The Economics of Missionary Expansion: Evidence from Africa and Implications for Development

Remi Jedwab and Felix Meier zu Selhausen and Alexander Moradi*

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Abstract

One of the most powerful cultural transformations in modern history has been the dramatic expansion of Christianity outside Europe. Recent, yet extensive, literature uses Christian missions established during colonial times as a source of exogenous variation to study the long-term effects of religion, human capital and culture in Africa, the Americas and Asia. We argue that the endogeneity of missionary expansion may be underestimated, thus questioning the link between missions and economic development. Using annual panel data on missions from 1751 to 1932 in Ghana as well as cross-sectional data on missions for 43 sub-Saharan African countries in 1900 and 1924, we show that: (i) locational decisions were driven by economic factors, as missionaries went to healthier, safer, and more accessible and developed areas, privileging the best locations first; (ii) these factors may spuriously explain why locations with past missions are more developed today, especially as most studies rely on historical mission atlases that tend to only report the best mission locations. Our study identifies factors behind the spatial diffusion of religion. It also highlights the risks of omission and endogenous measurement error biases when using historical data and events for identification.

JEL Codes: F54, L31, N37, O15, O17, Z12

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*Corresponding author: Remi Jedwab: Department of Economics, George Washington University, jedwab@gwu.edu. Felix Meier zu Selhausen: Department of Economics, University of Sussex, fm272@sussex.ac.uk. Alexander Moradi: Department of Economics, University of Sussex, a.moradi@sussex.ac.uk. We gratefully thank Sascha Becker, Matteo Cervellati, Denis Cogneau, James Fenske, Dany Jaimovich, Noel Johnson, Mark Koyama, Nathan Nunn, Dozie Okoye, Elias Papaioannou, Felipe Valencia Caicedo, Leonard Wantchekon and Jan Luiten van Zanden for their helpful comments. We are grateful to seminar audiences at AEHN 2015 (Wageningen) and 2016 (Sussex), ASREC Europe 2017 (Bologna) and 2018 (Luxembourg), CSAE 2018 (Oxford), Dalhousie, EHES 2017 (Tübingen), EHS 2018 (Keele), GDE 2018 (Zurich), George Mason, George Washington, Goethe University Frankfurt, Ingolstadt, Passau, Queen's University Belfast, Stellenbosch, Sussex and Utrecht. We also thank Julia Cagé and Valeria Rueda, as well as Morgan Henderson and Warren Whatley for sharing their datasets. Jedwab gratefully acknowledges the generous support of the Institute for International Economic Policy (George Washington). Meier zu Selhausen acknowledges financial support of the British Academy (Postdoctoral Fellowship no. pf160051) as part of his project 'Conversion out of Poverty? Exploring the Origins and Long-Term Consequences of Christian Missionary Activities in Africa'.

Significant literature exists on the long-term effects of historical events and uses historical shocks as a source of exogenous variation in institutions, human capital or culture (Nunn, 2014a; Michalopoulos and Papaioannou, forthcoming), both across countries (e.g., Acemoglu et al., 2001; Glaeser et al., 2004; Nunn, 2008; Feyrer and Sacerdote, 2009) and within countries (e.g., Dell, 2010; Nunn and Wantchekon, 2011; Acemoglu, Reed and Robinson, 2014b). Relatedly, recent, yet extensive, literature uses Christian missions established during colonial times to study the long-term effects of religion, human capital and culture (e.g., Nunn, 2010, 2014b; Acemoglu et al., 2014a; Wantchekon et al., 2015; Cagé and Rueda, 2016; Valencia Caicedo, 2017; Barro and McCleary, 2017). Most studies acknowledge that there may be endogeneity issues from studying missions. To our knowledge, no study investigates what these issues are, and their implications for the analysis of development. This paper uses new panel data on missionary expansion in colonial Ghana and existing data on colonial missions in Africa to show that the diffusion of Christianity was driven by local economic factors, thus arguing that the endogeneity of missionary expansion may be underestimated and questioning the link between past missions and contemporary development.

