DIFFUSING KNOWLEDGE WHILE SPREADING GOD'S MESSAGE: PROTESTANTISM AND ECONOMIC PROSPERITY IN CHINA, 1840-1920[*]

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Abstract
We provide an account of how Protestantism promoted economic prosperity in China—a country in which Protestant missionaries penetrated far and wide during 1840–1920, but only a tiny fraction of the population had converted to Christianity. By exploiting the spatial variation in the missionaries' retreat due to the Boxer Uprising to identify the diffusion of Protestantism, we find that the conversion of an additional communicant per 10,000 people increases the overall urbanization rate by 18.8% when evaluated at the mean. Moreover, 90% of this effect comes from knowledge diffusion activities associated with schools and hospitals erected by the missionaries. (JEL: N35, Z12, O18)

1. Introduction

There is little doubt that the best-known attempt to associate religion (specifically Christianity) with economic prosperity has been that of Max Weber. His famous work, *The Protestant Ethic and the Spirit of Capitalism* (1930), has spawned a rich literature that attempts to unveil the channel(s) through which culture may have contributed to economic growth.[1] Following this literature, we examine whether Protestantism had any distinct economic impact in China during 1840–1920—a period in which it was forced to open up to the West—in economic and other spheres. We also endeavor to identify a novel channel through which Protestantism—the diffusion of Western knowledge—may have contributed to economic prosperity in China.

With the opening up of China following its defeat by the Western powers in the Opium War (circa 1839–42), the missionary presence in China increased enormously, resulting in a surge in the number of converts by the early 1920s. While the overriding goal of the Protestant missionaries was to spread God's message by disseminating Christian texts, they did far more than that. By erecting several schools and hospitals, and by introducing a qualitatively new curriculum of subjects that were previously unfamiliar to the Chinese, the Protestant missionaries diffused a wide spectrum of what Simon Kuznets (1965) calls "useful" knowledge in the country. According to Jonathan Spence, an eminent historian of China, the strength of the intertwining influences of the (biblical) gospels, Western knowledge (schools and the new curriculum they introduced), and medicine (hospitals), "is impossible to calculate, but the missionaries did offer the Chinese a new range of options, a new way of looking at the world" (1990, p. 208).

By drawing on variations in the diffusion of Protestantism across China's then 1,175 counties, and by using urbanization as a proxy for economic prosperity, we find that Protestantism indeed had a positive effect on urbanization in the 1920s after controlling for a wide gamut of variables. To ensure that urbanization is a reliable measure, we also employ the cumulative number of modern industrial firms established during 1841–1915 as an alternative proxy for economic prosperity, which reaffirms the positive effect of Protestantism.

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[1] While the empirical vindication of Weber's thesis has produced mixed results (compare, e.g., Iannaccone 1998 with Glaser and Glendon 1998), many studies have indeed shown that Protestantism stimulates economic prosperity via a number of channels. These include moral codes (e.g., Lipset and Lenz 2000), a country's openness (La Porta et al. 1998), "spiritual capital" (e.g., Barro and McCleary 2003; Barro 2004), social networks (e.g., Glaeser and Sacerdote 2008), and human capital (e.g., Becker and Woessmann 2009, 2010; Gallego and Woodberry 2010; Woodberry 2012). See also Doepke and Zilibotti (2005, 2008) for the theoretical literature on the "spirit of capitalism" hypothesis.

To address the potential endogeneity issues associated with the diffusion of Protestantism, we construct an instrumental variable based on the fleeing of the Protestant missionaries in response to the Boxer Uprising (circa 1900), premised on the notion that the areas in which the missionaries resettled are likely to be positively correlated with the subsequent diffusion of Protestantism after peace resumed. Taking the geographic distribution of the missionaries before the Boxer Uprising as given, we try to predict where they might have fled. Given the same distance from the Boxer Uprising, the region where a few political elites had offered to protect the foreigners under the agreement of the "Yangtze Compact", i.e. the south of China, was likely to have received the most missionaries. Our instrumental variable is therefore an interaction term between "distance from the nearest Boxer Uprising" and "Yangtze Compact".

The instrumented result finds that the effect of Protestantism on economic prosperity remains significantly positive and with a sizeable magnitude: the conversion of an additional communicant per 10,000 people increases the overall urbanization rate by 18.8% when evaluated at the mean urbanization rate. Our falsification tests find that our instrument is significantly correlated with the diffusion of Protestantism only *after* the Boxer Uprising; with the enrollment density of Protestant schools (but not government schools); and is not significantly correlated with factors that may be related to urbanization or modern industrial development (e.g., Catholicism, railway, or Western business). Together, these findings support the instrument's validity.

We then attempt to identify the channel(s) through which Protestantism impacted economic prosperity during the period in question. To examine the extent to which knowledge diffusion activities can account for the association between Protestantism and economic outcomes, we include Protestantism and four specific "types" of knowledge diffusion activities as variables: (1) the enrollment density of lower primary schools, (2) the enrollment density of higher primary schools, (3) the number of middle schools, and (4) the number of hospitals. The results show that, once we control for these knowledge diffusion activities—which have a significantly positive effect on urbanization—the positive association between Protestantism and economic outcomes disappears.

However, knowledge diffusion activities may be just as endogenous as Protestantism. To address this concern, we employ the knowledge diffusion activities that the same missionary societies undertook in the rest of the world as an exogenous predictor of their behavioral patterns in China, under the assumption that the two are likely correlated. Employing these additional data allows us to

estimate a system of three equations in which (1) the interaction between "distance from the nearest Boxer Uprising" and "Yangtze Compact" is employed to predict the degree of Protestantism; (2) Protestantism and the knowledge diffusion activities conducted by the missionaries outside of China are used to predict knowledge diffusion activities in China; and (3) Protestantism and knowledge diffusion activities in China are used to predict economic prosperity. Overall, we find that Protestantism has no direct significant effect on economic prosperity, whereas knowledge diffusion does. Moreover, using the two-stage least squares (2SLS) estimate of the overall effect of Protestantism on urbanization as a benchmark, the channel of knowledge diffusion used accounts for as much as 90% of its effect on economic prosperity.

While our finding essentially complements the human capital story of Becker and Woessmann (2009, 2010), our empirical examination of China's Protestant history sheds additional light on the plausible channel(s) through which knowledge that was "useful" for economic development is diffused.[2] Since the Chinese population did not convert in large numbers to Protestantism (less than 0.1% converted), any positive association between Protestantism and economic prosperity would most certainly be attributed to channel(s) other than a cultural ethic or literacy. Moreover, the spreading of "useful" knowledge does not necessarily require a large fraction of the population to acquire it; evidence that the effect of Protestantism comes primarily from the diffusion of technological ("useful") knowledge lends strong support to this claim.[3]

The remainder of this article is organized as follows. In Section 2, we provide a brief overview of the historical background. In Section 3, we introduce our data sources and define the variables used in our analysis. In Section 4, we test the hypothesis regarding the alleged effect of Protestantism on economic prosperity in China. In Section 5, we ascertain whether the positive effect of Protestantism on economic prosperity actually comes from knowledge diffusion. Section 6 summarizes and concludes the study.

2. Historical Background

2.1 The Development of Protestantism in China

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[2] Becker and Woessmann (2009) show that, while the counties in Prussia that had a larger share of Protestants fared better economically than those with a larger share of Catholics, this difference was not caused by the Protestant work ethic, but rather by the increase in the literacy rate (and, accordingly, human capital) as more people in the former had greater opportunities to read the translated biblical texts, a finding that Cantoni (2013) disputes.

[3] We thank an associate editor of this journal for pointing this out.

Before the First Opium War (1839–42), which marked the end of China's long-term isolation and the beginning of modern Chinese history, Christianity had been banned in China since 1721, after Emperor Kangxi (1661–1722) disagreed with Pope Clement XI's decree over the Chinese Rites controversy, which led to a complete severance of ties with the Roman Catholic Church.[4] But with the signing of various "unequal treaties" with the Western powers between 1839 and 1842 (especially the Treaty of Nanjing), the Qing government was forced to admit the Western missionaries into China—initially to the five coastal cities or treaty ports, and with the signing of the second round of treaties (especially the Treaty of Tianjin) to the entire country, after which Protestantism spread quickly (Bays 2012). By 1920, more than 94% of China's counties had records of a missionary presence; 84% had records of Protestant communicant numbers, and 78% had established Protestant congregations or evangelistic centers (Stauffer 1922).

