Variables					
Coast Province	1585	0.38	-	0	1
Distance to Capital City (km)	1585	181.39	102.28	0.58	570.50
Temperature (°C)	1585	13.73	3.52	0.16	23.72
Rain (cm)	1585	9.62	3.52	0.09	22.53
Hist. Flood Freq (1900-1920)	1585	0.38	0.10	0.00	1.00
Hist. Draught Freq (1900-1920)	1585	0.28	0.10	0.00	0.80
Hist. Flood Freq (1978-2000)	1585	0.29	0.06	0.01	0.56
Hist. Draught Freq (1978-2000)	1585	0.46	0.08	0.18	0.82

Table 2. Relationship between Historical Church Activities and Current Economic Performance

Dependent Variable is Log GDP per Capita in 2000					
	(1)	(2)	(3)	(4)	(5)
ln(Convert/Pop1920)	0.11	0.07	0.05	0.05	0.04
	[0.01]***	[0.01]***	[0.01]***	[0.01]***	[0.01]***
Longitude			0.04	0.04	0.03
			[0.01]***	[0.01]***	[0.01]***
Latitude			-0.01	-0.01	-0.01
			[0.01]	[0.01]	[0.01]*
Dist to Prov.Capital			-0.13	-0.14	-0.14
(in logs)			[0.03]***	[0.03]***	[0.03]***
Altitude			-0.09	-0.09	-0.10
(in logs)			[0.02]***	[0.02]***	[0.02]***
Temperature				-0.42	-0.55
(in logs)				[0.17]**	[0.18]***
Rain				0.18	0.34
(in logs)				[0.15]	[0.17]**
Current Flood Freq.					-1.31
(1978-2000)					[0.48]***
Current Draught Freq.					-0.47
(1978-2000)					[0.36]
Reg. FE	NO	YES	YES	YES	YES
R-sq	0.10	0.24	0.31	0.32	0.32
N	1585	1585	1585	1585	1585

Notes:

The Christian Activities variable ln(Convert/Pop1920) is the logarithm of disciples of each county in 1920 normalized by population. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels.

Table 3. Estimates of the Relationship between Historical Church Activities and Current Economic Performance

	(1)	(2)	(3)	(4)	(5)
Panel A. Second Stage. Dependent Variable is Log GDP per Capita in 2000					
ln(Convert/Pop1920)	0.17	0.13	0.17	0.17	0.16
	[0.04]***	[0.06]**	[0.05]***	[0.05]***	[0.05]***
Location Controls	NO	NO	YES	YES	YES
Climate Controls	NO	NO	NO	YES	YES
Current Natural Disaster	NO	NO	NO	NO	YES
Reg. FE	NO	YES	YES	YES	YES
N	1585	1585	1585	1585	1585
Panel B. First Stage. Dependent Variable: ln(Convert/Pop1920)					
1900-1920 Flood Freq.	1.68	1.61	1.90	2.10	1.95
	[0.57]***	[0.57]***	[0.57]***	[0.59]***	[0.61]***
1900-1920 Draught Freq.	5.81	3.42	4.60	4.47	4.68
	[0.62]***	[0.66]***	[0.68]***	[0.69]***	[0.71]***
Location Controls	NO	NO	YES	YES	YES
Climate Controls	NO	NO	NO	YES	YES
Current Natural Disaster	NO	NO	NO	NO	YES
Reg. FE	NO	YES	YES	YES	YES
F-stat on IV	50.83	13.76	23.38	21.23	22.13
Over Identification (p-value)	0.56	0.46	0.25	0.69	0.96

Notes:

The Christian Activities variable ln(Convert/Pop1920) is the logarithm of disciples of each county in 1920 normalized by population. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels. The Hansen's J statistic is used for the test of overidentifying restrictions in the presence of heteroskedasticity. The joint null hypothesis is that the instruments are valid instruments, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation.