In most societies, religion represents an essential element of culture, and one of the most powerful cultural transformations in modern history has been the rapid expansion of Christianity to regions outside Europe. We focus on sub-Saharan Africa, "the future of the world's most popular religion" (The Economist, 2015).[1] While the share of Christians was low in 1900, it has grown to 61% in 2017 (Pew Research Center, 2017). This makes Africa the continent with the highest number of Christians (26% vs. 25% for Latin America and 24% for Europe). By 2060, Africans will comprise 42% of the global Christian population. Finally, The Economist (2015) writes: "Africa is also home to the world's most observant Christians. [...] Figures from the World Values Surveys [...] indicate that 90% of people calling themselves Christian also said they attended church regularly".

While a large literature has studied the economic consequences of evangelization, the economics behind the expansion of Christianity remains poorly understood. The conventional narrative is that missionaries' objective was to save as many souls as possible; they had very limited knowledge of the area; their locational choices were highly erratic, but once settled, missions remained there permanently. For example, Wantchekon et al. (2015, p. 714) describes how a series of historical accidents led missionaries to settle left rather than right of a river (in Benin). Such instances occurred and can provide an excellent context to identify causal effects. But rather the exception than the rule, this view cannot be maintained for the entire missionary enterprise. In

[1] The Economist. *The future of the world's most popular religion is African*. December 25th 2015.

present-day Togo, missionary Thauren (1931, p. 19/20) laid out their strategy as follows:

> The mission leadership knew that choosing suitable places would be crucial for missionizing the interior. Therefore, no effort was spared to get to know the interior better. Missionaries were sent out to explore the interior [...]. Atakpame became the first inland station. This place is at the junction of the northeast-northwest caravan route [...]. The mission society aimed to establish new stations in larger cities, so that few missionaries could spread the gospel to many. In particular, they preferred cities with regular markets. Furthermore, the places needed to be centrally located, so that surrounding villages (outstations) could be visited from there (main station) [...].

More recently, Acemoglu, Gallego and Robinson (2014a, p.887) challenge the idea that "missionary activity in the early twentieth century is excludable from regressions of long-run economic development [...] missionaries clearly chose where to locate. [...] they went to places with a lot of native people because their main objective was conversions". To deal with endogeneity, many studies compare neighboring locations or add controls. Yet, without more research on the factors driving missionary expansion, researchers have no guide as to what the contaminating factors are, and how valid their context is for identification purposes.

In addition, most studies use mission atlases to obtain data on the location of missions for one year only. Atlases used for Africa are the 1900 *Atlas of Protestant Missions* (Beach, 1903) and the 1924 *Ethnographic Survey of Africa* (Roome, 1925), which also includes Catholic missions (Figure 1(a) shows their locations). If we use ecclesiastical census returns and other primary missionary sources instead, we uncover large discrepancies. Figure 1(b) shows that atlases omit the lion's share of missions for most countries, in both 1900 and 1924. Overall, 90% of Africa's missions are omitted. In Ghana, this share is 91-98% and atlases locate the missions at the coast and miss most hinterland missions (Figures 2(a)-2(b) show their locations). This issue is not limited to Africa. The *World Atlas of Christian Missions* (Bartholomew et al., 1911) and the *Atlas Hierarchicus* (Streit, 1913) miss 85-95% of missions in China, India, Korea, and Japan. One century ago, Fahs (1925, p.27) pointed out that mission atlases provide an Eurocentric account of Christianization as they only show residence stations of European missionaries: "[...] mapping the Christian advance which puts a red underline under some place-name to indicate the residence of a British or Continental or American missionary, but does not indicate where an Azariah or a Kagawa serves his people, fails to give needful perspective". Atlases thus ignore the essential contribution of African missionaries to the diffusion of Christianity (Frankema, 2012; Meier zu Selhausen et al., 2018).