The Protestant missions were not only interested in spreading God's message; their conviction that China was backward (and thus needed to adopt Western culture in order to develop faster) led the missionaries to fundamentally revolutionize education and medicine in China. For instance, in addition to erecting their own schools, the Protestant missionaries introduced a thoroughly Western-based curriculum into China and taught a variety of novel subjects ranging from Mathematics and Astronomy to English, History, and Geography—subjects that differ fundamentally from the traditional Chinese classic texts that for centuries had been the cornerstone of China's civil examination system (Elman 2000). Likewise, by erecting hospitals starting in the 1860s, the Protestant missionaries also introduced Western medicine into China (Bays 2012; Elman 2006). The contrast between traditional Chinese and Western medicine was likewise huge (Needham 1954). Together, these two kinds of activities—related to education (building schools) and health (erecting hospitals)—arguably provided an important channel through which a body of new and "useful" knowledge could be subsequently disseminated.[5]

2.2 Boxer Uprising and "Yangtze Compact"

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[4] The Chinese Rites controversy was a dispute between the Chinese government and the Roman Catholic Church from the 1630s to the early 18th century. It revolved around whether Chinese folk religious rites and offerings to the emperor constituted idolatry. Pope Clement XI decided in favor of the Dominicans (who argued that Chinese folk religion and offerings to the emperor were incompatible with Catholicism), which led to an enormous reduction in the presence of Catholic missionary activities in China (Hsu 2000, pp. 100–103; see also Bays 2012, p. 28).

[5] Indeed, according to Spence (1990), the effects of Protestantism "came through the spread of Christian texts, the publication of general historical or scientific works, the development of schools, and the introduction of new techniques of medicine" (p. 206).

Not everything foreign was well received in China, however. Protestantism and Western ways more generally aroused resentment among many Chinese as soon as their influences were felt, resulting in the eruption of various violent anti-foreign and anti-Christian incidents.[6] In this context, the Boxer Uprising merely represented the pinnacle of the patriots' hatred of foreigners (Cohen 1978; Hsu 2000; Spence 1990). Originating from north China, the Boxers were a group of spontaneously formed, patriotic anti-imperialists who attacked foreign missionaries around 1900 in 26 prefectures across the country, resulting in the deaths of 188 foreign Protestant missionaries and 5,000 Protestant communicants (Esherick 1987; Yang 1968). Threatened by the Boxers' assault, many missionaries fled for their lives (Austin 2007; Glover 1918).

Just when the anti-foreign outbreaks threatened to spread from the north into the Yangtze provinces (located on the southeastern coastal seaboard of China), Sheng Xuanhuai, the then Ministry of Transportation, disregarded the imperial proclamation, and urged the provincial heads in the south—from whom he received tremendous support—not to give it circulation. Although the Yangtze Compact was applied initially to only the Lower Yangtze region, it was quickly "followed by the authorities in the other southern provinces with the result that the fighting and the destruction in the north were effectively kept out of South China" (Feuerwerker, 1958, p. 73). In response to the intensified crisis in north China, the Eight-Nation Alliance brought 20,000 armed troops to China to quell the uprising.[7] With peace restored, the number of Protestant communicants nearly tripled from 100,000 in 1900 to 289,874 in 1902 (Bays 2012).

3. Data

To test the overall effect of Protestantism on economic prosperity, and to identify the channel(s) through which Protestantism impacted economic prosperity, we construct a dataset that allows us to exploit the spatial variation in the development of Protestantism and knowledge diffusion in China for the period 1840–1920. The dataset is based primarily on digitizing Stauffer's (1922) survey; the result is a dataset that covers 1,175 counties in 14 provinces to the south of the Great Wall (see Figure 1). The sample counties covered approximately 2.3 million km^2 or 17.7% of the territory of Qing China, but a disproportionate 80% of the total population (around 350 million)

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[6] Perhaps the most prominent example is the Tianjin massacre in the 1860s, in which a hostile Chinese crowd killed the French consul, several traders, and their wives.
[7] The eight nations were Austria-Hungary, France, German, Italy, Japan, Russia, United Kingdom, and the United States. Beijing was made to sign the Boxer Protocol and paid an indemnity of 67 million pound sterling (Spence 1990).

in the 1850s (Ge 2000). In the remaining section we will define the variables we employ in the empirical analysis (Appendix A provides detailed information on the definition of variables and data sources).
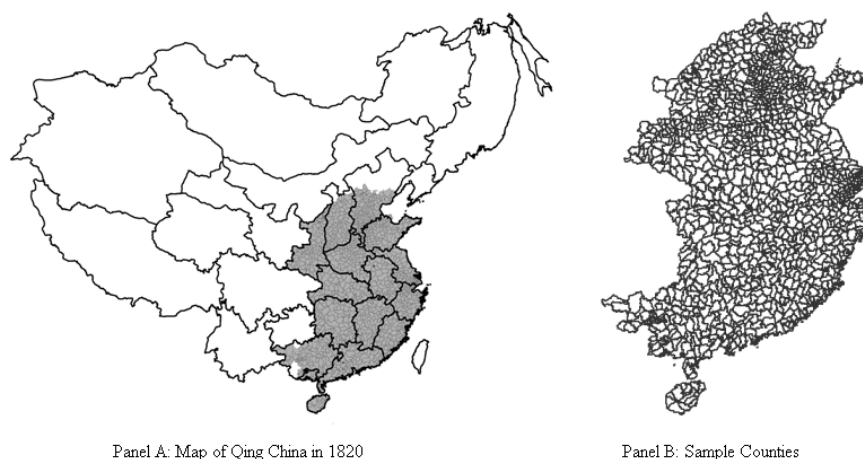

Panel A: Map of Qing China in 1820   Panel B: Sample Counties

FIGURE 1: The 14 provinces included in the dataset. Source: CHGIS 2007.

3.1 Economic Prosperity (Y): Urbanization and Modern Industrial Firms
To measure the effect of Protestantism on economic prosperity, we need information on the regional distribution of income across China for the period 1840–1920. Unfortunately, such data are not available. As a substitute, and following Acemoglu, Johnson and Robinson (2002, 2005), we use the degree of urbanization to proxy for economic prosperity, given its positive and significant correlation with per capita income. As with data on other measures of Protestantism, data on urbanization in China in 1920 are obtained from Stauffer (1922), which contains population statistics on cities with more than 25,000 residents. This allows us to compute, at the county level, the proportion of the population that lives in urban areas as our measure of urbanization—the first of our two dependent variables.

To ensure that urbanization is a sound proxy for economic prosperity, we also employ the cumulative number of modern industrial firms established by Chinese nationals from 1841–1915 as an alternative measure. The overriding criterion of a modern industrial firm, according to Chang (1989), is that its operations must be powered by steam engine or electricity. It also had to be relatively large and: (1) have registered capital of at least 10,000 silver *yuan*;[8] (2)

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[8] Approximately 1,094 pound sterling (Jastram 1981, pp. 164–188).

employ at least 30 workers; (3) produce an annual output of at least 50,000 silver *yuan* in value; and (4) have adopted modern (hierarchical) management practices (Chang 1989).[9] In addition to checking the reliability of our measure of economic prosperity, using the number of modern industrial firms as the dependent variable also allows us to construct panel data to rule out unobserved county-specific factors.

3.2 Protestantism and Knowledge Diffusion

We use the number of communicants per 10,000 people to proxy for the level of Protestantism (P). Although the Protestant missionaries managed to cover a vast stretch of China's territory, they had yet to achieve a significant density. Our data show that, of the 989 (out of 1,175) counties with Protestant communicants, 140 counties (slightly more than 14%) had less than one communicant per 10,000 people, 571 counties (about 57%) had between one and ten communicants, and 278 counties (28%) had more than ten per 10,000 people (see Panel A of Figure A1, Appendix B for details). The overall mean of this measure is a mere 8.394.