Table 4. Robustness Check

	Omitting Influential Obs	Coastal vs Hinterland		Urban vs Rural		Alternative Church Activities Measure	
		Coastal Dummy	Hinterland Sample	Urban Dummy	Rural Sample	Vicars	Churches
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Second Stage, Dependent Variable is Log GDP per Capita in 2000							
ln(Convert/Pop1920)	0.19	0.15	0.34	0.17	0.16		
	[0.04]***	[0.05]***	[0.15]**	[0.05]***	[0.05]***		
ln(Vicar/Pop1920)						0.48	
						[0.23]**	
ln(Church/Pop1920)							0.60
							[0.28]**
Coastal Province		0.17					
		[0.17]					
Urban				0.72			
				[0.12]***			
Controls	YES	YES	YES	YES	YES	YES	YES
Number of obs.	1507	1585	990	1585	1479	1585	1585
Panel B. First Stage							
Dep.Variable:	ln(Converts/Pop1920)					ln(Vicar/ Pop1920)	ln(Church/ Pop1920)
1900-1920 Flood Freq.	2.23	1.96	1.07	2.00	2.00	-0.09	0.38
	[0.61]***	[0.61]***	[0.75]	[0.60]***	[0.66]***	[0.42]	[0.41]
1900-1920 Draught Freq.	4.96	4.66	2.83	4.63	4.83	1.09	1.25
	[0.72]***	[0.72]***	[1.03]***	[0.71]***	[0.79]***	[0.48]**	[0.48]***
F-stat on IV	23.73	21.81	3.79	21.86	19.17	5.25	3.72
Over Identification (p-value)	0.88	0.71	0.07	0.83	0.44	0.16	0.71
Panel C. OLS Estimates. Dependent Variable is Log GDP per Capita in 2000							
ln(Convert/Pop1920)	0.05	0.04	0.02	0.05	0.05		
	[0.01]***	[0.01]***	[0.01]**	[0.01]***	[0.01]***		
ln(Vicar/Pop1920)						0.05	
						[0.01]***	
ln(Church/Pop1920)							0.04
							[0.01]***

Notes:

The Christian Activities variable ln(Convert/Pop1920) is the logarithm of converts of each county in 1920 normalized by population. Controls include location, climate and current natural disaster characteristics and regional fixed effect. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels. The Hansen's J statistic is used for the test of overidentifying restrictions in the presence of heteroskedasticity. The joint null hypothesis is that the instruments are valid instruments, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation.

Table 5. Effects of Church Activities on Other Social Economic Outcomes

	Human Captial				Foreign Direct Investment		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Second Stage							
Dependent Variable (in logs)	EduExp	Year Schooling	Literacy	Infant Mortality	Share of Asset	Share of Revenue	Share of Employee
ln(Convert/Pop1920)	0.08	0.05	0.03	-0.44	0.70	1.17	0.63
	[0.04]**	[0.01]***	[0.01]***	[0.09]***	[0.21]***	[0.38]***	[0.19]***
Location Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Climate Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Current Natural Disaster	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reg. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	1585	1585	1585	1585	1585	1585	1585
Panel B. First Stage. Dependent Variable: ln(Converts/Pop1920)							
1900-1920 Flood Freq.	1.95	1.95	1.95	1.95	1.95	1.95	1.95
	[0.61]***	[0.61]***	[0.61]***	[0.61]***	[0.61]***	[0.61]***	[0.61]***
1900-1920 Draught Freq.	4.68	4.68	4.68	4.68	4.68	4.68	4.68
	[0.71]***	[0.71]***	[0.71]***	[0.71]***	[0.71]***	[0.71]***	[0.71]***
F-stat on IV	22.13	22.13	22.13	22.13	22.13	22.13	22.13
Over Identification (p-value)	0.00	0.10	0.00	0.00	0.20	0.04	0.21
Panel C. OLS Estimates. Dependent Variable is Log GDP per Capita in 2000							
ln(Convert/Pop1920)	0.02	0.01	0.00	-0.04	0.18	0.33	0.15
	[0.01]***	[0.00]***	[0.00]*	[0.01]***	[0.04]***	[0.07]***	[0.03]***

Notes:

The Christian Activities variable ln(Convert/Pop1920) is the logarithm of converts of each county in 1920 normalized by population. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels. The Hansen's J statistic is used for the test of overidentifying restrictions in the presence of heteroskedasticity. The joint null hypothesis is that the instruments are valid instruments, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation.