All this may have implications for the economic analysis of Christian missions. First, the dynamics of missionary expansion question the exogeneity of their placement and the appropriate set of controls when studying their long-term effects. Second, the significant omissions in the atlases could lead to a large attenuation bias, but only if measurement error is classical. In contrast, if measurement error is not classical and if atlas missions are positively selected, i.e. if atlases only report the "best" missions/locations in ways unaccounted for by the controls, this creates an upward bias. In that case, the contemporary effects of missions may be over-estimated, and missions may not serve as a source of exogenous variation in human capital, religion or culture.

This paper tests these hypotheses. We focus on Ghana, for which we create a novel annual panel dataset on the locations of missions at a precise spatial level over almost two centuries: 2,091 grid cells of 0.1x0.1 degrees (11x11km) in 1751-1932. During that period, the number of missions increased from about nil to 1,838. Today, Ghana is one of the most devout Christian countries (The Economist, 2012), making it an ideal context to address our research question.[2] Creating a new dataset on the geographical, political, demographic, and economic characteristics of locations in pre-1932 Ghana, we first investigate the local determinants of missionary expansion using cross-sectional and panel regressions, and apply identification strategies to estimate the causal effects of selected determinants. We find that missionaries went to healthier, safer, and more accessible and developed areas, privileging the best locations first. We then show that these factors may spuriously explain why locations with past missions are more developed today. The effects of colonial missions on present-day measures of economic development (night lights, urbanization), Christianity, and human capital (literacy, educational attainment) are strongly reduced when including controls for pre-1932 locational characteristics. Next, we replicate these results on the determinants of missions and their long-term effects using cross-sectional data from mission atlases and other sources for 203,574 cells of 0.1x0.1 degrees in 43 sub-Saharan African countries.

Our study contributes to wider literature that explores the economic effects of religion (see McCleary and Barro (2006a) and Iyer (2016) for surveys). Thus far, the literature has focused on the effect of religion on economic development (e.g., Barro and McCleary, 2003; Guiso et al., 2006; Cantoni, 2015; Campante and Yanagizawa-Drott, 2015; Rubin, 2017; Bryan et al., 2018) and other outcomes such as human capital (e.g., Becker and Woessmann, 2009; Dittmar, 2011; Chaney, 2016;

[2] The Economist. *True Believers: Christians in Ghana and Nigeria*. September 5th 2012.

Becker and Woessmann, forthcoming) and political and social attitudes (e.g., Guiso et al., 2003; Voigtländer and Voth, 2012; Cantoni et al., forthcoming). One strand of that literature explores the long-term effects of missions or uses missions for identification purposes. Web Appendix Table 1 gives details on 55 related studies. Whether the analysis is conducted at the country, subnational or individual level, most find strong effects, whether on economic development (Bai and Kung, 2015; Valencia Caicedo, 2017; Castelló-Climent et al., 2018; Michalopoulos et al., 2018), human capital (Nunn, 2010; Gallego and Woodberry, 2010; Wantchekon et al., 2015; Waldinger, 2017; Barro and McCleary, 2017; Calvi and Mantovanelli, 2018), political and social attitudes (Woodberry, 2012; Nunn, 2014b; Wantchekon et al., 2015; Fenske, 2015; Cagé and Rueda, 2016), or social mobility (Wantchekon et al., 2015; Alesina et al., 2018). With a few exceptions, studies use only one year of mission data and rely on missions atlases to obtain this data (see last column), thus ignoring the potentially endogenous dynamics of missionary expansion.[3] While this questions the internal validity of these analyzes, we are not claiming that missions may not exert long-term effects. Some studies have used innovative strategies to identify causal effects.[4] Our goal instead is to stimulate future research by providing a better understanding of the factors behind missionary expansion and raising awareness of the empirical issues surrounding the analysis of missions.