As mentioned earlier, erecting hospitals and schools were the two primary knowledge diffusion activities carried out by the Protestant missionaries. The Protestants erected 220 hospitals in 173 sample counties and established lower primary schools in 719 counties (61.1%) and higher primary schools in 314 counties (26.7%), which enrolled 122,089 and 30,067 students, respectively. While enrollment figures for middle schools are not available, Stauffer's (1922) survey reveals that there were 254 middle schools spread across 107 sample counties (9.1%). Together, we are able to employ the number of students per 10,000 people enrolled in Protestant lower primary schools (K_1, abbreviated as enrollment density of Protestant lower primary schools hereafter), the number of students per 10,000 people enrolled in Protestant higher primary schools (K_2, abbreviated as enrollment density of Protestant higher primary schools hereafter), the number of Protestant middle schools (K_3), and the number of hospitals (K_4) to proxy for the level of knowledge diffusion (see Figure A2, Appendix B for details). The summary statistics of these variables are reported in Table 1.

Table 1 about here

3.3 Control Variables

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[9] Based on a variety of historical archives, Chang (1989) identifies 1,148 such modern industrial firms during this period, 846 of which are located in our sample provinces.

In addition to the key variables of Protestantism and knowledge diffusion, we control for the possible effects of Western penetration, initial economic conditions (of urbanization), and the possible influences of politics, geography, county size, and population density.

Western Penetration. Western influences can be divided into two aspects—religious and economic. Since Catholicism became active in China after various treaties allowed foreigners to enter the country, the possible influence of the Catholic Church must be taken into account. To control for such effect, we employ the number of Catholic missionary stations per 1 million people to proxy for its development in China (see Panel B of Figure A1, Appendix B for details). To control for Western economic influence, we employ two dummy variable measures, viz. treaty ports (county with treaty port = 1) and railway networks (county with railway = 1).

Initial Economic Conditions. Given that differences in initial economic conditions may affect both the diffusion of Protestantism and urbanization, it is necessary to control for differences in economic conditions at the outset. In the absence of information on the share of urban population in 1840, we use the three sizes of cities generated by Rozman (1974) in the form of dummy variables as a proxy: big cities (population of 300,000 and over (3.1%)), medium (70,000–300,000 (2.2%)), and small (30,000–70,000 (0.7%)).

Political Center. To the extent that counties with a prefectural government were distinctly more prosperous, and that the share of government officials in a given urban population was higher in the political centers, we control for the location of the prefectural government seat using a dummy variable.

Geography. As geography may affect economic performance, we use three dummy variables to control for its difference among counties. The first is whether a county is located along the *Jinghang* or the Grand Canal (3.7%), a vital transportation route between north and south China; the second is whether a county is located on the coast (4.8%); and the third is whether a county is situated along the *Changjiang* (Yangtze) River (10.8%), the most navigable river in China.

County Size and Population Density. To the extent that foreign missionaries chose to begin their work in populous or larger regions, the development of religion may also be affected by a region's size and population density. We thus include both population density and county size in our empirical estimations, in addition to controlling for the provincial dummies. Details concerning the definition, summary statistics of the pertinent variables, and their sources are all summarized in Table 1.

4. Protestantism And Economic Prosperity

4.1 Protestantism and Urbanization: Baseline Results

We begin by regressing urbanization (Y), our first proxy for economic prosperity of the 1,175 Chinese counties, on the proxy of Protestantism (P) using the method of ordinary least squares (OLS) based on Equation (1):

$$Y = \rho P + W\beta + \varepsilon, \quad (1)$$

in which ρ represents the effect of Protestantism on economic prosperity. We also control for a number of independent variables (W), including Catholicism, initial economic conditions around 1840, Western economic influences (treaty ports and railway networks), whether a county was a political center, whether a county was located on the coast, along the *Changjiang* River, or along the Grand Canal, population density, size of the county, provincial dummies, and the constant term. β represents the set of coefficients of these control variables.

Reported in Table 2, our baseline results show that there is a significant and positive relationship between Protestantism and economic prosperity (specifically, the degree of urbanization). For instance, Column (1) of Table 2 shows that Protestantism has the effect of significantly increasing urbanization after controlling for only population density, county size, and provincial dummies. In contrast, the estimated coefficient on Roman Catholicism is insignificant. In terms of magnitude, the conversion of an additional communicant per 10,000 people increases the level of urbanization by 0.215 percentage points. As for the other control variables, population density is, as expected, positively correlated with urbanization.

After controlling for political center and geographic factors (Column (2)), Protestantism remains significant, although the pertinent magnitude decreases slightly from 0.215 (Column (1)) to 0.194 (Column (2)). Not surprisingly, counties in which a prefectural government is seated also tend to have a higher rate of urbanization (about 10 percentage points higher). Some geographic factors also have a positive effect on urbanization; for example, counties located in the coastal region or along the Grand Canal are more urbanized.

Table 2 about here

While the coefficient decreases somewhat (from 0.194% (Column (2)) to 0.162% (Column (3)) as we extend our control to include differences in initial economic conditions, the main effect remains significant. The same is true with the inclusion of the two measures of Western economic influences (Column (4)). The full model, which includes all the control variables, does not change the conclusion that the effect of Protestantism (the number of

communicants per 10,000 people) is significant (Column (5)). In terms of magnitude, a one-standard-deviation increase in the density of Protestant communicants (15.161) increases the level of urbanization by 2.411 percentage points ((0.159*15.161), Column (6)). Given the mean urbanization rate of 4.265% in 1920, this effect accounted for more than half (56.5%) of the overall urbanization rate in China.[10]

4.2 Missionary Presence and the Establishment of Modern Industrial Firms, 1841–1915

To ensure that urbanization is a sound proxy for economic prosperity, we employ the number of modern industrial firms established during 1841–1915 in county i during period t as an alternative measure of our dependent variable, where t is a period spanning five years. Period 1, for instance, covers 1841–1845, Period 2 1846–1850, and so forth. There are 15 periods, denoted by $t = 1, 2 \cdots 15$. As befits the panel data structure, an ideal independent variable would be the yearly density of Protestant communicants. Since we do not have such detailed information, we employ the duration of Protestantism in a county—measured from the year of its recorded presence—as the explanatory variable instead. Denoting the year when formal missionary work began as A_i, the duration of Protestantism since its recorded presence in the first year of each period can be denoted by $P_{it}^d = \min\{0, 1836 + 5t - A_i\}$.[11] We begin our analysis using a simple two-way fixed-effects model as Equation (2):

$$Y_{it} = \rho P_{it}^d + \alpha_i + \lambda_t + \varepsilon_{it},$$ (2)

in which α_i is the county fixed effect, λ_t is the period fixed effect, and ε_{it} is the error term. By taking the first-difference we obtain:

$$\Delta Y_{it-1} = \rho \Delta P_{it}^d + \Delta \lambda_t + \Delta \varepsilon_{it},$$

where $\Delta Y_{it-1} = Y_{it} - Y_{it}$ stands for an enterprise's five-year growth rate. In counties where Protestants had set up missionary operations, $\Delta P_{it}^d = 5$, and in counties where they had not, $\Delta P_{it}^d = 0$. The coefficient ρ thus represents the difference in the annual growth rate of firms' establishment between these two kinds of counties. Reported in Column (1) of Table 3, we find that the annual growth rate of modern industrial firms in counties where Protestants had set up missionary operations is about 0.68% higher than in counties where it had not.

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[10] To check whether Protestantism has different effects in regions characterized by differing geographic-cum-economic conditions, we interact these variables with Protestantism and find that the main effect of Protestantism remains significant (Appendix C).

[11] For instance, assuming that some Protestant missionaries arrived in a certain county in 1848, in the period 1901–1905 ($t = 13$) the measured duration of Protestantism would be 53 (1901–1848 = 53).

To ensure that this result is not driven by an unobserved growth trend in the Protestant counties, we include all interaction terms between B_i (a dummy variable indicating whether Protestantism had a recorded presence by the end of 1920) and a full set of time dummies covering all the periods, as represented by:

$$Y_{it} = \rho P_{it}^d + \sum_{\tau=2}^{15} \phi_\tau I_\tau B_i + \alpha_i + \lambda_t + \varepsilon_{it}$$

Reported in Column (2) of Table 3, the result shows that the effect of Protestantism increases only slightly from 0.0068 (Column (1)) to 0.0071 (Column (2)), and remains highly significant at the 1% level. An alternative estimation method that allows controlling for the unobserved growth trend in the Protestant counties (i.e., $T_{it} = 1836 + 5t - A_i$) is to include $B_i T_{it}$ in the estimation instead of using the interaction terms between B_i and a full set of time dummies. The results are strikingly similar (Column (3)).