Table 6. Alternative Channels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Second Stage. Dependent Variable is Log GDP per Capita in 2000								
ln(Convert/Pop1920)	0.13	0.12	0.11	0.16	0.13	0.14	0.13	0.09
	[0.04]***	[0.06]**	[0.05]**	[0.05]***	[0.05]**	[0.05]***	[0.05]**	[0.06]
EduExp	0.59							
	[0.05]***							
Year Schooling		1.12						0.91
		[0.28]***						[0.27]***
Literacy			1.96					
			[0.22]***					
Infant Mortality Rate				-0.02				-0.01
				[0.01]				[0.01]
Share of Asset					0.05			0.04
					[0.01]***			[0.01]***
Share of Revenue						0.02		
						[0.00]***		
Share of Employee							0.05	
							[0.01]***	
Location Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Climate Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Current Natural Disaster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reg. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1585	1585	1585	1585	1585	1585	1585	1585
Panel B. First Stage. Dependent Variable: ln(Converts/Pop1920)								
1900-1920 Flood Freq.	2.15	1.55	1.84	1.99	1.78	1.74	1.77	1.50
	[0.62]***	[0.60]***	[0.61]***	[0.61]***	[0.61]***	[0.61]***	[0.61]***	[0.59]**
1900-1920 Draught Freq.	4.52	4.10	4.54	4.50	4.42	4.43	4.40	3.87
	[0.72]***	[0.69]***	[0.70]***	[0.72]***	[0.71]***	[0.71]***	[0.71]***	[0.69]***
F-stat on IV	20.09	18.77	21.62	19.81	20.29	20.48	20.12	16.29
Over Identification (p-value)	0.32	0.74	0.46	0.87	0.85	0.76	0.86	0.67
Panel C. OLS Estimates. Dependent Variable is Log GDP per Capita in 2000								
ln(Convert/Pop1920)	0.03	0.03	0.04	0.04	0.03	0.03	0.03	0.03
	[0.01]***	[0.01]***	[0.01]***	[0.01]***	[0.01]***	[0.01]***	[0.01]***	[0.01]***

Notes:

The Christian Activities variable ln(Convert/Pop1920) is the logarithm of converts of each county in 1920 normalized by population. Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at 1%, 5% and 10% levels. The Hansen's J statistic is used for the test of overidentifying restrictions in the presence of heteroskedasticity. The joint null hypothesis is that the instruments are valid instruments, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation.

Data Appendix

1. Mapping historical information with 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. For the latter we have measures of Christian activities (X_i^{1920}, i=1,…,5), including number of converts, vicars, and churches. The corresponding 2000 county level measures (X^{1999}), shown as the grey area, is calculated by

$$x_k = \sum_{k=A\sim E} x_k^{1999}$$

where

$$x_A^{1999} = x_1^{1920} \cdot \frac{s_A}{s_1}$$

…

$$x_E^{1999} = x_5^{1920} \cdot \frac{s_E}{s_5}$$

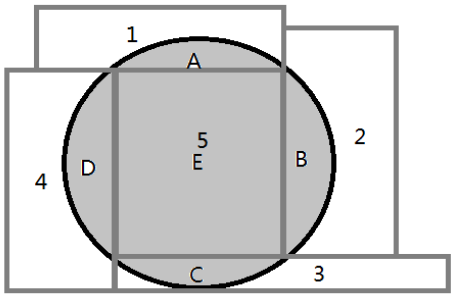

Figure A1. An illustrative map

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

2. Convert station level information into county level

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

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

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

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