By studying missionary expansion, this paper adds to the literature on the determinants of religion (see McCleary and Barro (2006a) and Iyer (2016) for surveys). Existing studies concentrate on the role of religious markets and competition (e.g., Bisin and Verdier, 2000; Barro and McCleary, 2005) or the secularization hypothesis which predicts that religiosity declines with income or education (e.g., McCleary and Barro, 2006b; Glaeser and Sacerdote, 2008; Becker and Woessmann, 2013; Buser, 2015; Becker et al., 2017). To our knowledge, there are very few quantitative studies on the spatio-temporal diffusion of religion. Cantoni (2012) studies the Reformation using data for German territories and finds that ecclesiastical territories, more powerful territories, and territories more distant from Luther's town were less likely to become Protestant. Rubin (2014) uses data for European cities to show that the Reformation was linked to the spread of the printing press. Michalopoulos et al. (forthcoming) finds that trade routes and ecological similarity to the

[3] 26 studies use Roome (1925), 6 use Bartholomew et al. (1911), 6 use Streit (1913), and 4 studies use Beach (1903).

[4] Wantchekon et al. (2015) study four villages with missions, using control villages that they identified as "as likely to be selected" based on historical sources. Cagé and Rueda (2016) compare protestant missions with and without a printing press. Valencia Caicedo (2017) compares locations with missions with locations with missions abandoned for exogenous reasons. Valencia Caicedo (2017), Waldinger (2017) and Barro and McCleary (2017) compare locations evangelized for exogenous reasons by different Christian denominations. Waldinger (2017) uses an instrumental variable strategy that exploits the initial directions of missionary expansion paths.

birthplace of Islam predict today's Muslim adherence across countries and ethnic groups. While these studies have greatly improved our understanding of religious diffusion, there remain some limitations. Given that these episodes of religious diffusion take place five centuries ago or more, the studies have limited localized data on their determinants. Moreover, this analysis is cross-sectional in nature, except Cantoni (2012) who uses panel data on the dates of introduction of Protestantism for 74 territories in 5 periods. Finally, they study conditional correlations, except Rubin (2014) who instruments for the printing press with a city's distance to Mainz.[5]

Studying the spatio-temporal diffusion of religion requires: (i) localized data on the establishments and closures of places of worship, (ii) localized data on the determinants of religious supply and demand; and (iii) identification strategies for these determinants. Most major religions spread out in earlier centuries, which makes data availability issues acute and complicates the search for identification strategies. We study Africa, where Christianity spread comparatively late. By constructing an annual panel data set of missions (N = 2,163) at the cell level (2,091) in Ghana from 1751 to 1932, we fulfill condition (i). Our data set is one the largest databases ever built on places of worship. Other studies with panel data on missionary expansion over a long period – Barro and McCleary (2017) (22 departments, 1880-2011), Valencia Caicedo (2017) (39 missions, 1609-1767) and Waldinger (2017) (1,145 missions, 1524-1810) – do not use their data to study religious diffusion and their panel is also not annual. Next, by obtaining data on numerous local characteristics in pre-1932 Ghana, we satisfy condition (ii). Lastly, by using panel regressions for Ghana as well as identification strategies for selected factors for both Ghana and Africa, we contribute to (iii). Our work thus complements and improves upon existing studies.

We show that missionary expansion was far from random. Missionaries privileged better locations, especially in earlier years. Wealthier, more urban and more trade-oriented communities were targeted and adopted Christianity first. This finding could seem to contradict the secularization hypothesis that predicts that religiosity declines with income. However, one interesting and tentative reconciliation could be that the new religion appeared as a vehicle of modernization for converts. We also find that missionaries went to safer areas, avoiding non-coastal areas, areas with hostile African kingdoms or that were colonized late, and areas in the vicinity of Muslim centers. This contradicts the view that missionaries were adventurers crossing

[5]While there is long-standing non-economic literature on missionary expansion in Africa (Johnson, 1967; Park, 1994), and the decisive role of Western missionary personalities in particular (Kretzmann, 1923; Bartels, 1965; Ballard, 2008), there have been few systematic attempts to quantify the factors behind the diffusion of Christianity in Africa.

political boundaries[6], and that their decisions of where to establish missions were not driven by local political conditions. Finally, we challenge the general wisdom that malaria played a lasting role for evangelization in Africa. While malaria was initially an impediment for Europeans, it ceased to be one after quinine was used as antimalarial medication. Moreover, many African converts – who acquired immunity at birth – eventually became missionaries.