We then further control for two time-varying variables, including the duration of treaty ports and railway networks (Z_{it}). Moreover, to rule out the possibility that the effects of the time-invariant control variables (W) may change over time, we interact them with the full set of time dummies ($I_\tau W_i$) as follows:

$$Y_{it} = \rho P_{it}^d + \sum_{\tau=2}^{15} \phi_\tau I_\tau B_i + Z_{it}\varphi + \sum_{\tau=2}^{15} I_\tau W_i \Phi_\tau + \alpha_i + \lambda_t + \varepsilon_{it} \qquad (3)$$

Column (4) of Table 4, which reports the results that include the respective durations of treaty ports and railway networks (Z_{it}), finds that the effect of Protestantism remains highly significant, though the magnitude decreases from 0.0071 (Column (2)) to 0.0058 (Column (4)). In Column (6), which includes all the control variables (W_i) and their interactions with the full set of time dummies, the effect of Protestantism further decreases to 0.0027, but remains highly significant as before.

4.3 Instrumented Evidence

Our estimation of the effect of Protestantism on economic prosperity may be biased by the problems of measurement error in the proxy for Protestantism, reverse causality, and omitted variables. To address these concerns, we exploit the variation in the consequences of the Boxer Uprising in terms of the spatial resettlement of the Protestant missionaries after the Boxers' assault in 26 prefectures across China (Panel A of Figure 2). We reason that the areas to which these missionaries fled should be positively correlated with the subsequent

diffusion of Protestantism. Taking the distribution of missionaries before the uprising as given, our task is to predict where they might have fled to. Holding other conditions constant, the Protestant missionaries would have fled to the safest place at the time.

Specifically, given the same distance from the Boxer Uprising, the region protected by the Yangtze Compact was likely to have received the most missionaries. This is illustrated in Panel B of Figure 2, in which a solid black line demarcates the safe and unsafe regions, and where the different shades of grey represent variations in the distance from the nearest conflict area.[12] Given the choice between two counties of equal distance—one in the south and the other in the north, the missionaries would have fled to the county south of the solid black line. This reasoning is well supported by the diary of Reverend Saunders (1900), a fleeing missionary who initially fled to the north, only to discover that in order to be completely safe from the Boxers, he and his family had to cross the treaty line (see Appendix D for details).[13]
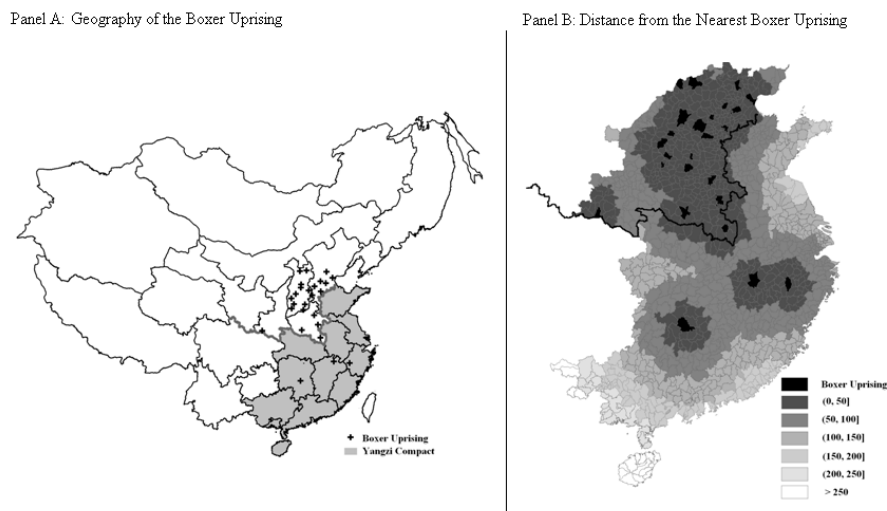
FIGURE 2. The location of the boxer uprising. Source: CHGIS 2007.

Denoting the distance from the nearest conflict area by D and the counties to the south of the Yangtze Compact region by S (where $S = 1$), our instrumental variable is represented by their interaction

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[12] Distance from the nearest Boxer Uprising is calculated using the Great Circle distance of each county to the nearest Uprising prefecture based on their centroids.
[13] Saunders' experience is by no means unique. For instance, Austin (2007) characterizes the evacuation of the missionaries from Shanxi Province to the coast as essentially an "exodus" (p. 415).

(DS). To qualify as a valid instrument, DS should be positively and significantly correlated with the level of Protestantism in 1920 (P). We examine this relationship first with a short regression, which includes only "distance to the nearest Boxer Uprising" (D), "Yangtze Compact" (S), and their interaction (DS):

$$P = \delta_1 D + \delta_2 S + \delta_3 DS + v \qquad (4).$$

Reported in Column (1) of Table 4, the result shows that DS is indeed positively correlated with the level of Protestantism.

Table 4 about here

To ensure that the relationship between DS and Protestantism does not capture other unobserved geographic factors, we control for more additional spatial variables. First, we include a county's distance to the sea and to the five earliest treaty ports (as a proxy for locations with the earliest presence of Protestantism), and their respective interaction with S .[14] But since it is impossible to control for every conceivable spatial dimension, we directly control for a county's geographic coordinates—longitude and latitude (x , y). In addition, to rule out the possibility that geographic coordinates may have nonlinear effects, we also include their squared terms, namely x^2 , xy , and y^2 . Our specification can now be rewritten as:

$$P = \delta_1 D + \delta_3 DS + \tilde{W}\gamma + v \qquad (5)$$

in which $\tilde{W}$ includes the vector of controls previously employed in the baseline estimations (W) and the additional spatial variables just introduced in the instrumented estimations. As with the baseline estimate, we also control for the provincial dummies; hence the dummy variable indicating the Yangtze Compact region (S) is dropped. Column (2) of Table 4 clearly shows that DS remains positively and significantly correlated with the level of Protestantism in 1920 even with the inclusion of these controls ($\tilde{W}$).

4.3.1 Falsification Tests

For our instrument to be valid, it needs to satisfy exclusion restrictions beyond proving that it is significantly correlated with Protestantism (*P*)—i.e., that DS did not affect economic prosperity via other alternative channels. To that end, we perform three falsification tests. First, DS should affect the diffusion of Protestantism only after the Boxer Uprising if our logic is correct; a significant relationship between DS and Protestantism before the Boxer Uprising would

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[14] In Appendix E (Table A4), we further show that distance to the nearest Boxer Uprising has no significant relationship with whether a county was located on the coast, along the Yangtze River, along the Grand Canal, distance to the sea, distance to the five earliest treaty ports, or the dummy of treaty ports and railway networks.

imply that DS operates through other channels. Second, we compare the effect of DS on the enrollment density of Protestant schools with the enrollment density of government schools. According to our logic, DS should have a positive effect on the enrollment density of Protestant schools (a proxy for missionary activity) but not on the enrollment density of government schools (a proxy for economic development). If DS also has a positive effect on the enrollment density of government schools, then it is likely that DS is correlated with some omitted variables. Third, we also need to rule out the possibility that DS affects economic prosperity via railroad, foreign influences (specifically Western business), the prevailing level of urbanization, and so forth.

To perform our first falsification test, we regress the duration of Protestantism (P_{it}^d) on the interaction between $D_i S_i$ and a dummy variable that indicates the post-Boxer Uprising period with a random-effect model on a panel dataset:

$$P_{it}^d = \psi_1 \cdot Post \cdot D_i S_i + \psi_2 \cdot D_i S_i + \psi_3 \cdot Post \cdot D_i + \psi_4 \cdot D_i + \tilde{Z}_{it}\Pi + u_i + \lambda_t + v_{it}$$
$$(6)$$
,

in which $\tilde{Z}_{it}$ represents all the control variables included in Equation (3). Reported in Column (1) of Table 5, the effect of $D_i S_i$ on the diffusion of Protestantism is insignificant for the entire period but becomes significant after the Boxer Uprising. Moreover, the size of the coefficients, which is distinctly smaller before 1900, increases sharply (from 0.130 to 1.474) thereafter. In order to obtain the pure effects of $D_i S_i$ for all 15 periods covered in our sample, we further interact $D_i S_i$ with a full set of time dummies in Column (2). The results consistently show that the effect of Protestantism remains insignificant for each period before the Boxer Uprising, but becomes significant thereafter (Column (2)). We repeat the above exercise using the establishment of domestically owned modern industrial firms as the dependent variable. This reduced-form regression shows that, while our instrument is significantly correlated with domestic firms only after the Boxer Uprising (Columns (3) and (4)), it is insignificantly correlated with Western business (proxied by the establishment of foreign firms) both before and after the Boxer Uprising (Column (5)).

Table 5 about here

We then compare the effect of DS on the enrollment density of Protestant schools with that of the enrollment density of

government schools—our second falsification test. Reported in Columns (3) and (4) of Table 4, the results show that, while DS has a positive effect on the enrollment density of Protestant schools, it does not have a significant effect on the enrollment density of government schools. This takes us to our third falsification test, in which we repeat the above exercise but replace primary education with railway (Column (5)), Catholicism (Column (6)), treaty ports (Column (7)), and initial conditions (Column (8)). Consistently, we find that DS does not have a significant effect on these variables, suggesting that our instrument does not capture the effect of a wide gamut of unobserved factors.

4.3.2 Effect of Instrumented Protestantism on Economic Prosperity
Now we can apply our instrument to identify the causal effect of Protestantism on urbanization using the 2SLS method as expressed in Equation (7):

$$Y = \rho P \qquad + \eta_1 D + \tilde{W}\beta + \varepsilon$$
$$P = \qquad \delta_3 DS + \delta_1 D + \tilde{W}\gamma + v \qquad . \tag{7}$$

The results are reported in Table 6. Unlike the baseline findings in Table 2, in which the coefficient of Protestantism decreases somewhat after controlling for initial economic conditions and Western economic influences, here the pertinent magnitude increases slightly from 0.837 in the estimation (in which initial economic conditions and Western penetration are excluded (Column (1.2), Table 6)), to 0.868 when all the controlled variables are fully accounted for (Column (2.2), Table 6). These results are very encouraging because they show that the effect of instrumented Protestantism remains stable with the inclusion of other possible co-determinants of urbanization. In terms of magnitude, the conversion of an additional communicant per 10,000 people now increases the overall urbanization rate by 18.8% when evaluated at the mean (0.868/4.625), which is much larger than the baseline estimate, suggesting that the baseline estimators are likely biased by the measurement error in the proxy for Protestantism.

But might the Boxer Uprising affect our results directly? To control for this possible effect, we include a dummy variable that indicates the incidence of Boxer Uprising in the 23 prefectures in the regression (Column (3)), and find that it had no significant effect on the development of Protestantism in the 1920s—possibly because missionary activities resumed as soon as the Boxers were defeated.[15] Most importantly, the effect of Protestantism changes little when compared to the estimation for which the direct effect of the Uprising is not controlled (compare, e.g., Column (3.2) with Column (2.2)).

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[15] We thank an anonymous reviewer for pointing this out.

Yet another concern may be that, given that the Boxer Uprising was mainly restricted to north China, it is possible that the results might be driven by counties remote from the Boxer Uprising—especially counties in the south. To check if this is the case, we exclude the two southernmost provinces, Guangdong and Guangxi, and replicate the exercise in Column (2). The results in Column (4) show that the effect of Protestantism remains firmly significant.

Table 6 about here

Turning to the panel data analysis (of the establishment of modern industrial firms), our instrument entails the interaction between $D_i S_i$ and post-Boxer Uprising ($Post$), in which we hypothesize that $Post \cdot D_i S_i$ has a positive effect on the diffusion of Protestantism (P_{it}^d). This specification can be written as:

$$Y_{it} = \rho \cdot P_{it}^d \qquad + \varpi \cdot Post \cdot D_i + \tilde{Z}_{it}\Phi + \alpha_i + \lambda_t + \varepsilon_{it}$$
$$P_{it}^d = \psi_1 \cdot Post \cdot D_i S_i + \psi_3 \cdot Post \cdot D_i + \tilde{Z}_{it}\Pi + \tilde{\alpha}_i + \tilde{\lambda}_t + v_{it},$$

(8)

in which $\tilde{Z}_{it}$ comprises all the control variables that were included in the earlier panel analysis (Equation (3)). The results (reported in Column (1) of Table 7) confirm that our instrument is highly correlated with Protestantism (Column 1.1), and that Protestantism significantly affects the establishment of modern industrial firms (Column 2.2). In terms of magnitude, the effect of instrumented Protestantism (0.0184, Column (1.2)) is significantly larger than the baseline estimate of 0.0026 (Column (7), Table 3). To further check robustness, we replace $D_i S_i \cdot Post$ with the interactions between $D_i S_i$ and the three post-Boxer Uprising time dummies, and control for the interaction between $D_i S_i$ and the pre-Uprising time dummies.

Reported in Column (2), the results robustly show that $D_i S_i$ is significant only *after* the Boxer Uprising, and that the effect of Protestantism (0.0181, Column (2.2)) differs little from the result that uses $D_i S_i \cdot Post$ as the pertinent instrument.

Table 7 about here

5. Protestantism, Knowledge Diffusion And Economic Outcome

5.1 Effect of Protestantism When Controlling for Knowledge Diffusion
To examine the role of knowledge diffusion in determining economic outcome, we estimate the effects of the level of knowledge diffusion and the density of Protestant communicants on urbanization at the county level using:

$$Y = \rho P + K \gamma + W \beta + \varepsilon .$$

(9)

16

We do so by adding the four types of knowledge diffusion activities to the regressions one at a time: enrollment density of Protestant lower primary schools (K_1), enrollment density of Protestant higher primary schools (K_2), number of middle schools (K_3), and number of hospitals (K_4).[16] The results demonstrate that the effect of Protestantism decreases with the inclusion of any of these four types of knowledge diffusion activities (Table 8, Columns (2)–(5)). In particular, Protestantism becomes insignificant if either of the two primary school variables is included (Columns (2)–(3)). When all four types of knowledge diffusion activities are included Protestantism becomes insignificant, and its coefficient drops to near zero (Column (6)). To check the robustness of our results, we transform the four knowledge diffusion variables into a single variable (K) using principal component analysis, and find that the effect of Protestantism similarly decreases to near zero (Column (7)).

Table 8 about here

The decomposition of knowledge diffusion indeed yields results that are consistent with our "knowledge diffusion" hypothesis. For example, of the three educational variables, only higher primary school enrollment density and the number of middle schools erected are significant. This finding may be explained by the possibility that, while lower primary schools taught the fundamental tools of education (including reading, writing, and elementary arithmetic), higher primary schools offered practical occupational training (Committee of Reference and Counsel of the Foreign Missions Conference of North America 1922). But only middle schools, where the newly invigorated curriculum of Western subjects was systematically provided, produced what Simon Kuznets (1965) called "useful knowledge". The results in Column (8) bear out these essential differences, especially the huge contrasts between lower primary schooling and the middle schools.

Not surprisingly, the number of hospitals built by the Protestant missionaries was also significant in stimulating urban economic growth in China in the early 1900s. In the absence of further evidence, we can only speculate that the physical health of the workforce was enhanced through an increased awareness of Western medicine and health practices promoted by the Protestant missionaries, which Mokyr (2002) thought was important in bringing about the sharp decline in mortality rate for various diseases in the West long before the relevant cures were found. To further check the robustness

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[16] A possible limitation of our study relates to the lack of specifics regarding the knowledge diffusion activities conducted by the Catholic churches. While Catholic missionaries also erected various levels and types of schools in China, they had much narrower goals during this period, and were thus much less active than the Protestants in the provision of education and health services (Wiest 2001).

of knowledge diffusion hypothesis, we include the number of Bible schools that were erected to diffuse religious knowledge, and find that it has no significant effect on urbanization (Columns (8) and (9))—a result that can be explained by their likely effects of strengthening the Protestant ethic and raising literacy levels, but not of diffusing "useful" Western knowledge.