Our work also contributes to the debate on the historical roots of African development (see Michalopoulos and Papaioannou (forthcoming) for a survey). Recent contributions emphasize the role of the slave trade (Nunn, 2008; Nunn and Wantchekon, 2011), pre-colonial state formation (Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013; Alsan, 2015), colonial institutions (e.g., Acemoglu et al., 2014b; Michalopoulos and Papaioannou, 2016), colonial investments in physical capital (Jedwab and Moradi, 2016; Jedwab et al., 2017) or human capital (e.g., Glaeser et al., 2004; Gallego and Woodberry, 2010; Nunn, 2014b; Wantchekon et al., 2015; Cagé and Rueda, 2016). We re-assess the long-term effects of Christian missions on African human capital and other developmental outcomes and find them to be potentially over-estimated.

Finally, our contribution is methodological. Many studies on path dependence link a historical event to outcomes observed today, but ignore the dynamics between the two cross-sections: what Austin (2008) called the "compression of history". Moreover, to identify historical variation, data is increasingly sourced from historical atlases, or mission atlases in our case. Another example is the *Ethnographic Atlas* of Murdock (1967), which has been widely used to study the historical roots of African development. Atlases give the impression of completeness. Non-random omissions and their consequences for the analysis of path dependence are, we believe, under-investigated.[7] Using Christian missions as an example, we draw attention to the risks of omission and non-classical measurement error biases when using historical data and events for identification.

1. Conceptual Framework: Determinants and Effects of Missions

In this section, we approach the question of mission locations through the perspective of a mission society, its aims and its constraints which feed into supply. We also take into account the demand side. These considerations motivate the selection of the variables in our analysis.

Determinants: Locational Factors. The mission society obtains utility from converting locals

[6] See, for example, the Jubilee magazine celebrating 200 years of the Basel Mission Society, which has been active in Africa since 1828 (url: https://issuu.com/mission21/docs/jubil__umsmagazin_2015_ausz__ge).

[7] Measurement error in survey data, in contrast, has received a lot of attention (e.g. Aigner, 1973; Bollinger, 1996; Bound et al., 2001; Chen et al., 2011; Mahajan, 2006; Nguimkeu et al., 2017).

in various locations. Utility in a location depends on the location-specific benefits and costs of conversion. For a given location, the society maximizes membership, but also how much members give in terms of time and money. In addition, some conversions are valued relatively more. For example, if another objective is the abolishment of slavery, more weight is put on conversions in slave-exporting locations. Variable costs for a given membership depend on: (i) the number of missionaries needed, which is a function of their productivity, salary and training costs divided by years of service, hence life expectancy; and (ii) the structures and equipment needed, since larger communities require larger buildings and more tools of conversion (religious artifacts and books). Fixed costs of opening a mission depend on access to the coast. There is also a fixed cost every year of having one missionary report to the capital.

In our empirical analysis, we will arbitrarily classify the locational factors into five groups proxying for *geography* (coastal proximity, ports, malaria, rain, soils, altitude, ruggedness), *political conditions* (native resistance, colonial administrative cities), *transportation* (rivers, trade routes, explorer routes, railroads, roads), *population* (urban and rural populations) and *economic activities* (slavery, cash crops, mining). A same determinant can affect both benefits and costs.

Determinants: Expansion. Initial expansion cannot occur without donations from the motherland. Over time, local revenues are generated. The number of locations converted each year depends on the budget and the net benefits of the *next* best locations not converted yet. The society expands by converting the best locations first, followed by less optimal locations until it runs out of locations or money. The relative importance of each locational factor may change over time, which affects future expansions if the ranking of the remaining locations is altered.[8]

Long-Term Effects of Missions. We will study how the effects of colonial missions on present-day outcomes vary when: (i) Considering commonly used subsets of the full set of missions, e.g. missions established earlier vs. later; and (ii) Using as controls subsets of the determinants listed above. Our main hypothesis is that missionary expansion was not random, with the best locations receiving missions first, so that using early missions and/or not including the right controls for early selection over-estimates the long-term effects of colonial missions on development today.