5.2 A Three-stage Model
5.2.1 Knowledge Diffusion Activities of Protestant Missionary Societies across Countries
A problem with the above exercise, however, is that (aside from the diffusion of Protestantism), knowledge diffusion is also endogenous. Just as we need an instrument to identify the causal effects of Protestantism, we also need one to identify the causal effects of knowledge diffusion. Premised on the assumption that the strategy and actions of a missionary society are likely highly correlated *across* countries, we employ the level of knowledge diffusion activities undertaken by Protestant missions in other parts of the world to predict how much they were likely to "invest" in the same activities in China. Beach (1903) provides region-level data on missionaries' knowledge diffusion activities—specifically day school and higher education enrollments and the number of hospital patients—in 19 regions around the world (see Appendix G for details). But since our unit of analysis is the Chinese county, it is necessary to transform region-level data into mission-level data, and then into county-level data.

To transform region-level data into mission-level data, we begin by measuring the level of knowledge diffusion activities provided by each missionary society, n, in terms of day school enrollments, higher education enrollments, and hospital patients in each region, j, using the share of each type of activities relative to the size of the mission, denoted by k_{1j}^n (the share of day school enrollments), k_{2j}^n (the share of higher education enrollments), and k_{3j}^n (the share of hospital patients).[17] Then, by calculating the *average* of k_{1j}^n, k_{2j}^n, and k_{3j}^n in the other 18 regions (i.e., excluding China), using

$$\bar{k}_1^n = \sum_{j=1}^{18} k_{1j}^n, \quad \bar{k}_2^n = \sum_{j=1}^{18} k_{2j}^n, \text{ and } \bar{k}_3^n = \sum_{j=1}^{18} k_{3j}^n,$$ we are able to measure the

overall intensity of knowledge diffusion activities pursued by each missionary society in the rest of the world.

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[17] In other words, these activities are normalized by the size of the missionary (defined as the number of communicants).

Next, to transform the mission-level data into county-level data, we first match the list of missionary societies in China provided by Stauffer (1922) [in Appendix F] with that of the 19 regions of the world provided by Beach (1903). This process tells us which mission invested how much in each of the three knowledge diffusion activities worldwide, as well as which mission had a presence in China on a county-by-county basis. Aggregating the worldwide knowledge diffusion activities of those missions with their presence in a particular county gives us a measure that reflects the level of knowledge diffusion activities that these missions had undertaken in the rest of the world. We then apply this measure as our instrument. For example, suppose there are λ missionary societies in Chinese county i. We take the sum of the knowledge diffusion activities of those λ missions in terms of day schools ($\bar{k}_1^n$), higher education institutions ($\bar{k}_2^n$), and hospitals ($\bar{k}_3^n$) in the rest of the world as a measure of what these missions in county i invested in the rest of the world, denoted by $\tilde{K}_1 = \sum_{n=1}^{l} \bar{k}_{1n}$, $\tilde{K}_2 = \sum_{n=1}^{\lambda} \bar{k}_{2n}$, and $\tilde{K}_3 = \sum_{n=1}^{\lambda} \bar{k}_{3n}$. We obtain a total of three indices of knowledge diffusion activities ($\tilde{K}_m, m = 1, 2, 3$). Using principal component analysis, we transform the three correlated variables into a single variable ($\tilde{K}$), which becomes our instrumental variable for knowledge diffusion.

5.2.2 Estimation Results of the Three-stage Model
Using this additional instrument, we are now able to confirm that knowledge diffusion is the main channel through which Protestantism impacts economic prosperity by estimating a system of three equations. In the first equation, we employ the interaction between "distance from the nearest Boxer Uprising" and "Yangtze Compact" to predict the spread of Protestantism. We then employ Protestantism and the knowledge diffusion activities conducted by the missionaries outside of China—our additional instrument—to predict knowledge diffusion activities performed by the same missionaries within China in the second equation. Finally, our third equation estimates the effects of Protestantism and knowledge diffusion on urbanization. This system of simultaneous equations is:

$$
\begin{aligned}
Y &= r\,P + q\,K & + h\,D + \tilde{W}g_3 + e \\
K &= r_1 P + h_0 \tilde{K} & + h_1 D + W g_2 + u\,. \\
P &= & d_3 DS + d_1 D + \tilde{W}g_1 + v
\end{aligned}
\tag{10}
$$

The system can be identified as both the order condition and rank condition are met under the specification of Equation (10).

We estimate the system based on Equation (10) using the three-stage least squares (3SLS) method. The 3SLS results reported in Table 9 show that (1) the interaction between "distance from the nearest Boxer Uprising" and "Yangtze Compact" (*DS*) is positively correlated with the degree of Protestantism (Column (2.1)); (2) the part of Protestantism that is due to the instrument is positively associated with knowledge diffusion (Column (2.2)); and (3) the part of knowledge diffusion that is due to the portion of Protestantism that is linked to the instrument has a positive effect on economic outcome (Column (2.3)). In short, these results unambiguously support the hypothesis that economic prosperity in China was due primarily to the diffusion of knowledge-intensive activities associated with Protestant development. Moreover, our results also show that knowledge diffusion activities undertaken by the Protestant missionary societies in the rest of the world, namely $\tilde{K}$, also positively affected knowledge diffusion in China. The overall effect of Protestantism on urbanization consists of both the direct effect of Protestantism and its indirect effect via knowledge diffusion. Estimated at about 0.865 (0.095 + 0.081 * 9.502), the indirect effect accounts for approximately 89% of the overall effect. Against the 2SLS benchmark estimate of the overall effect of Protestantism on urbanization (0.853, Column (1)), we find that as much as 90% (0.0770 of 0.853) of the overall effect comes from knowledge diffusion.[18]

Table 9 about here

Recall that our exclusion restrictions assumption (that the missionary societies' involvement in education and health matters in the rest of the world ($\tilde{K}$)) does not directly affect the economic development of the counties in which they set up operations (i.e., $\tilde{K}$ is not correlated with the error term ε). This assumption would be violated, however, if some missionary bodies that happened to have a preference for setting up schools and hospitals also preferred to settle in, for example, the more prosperous regions; in that case, $\tilde{K}$ might be correlated with the unobserved characteristics of the regions ($\tilde{g}$) in which a missionary society settled. Assuming that the same missionary body has similar preferences regarding settlement choice around the world (including China), g (the unobserved economic characteristics of the county in which a missionary society settled) should be positively correlated with $\tilde{g}$, in which case $\tilde{K}$ could affect economic outcome Y via g. To rule out this possibility, we include the *average* population density—a proxy for economic prosperity—of

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[18] This figure is obtained by multiplying 0.0851 (Column (2.2), the coefficient of the relationship between knowledge diffusion and Protestantism) by 9.502 (Column (2.3), the coefficient of the relationship between knowledge diffusion and urbanization).

the regions in the rest of the world where the missionary societies had set up operations in Equation (10).[19] The underlying assumption is that, should such a bias exist, this additional control variable would be significantly correlated with urbanization. Columns (3) and (4) of Table 9, however, show that it is not. More importantly, Protestantism still does not have a significant direct effect on economic prosperity—more than 90% of its effect comes from knowledge diffusion.

6. Conclusion

Using survey data collected by Stauffer (1922) that documented the religious and non-religious activities of the Protestant missionaries in early 20th century China, we examined the effects of Protestantism in a country where it could not possibly create the same positive economic benefits as it had in Europe, according to Max Weber. But, even after controlling for a wide array of variables that may affect economic prosperity, Protestantism—measured as the density of communicants—was positively associated with both the degree of urbanization and the establishment of modern industrial firms in China in the period examined. This result remains robust even after we instrumented Protestantism with the consequences of the Boxer Uprising.

By focusing on a country with only a tiny fraction of its population converted to Christianity, it would appear highly unlikely for the Protestant "work ethic" or literacy to be the primary channel through which the observed economic effect of Protestantism was identified; this makes the alternative story of knowledge diffusion much more plausible by comparison. Indeed, we found that as much as 90% of the overall effect of Protestantism comes from knowledge diffusion. By establishing a large number of schools and hospitals, the Protestant missionaries effectively created a large stock of the "useful knowledge" required for modern economic development. All of these events occurred at a time when China seemed unable to move away from knowledge that was *not* conducive to economic development, only serves to make our story more credible.

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[19] We calculated the average population density in 1900 in regions around the world where the same missionary societies had set up operations. We then applied these averages to estimate their settlement preferences in China.

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TABLE 1. Definition of variables and summary statistics.

Variable	Definition	Obs.	Mean	S.D.	Data sources
(1) Economic prosperity					
	Urbanization: percentage of urban population to total population	1,175	4.265	(12.296)	A
	Number of firms established	1,175x15	0.049	(0.871)	E
(2) Protestantism					
	Total communicants per 10,000 people	1,175	8.394	(15.161)	A
	Year when the missionary work formally began	916	1896.876	(14.832)	A
(3) Knowledge diffusion					
	Lower primary school (number of students per 10,000 people)	1,175	3.200	(6.874)	A
	Higher primary school (number of students per 10,000 people)	1,175	0.568	(1.738)	A
	Middle school (number)	1,175	0.216	(1.092)	A
	Hospital (number)	1,175	0.187	(0.526)	A
	Bible school (number)	1,175	0.075	(0.384)	A
(4.1) Western penetration					
	Roman Catholicism: Number of Catholic missionary stations per 1 million population	1,175	0.630	(1.269)	A
	Treaty ports	1,175	0.179	(0.383)	D
	Railways	1,175	0.345	(0.475)	D
(4.2) Initial economic conditions					
	Small city (1840)	1,175	0.031	(0.175)	C
	Middle city (1840)	1,175	0.022	(0.147)	C
	Large city (1840)	1,175	0.007	(0.082)	C
(4.3) Political and geographic factors					
	Prefectural government location	1,175	0.150	(0.357)	B
	Grand Canal	1,175	0.037	(0.188)	B
	Changjiang (Yangtze) River	1,175	0.048	(0.213)	B
	Coast	1,175	0.108	(0.311)	B
	Population density	1,175	189.399	(211.683)	A
	Size	1,175	1914.911	(1218.037)	B
(5) Boxer Uprising					
	Distance to Boxer Uprising (log-term)	1,175	3.944	(0.986)	B
	Latitude	1,175	114.544	(3.618)	B
	Longitude	1,175	31.728	(5.205)	B
	Dist. to the sea (log-term)	1,175	4.351	(1.187)	B
	Dist. to the earliest 5 treaty ports (log-term)	1,175	5.127	(0.897)	B, D

A: Stauffer 1922; B: CHGIS 2007; C: Rozman 1974; D: Yan 1955; E: Chang 1989.
Note: Appendix A provides detailed information on the definition of variables and data sources.

TABLE 2. The effects of Protestantism on urbanization.

	(1)	(2)	(3)	(4)	(5)
Protestantism	0.215***	0.194***	0.162**	0.186***	0.158**
	(0.064)	(0.061)	(0.056)	(0.060)	(0.055)
Catholicism	0.637	-0.229	0.009	-0.173	0.031
	(0.491)	(0.266)	(0.285)	(0.273)	(0.290)
Initial economic conditions:					
Small city			6.491**		6.324*
			(2.990)		(3.025)
Middle city			18.466***		18.106***
			(4.422)		(4.469)
Large city			44.449***		43.841***
			(9.458)		(9.623)
Treaty ports				2.849***	1.716***
				(0.545)	(0.538)
Railways				0.793	0.132
				(0.623)	(0.567)
Prefectural government location		10.296***	4.810***	10.474***	5.009***
		(1.351)	(1.323)	(1.345)	(1.307)
Grand Canal		8.879***	5.796***	8.935***	5.928***
		(1.001)	(1.279)	(0.748)	(1.191)
Changjiang (Yangtze) River		1.848**	-0.529	0.668	-1.174
		(0.635)	(1.354)	(0.895)	(1.332)
Coast		2.503*	2.261*	1.312	1.574
		(1.215)	(1.250)	(1.228)	(1.126)
Population density (log-term)	4.493***	2.622***	1.329**	2.494***	1.293**
	(0.494)	(0.456)	(0.541)	(0.482)	(0.555)
Size (log-term)	2.347***	0.339	-0.291	0.391	-0.267
	(0.538)	(0.465)	(0.397)	(0.493)	(0.437)
Province dummies	Yes	Yes	Yes	Yes	Yes
Observations	1175	1175	1175	1175	1175
R-squared	0.15	0.24	0.34	0.25	0.34

Note: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Constant terms are not reported.

TABLE 3. Panel analysis: the effect of Protestantism on the establishment of modern industrial firms.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Duration	0.0068***	0.0071***	0.0071***	0.0058***	0.0058***	0.0027***	0.0026***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Time dummies * Protestantism		Yes		Yes		Yes	
Time Trend * Protestantism			Yes		Yes		Yes
Duration of Treaty Ports				Yes	Yes	Yes	Yes
Duration of Railways				Yes	Yes	Yes	Yes
Time dummies * Treaty ports						Yes	Yes
Time dummies * Railways						Yes	Yes
Time dummies * Catholicism						Yes	Yes
Time dummies * Initial economic conditions						Yes	Yes
Time dummies * Prefectural government location						Yes	Yes
Time dummies * Grand Canal						Yes	Yes
Time dummies * *Changjiang* (Yangtze) River						Yes	Yes
Time dummies * Coast						Yes	Yes
Time dummies * Population density (1850s)						Yes	Yes
Time dummies * Size						Yes	Yes
Time dummies (I_τ)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17625	17625	17625	17625	17625	17625	17625
County number	1175	1175	1175	1175	1175	1175	1175
R-squared	0.10	0.10	0.10	0.12	0.12	0.27	0.27

Note: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 4. The effect of instrument on Protestantism and other related variables (cross-sectional).

	(1) Protestantism	(2) Protestantism	(3) Protestant primary student	(4) Government primary student	(5) Railways	(6) Catholicism	(7) Treaty ports	(8) City level in 1840
D * South	4.139**	3.234***	1.633**	-9.525	0.120	-0.081	-0.003	-0.043
	(1.879)	(0.742)	(0.696)	(12.181)	(0.088)	(0.094)	(0.043)	(0.078)
D	-1.010*	-1.344**	-0.424	-2.728	0.024	0.061	0.005	-0.018
	(0.545)	(0.523)	(0.400)	(4.153)	(0.026)	(0.035)	(0.011)	(0.062)
Spatial variables* South		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial variables		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control variables		Yes	Yes	Yes	Yes	Yes	Yes	Yes
South	Yes							
Province dummies		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1175	1175	1175	1175	1175	1175	1175	1175
R-squared	0.02	0.21	0.17	0.34	0.46	0.20	0.39	0.40

Note: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Constant terms are not reported. The dummy of safe region is dropped due to collinearity, since we control for province dummies in the regressions. The spatial variables include distance to the sea, distance to the earliest five treaty ports, latitude, longitude, and the squared terms of geographic coordinates (latitude, longitude). The control variables include prefectural government location, Grand Canal, *Changjiang* (*Yangtze*) River, coast, population density, prefecture size, and constant term.

Table 5. Falsification tests: panel analysis.

Dependent Variable	(1) Protestant duration	(2) Protestant duration	(3) Domestic firms (county)	(4) Domestic firms (prefecture)	(5) Foreign firms (prefecture)
D*South *Post-1900	1.474*** (0.235)				
D*South	0.130 (0.343)				
D*South*1911		1.4680*** (0.4609)	0.0738*** (0.0113)	0.1301*** (0.0339)	0.0311 (0.0269)
D*South*1906		1.6469*** (0.4609)	0.0534*** (0.0113)	0.0906*** (0.0339)	0.0136 (0.0269)
D*South*1901		1.6998*** (0.4609)	0.0239** (0.0113)	0.0613* (0.0339)	0.0326 (0.0269)
D*South*1896		0.1199 (0.4494)	0.0077 (0.0108)	0.0161 (0.0330)	0.0196 (0.0265)
D*South*1891		0.1005 (0.4494)	-0.0031 (0.0108)	0.0128 (0.0330)	0.0093 (0.0265)
D*South*1886		0.0970 (0.4494)	0.0016 (0.0108)	0.0062 (0.0330)	0.0071 (0.0265)
D*South*1881		0.1885 (0.4493)	-0.0032 (0.0108)	-0.0009 (0.0330)	-0.0025 (0.0265)
D*South*1876		0.2317 (0.4493)	0.0037 (0.0108)	0.0104 (0.0330)	0.0107 (0.0265)
D*South*1871		0.2079 (0.4493)	0.0029 (0.0108)	0.0037 (0.0330)	-0.0076 (0.0265)
D*South*1866		0.1433 (0.4493)	-0.0013 (0.0108)	0.0087 (0.0330)	-0.0030 (0.0265)
D*South*1861		0.0790 (0.4493)	0.0021 (0.0108)	0.0060 (0.0330)	0.0029 (0.0265)
D*South*1856		0.0806 (0.4493)	0.0038 (0.0108)	0.0054 (0.0330)	0.0058 (0.0265)
D*South*1851		0.0957 (0.4493)	0.0020 (0.0108)	0.0020 (0.0330)	0.0070 (0.0265)
D*South*1846		0.1185 (0.4493)	0.0014 (0.0108)	0.0028 (0.0330)	0.0042 (0.0265)
D*South*1841		0.1109 (0.4388)	0.0021 (0.0105)	0.0007 (0.0313)	-0.0031 (0.0257)
D*Post 1900	Yes	Yes	Yes	Yes	Yes
D	Yes	Yes	Yes	Yes	Yes
$\tilde{Z}_{it}$	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes
Observations	17625	17625	17625	2700	2700
County number	1175	1175	1175	180	180
R-squared	0.63	0.63	0.34	0.65	0.36