2. New Data on Ghana and Africa

The Web Data Appendix gives details on the sources used and data construction.

[8]While our conceptual framework considers only one mission society, there may be several societies in the country. These may differ in their utility functions and budgets; they may also behave strategically.

Missions in Ghana. We partition Ghana into 2,091 grid cells of 0.1 x 0.1 degrees (11x11 km) and construct an annual panel data set from 1751 to 1932 (181 years). We recreate the history of every mission station (N = 2,163) for all societies (classified as Presbyterian, Methodist, Catholic or other) and geocode their locations.[9] Our main sources are the ecclesiastical returns published in the *Blue Books of the Gold Coast*, 1844-1932. Each society was required to submit annual reports on its activities to the colonial administration. We use numerous society reports and secondary literature to reconstruct missions before 1844 (see Web Data Appendix). Based on the same sources, we identify if a mission was a main station or had a school. We focus on "assisted schools" which were monitored by the government and received subsidies conditional on meeting quality standards (Williamson, 1952). Figure 3 presents the evolution of the number of missions.

Missionaries in Ghana. We create a new data set of 338 European and 172 African missionaries stationed in Ghana during 1751-1890 from a variety of sources (data not available post-1890). For each male missionary, we collect data on his time of service, year of birth, and year and location of death. African missionary careers are less well-documented in official statistics (and possibly not entirely representative). Figure 5(a) shows the evolution of the number of European missionaries.

Locational Factors for Ghana. We construct a GIS data set of factors at the same grid resolution: (i) *Geography:* Historical malaria intensity (based on genetic data) comes from Depetris-Chauvin and Weil (2018). We compute distance to the coast and obtain ports circa 1850 from Dickson (1969); (ii) *Political conditions:* Data on large pre-colonial cities before 1800 are from Chandler (1987) and headchief towns in 1901 from Guggisberg (1908). From Dickson (1969), we derive the boundary of the Gold Coast Colony established by the British circa 1850; (iii) *Transportation:* We obtain from Dickson (1969) navigable rivers in 1850-1930 and trade routes circa 1850. Railroads and roads in 1932 come from Jedwab and Moradi (2016); (iv) *Population:* Using census gazetteers, we compile a GIS database of towns above 1,000 inhabitants in 1891, 1901 and 1931. We also collect rural population data for 1901 and 1931. Because all cells have the same area, population levels are equivalent to densities.[10]; (v) *Economic activities:* Slave export and slave market data come from Nunn (2008) and Osei (2014) respectively. We obtain cash crop production areas from Dickson (1969) and total export value of cash crops from Frankema et al. (2018).[11] Mine locations are taken

[9]We use grid cells to minimize measurement errors from imprecise geographical coordinates in our data.

[10]While we have exhaustive urban data for all census years, we only have georeferenced rural population data for Southern Ghana in 1901. We thus include a dummy if any locality in the cell was surveyed by the 1901 census.

[11]We obtain soil suitability for the same cash crops from the *1958 Survey of Ghana Classification Map of Cocoa Soils for Southern Ghana*, Survey of Ghana, Accra, as well as Gyasi (1992) and Globcover (2009).

from Dickson (1969); and (vi) *Other:* We control for land area, mean annual rainfall (mm) in 1900-1960, mean altitude (m), ruggedness (standard deviation of altitude), and soil fertility.[12]

Contemporary Data for Ghana. We use satellite data on night lights in 2000/2001 as a proxy for economic development (NOAA, 2012). Census data on education, religion, urbanization and employment in industry/services in 2000 are from Ghana Statistical Service (2000).[13]

Missions in Africa. We compile similar data for 203,574 grid cells of 0.1 x 0.1 degrees (11x11 km) for 43 sub-Saharan African countries. We retrieve mission location data widely used in the literature. First, we use Beach (1903), compiled by Cagé and Rueda (2016), which reports the locations of 672 Protestant missions in 1900. Secondly, we use Roome (1925), digitized by Nunn (2010), which shows the locations of both Catholic (361) and Protestant missions (851) in 1924.