Notes: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. $\tilde{Z}_{it}$ includes all control variables in Column (6) of Table 3 and all interaction terms between spatial variables and a full set of time dummies. Column (3) reports the results based on county-level data; in Column (4), we collapse the data into prefecture level (in Qing China the prefecture was an administrative unit between the province and the county); In Column (5), we regress the establishment of foreign firms using the specification of Column (3).

TABLE 6. Instrumented evidence.

	(1)		(2)		(3)		(4)	
	(1.1)	(1.2)	(2.1)	(2.2)	(3.1)	(3.2)	(4.1)	(4.2)
	1st step	2nd step	1st step	2nd step	1st step	2nd step	1st step	2nd step
Protestantism		0.837** (0.381)		0.868** (0.405)		0.828** (0.397)		0.916** (0.438)
D * South	3.234*** (0.716)		3.273*** (0.601)		3.284*** (0.611)		3.362*** (0.725)	
D	-1.344*** (0.504)	-1.044 (0.749)	-1.432*** (0.394)	-0.669 (0.735)	-1.476*** (0.554)	-0.239 (0.668)	-1.281*** (0.288)	-0.738 (0.759)
Incidence of Boxer Uprising					-0.168 (1.142)	1.883** (0.850)		
Small city			5.481** (2.430)	2.353 (2.362)	5.494** (2.417)	2.420 (2.344)	4.790** (2.107)	0.082 (2.115)
Middle city			5.420*** (1.969)	13.455*** (4.662)	5.433*** (1.976)	13.511*** (4.611)	5.652** (2.211)	13.049*** (5.058)
Large city			19.595*** (5.905)	26.198** (11.504)	19.612*** (5.933)	26.777** (11.440)	16.088*** (5.758)	23.163** (10.647)
Catholicism			0.496*** (0.152)	-0.376 (0.286)	0.493*** (0.151)	-0.322 (0.285)	0.450*** (0.129)	-0.328 (0.305)
Treaty ports			1.841*** (0.690)	0.601 (0.963)	1.833*** (0.700)	0.755 (0.956)	3.142*** (0.564)	-0.155 (1.554)
Railways			0.625 (1.483)	-0.319 (1.294)	0.627 (1.485)	-0.304 (1.204)	-0.034 (1.538)	-0.130 (1.252)
Spatial variables * South	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spatial variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,175	1,175	1,175	1,175	1,175	1,175	1,013	1013
R-squared	0.21		0.22		0.22	.	0.20	.

Note: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The spatial variables include distance to the sea, distance to the earliest five treaty ports, latitude, longitude, and the squared terms of geographic coordinates (latitude, longitude). The control variables include prefectural government location, Grand Canal, *Changjiang* (*Yangtze*) River, coast, population density, prefecture size, and constant term.

TABLE 7. Instrumental evidence: panel analysis.

	(1)		(2)	
	(1.1) P	(1.2) Y	(2.1) P	(2.2) Y
Dependent variable				
P		0.0184***		0.0181***
		(0.0037)		(0.0052)
D*South *Post-1900	1.4659***			
	(0.2351)			
D*South*1911			1.3292***	
			(0.4473)	
D*South*1906			1.5081***	
			(0.4473)	
D*South*1901			1.5611***	
			(0.4473)	
D*South*1896			-0.0158	-0.0097
			(0.4276)	(0.0131)
D*South*1891			-0.0345	-0.0192
			(0.4276)	(0.0128)
D*South*1886			-0.0373	-0.0135
			(0.4275)	(0.0131)
D*South*1881			0.0549	-0.0220*
			(0.4275)	(0.0128)
D*South*1876			0.0988	-0.0149
			(0.4275)	(0.0128)
D*South*1871			0.0756	-0.0155
			(0.4275)	(0.0128)
D*South*1866			0.0116	-0.0207
			(0.4275)	(0.0132)
D*South*1861			-0.0522	-0.0143
			(0.4275)	(0.0132)
D*South*1856			-0.0504	-0.0114
			(0.4275)	(0.0131)
D*South*1851			-0.0356	-0.0119
			(0.4275)	(0.0131)
D*South*1846			-0.0130	-0.0149
			(0.4275)	(0.0130)
D*Post 1900	Yes	Yes	Yes	Yes
$\widetilde{Z}_{it}$	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Observations	17,625	17,625	17,625	17,625
County number	1,175	1,175	1,175	1,175
R-squared	0.63	0.16	0.63	0.17

Notes: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. $\widetilde{Z}_{it}$ includes all control variables in Column (6) of Table 3 and all interaction terms between spatial variables and a full set of time dummies.

TABLE 8. Protestantism, knowledge diffusion, and urbanization.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Protestantism	0.158**	0.090	0.063	0.098**	0.100**	0.049	0.002	0.049	0.001
	(0.055)	(0.056)	(0.044)	(0.041)	(0.044)	(0.043)	(0.041)	(0.043)	(0.040)
Knowledge diffusion (index)							3.445***		3.464***
							(0.591)		(0.517)
Lower primary school		0.225				0.023		0.024	
		(0.132)				(0.112)		(0.110)	
Higher primary school			2.231***			1.064**		1.070**	
			(0.691)			(0.483)		(0.468)	
Middle school				4.340***		2.878***		2.896***	
				(0.457)		(0.367)		(0.473)	
Hospital					7.323***	2.078*		2.153*	
					(1.889)	(1.127)		(1.119)	
Bible school								-0.288	-0.134
								(2.658)	(2.446)
Control variables (W)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,175	1,175	1,175	1,175	1,175	1,175	1,175	1,175	1,175
R-squared	0.34	0.35	0.41	0.43	0.39	0.45	0.44	0.45	0.44

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The control variables (W) include Catholicism, small city, middle city, large city, treaty ports, railways, Grand Canal, *Changjiang* (Yangtze) River, coast, population density (log-term), size (log-term), province dummies, and constant term.

TABLE 9. Estimation results using the three-stage model.

	(1) Y	(2)			(3)	(4)		
		(2.1): P	(2.2): K	(2.3): Y		(4.1): P	(4.2): K	(4.3): Y
Protestantism (P)	0.853**		0.081*	0.095	0.851**		0.085**	0.082
	(0.434)		(0.043)	(0.844)	(0.424)		(0.041)	(0.838)
Knowledge diffusion activities (K)				9.502**				9.851**
				(4.684)				(4.719)
Knowledge diffusion activities in the rest of the world ($\tilde{K}$)			0.287***				0.295***	
			(0.090)				(0.092)	
D * South		3.205**				3.310**		
		(1.494)				(1.527)		
Population density in the rest of the world (g)					-0.168	-0.248	-0.005	-0.888
					(0.456)	(0.706)	(0.071)	(0.809)
Control variables ($\tilde{W}$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,130	1,130	1,130	1,130	1,097	1,097	1,097	1,097
R-squared	.	0.22	0.51	.03	.	0.22	0.50	.

Notes: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The control variables ($\tilde{W}$) include distance to the nearest Boxer Uprising (D), the list of spatial variables, the interaction between the spatial variables and south, Catholicism, small city, middle city, large city, treaty ports, railways, Grand Canal, *Changjiang* (Yangtze) River, coast, population density (log-term), size (log-term), province dummies, and constant term.