Locational Factors for Africa. We identify a number of locational factors: (i) *Geography:* Historical malaria intensity is from Depetris-Chauvin and Weil (2018) and tsetse fly ecology from Alsan (2015). We compute distance to the coast, and 19th century slave ports are from Nunn and Wantchekon (2011); (ii) *Political conditions:* Data on large pre-colonial cities before 1800 are from Chandler (1987). Data on the capital, largest and 2nd largest cities come from Jedwab and Moradi (2016). The year of colonization for each ethnic group is derived from Henderson and Whatley (2014). Using the Murdock (1967) map of ethnic boundaries from Nunn (2008), we then assign a colonization year to each cell. From the same sources, we identify if the cell was in an ethnic area with a centralized state before colonization. We compute the distance to historical Muslim centers based on Ajayi and Crowder (1974) and Sluglett (2014); (iii) *Transportation*: We obtain navigable rivers and lakes from Johnston (1915), pre-colonial explorer routes from Nunn and Wantchekon (2011) and railroads from Jedwab and Moradi (2016); (iv) *Population:* We control for population density circa 1800 and log urban and rural population circa 1900 from HYDE (Klein Goldewijk et al., 2010), and log city population circa 1900 for towns above 10,000 from Jedwab and Moradi (2016) (who use colonial administrative sources);[14] (v) *Economic activities:* We know if slavery (and polygamy) was practiced before colonization (Murdock, 1967). The log number of slaves exported per land area is taken from Nunn and Wantchekon (2011). We obtain land suitability measures for

[12]Climate data comes from *Terrestrial Air Temperature and Precipitation: 1900-2007 Gridded Monthly Time Series* (v1.01), 2007, University of Delaware. Topography comes from SRTM3 data and soil fertility from (FAO, 2015).

[13]Since we only have data for 10% of the population census, the most rural cells of our sample do not have enough observations to correctly estimate these shares. Data is available for 1,895 cells only (= 2,091 - 196 missing cells).

[14]Klein Goldewijk et al. (2010) do not rely on census data for earlier centuries (there were no censuses then). These population estimates are unreliable. We nonetheless use them for three controls to be consistent with the literature.

seven major export crops (cocoa, coffee, cotton, groundnut, palm oil, tea and tobacco). We then obtain cash crops' national export value circa 1900 and 1924. Mines in 1900 and 1924 come from Mamo et al. (2017); and *(vi) Other:* We control for land area, mean annual rainfall (mm) in 1900-1960, mean altitude (m), ruggedness (the standard deviation of altitude), and soil fertility. We also add a dummy if the main ethnic group in the cell has data in the Murdock (1967) Atlas and a dummy if the underlying anthropological survey used to create this data precedes 1900 or 1924.

Contemporary Data for Africa. We use satellite data on night lights in 2000/2001 (NOAA, 2012). From the *Demographic Health Surveys* in 32 countries with GPS readings for the closest year to 2000, we obtain measures of education, religion and wealth at the individual or household level. We use their means at the cell level.[15] Finally, we obtain urban population (the total population of cities above 10,000) from Jedwab and Moradi (2016), who rely on Africapolis (2012) and census data.

3. Background: Missionary Expansion in Ghana

Christianity grew rapidly in sub-Saharan Africa during the 20th century, at the expense of traditional African religions (Hastings, 1994). The share of African Christians grew from 9% in 1900 to 61% in 2017 (Pew Research Center, 2017). In this section, we focus on Ghana's experience.

Colonization. The first mission station in Ghana was established in 1751 at the port of Elmina (Figure 4(a) shows the location of the places mentioned in this paragraph). By that time, European powers had established trading posts on the coast. Beginning in 1850, Britain gradually annexed the coastal regions of Ghana into an informal protectorate called the Gold Coast Colony. In 1874, the British defeated the Ashanti Kingdom centered around its capital Kumasi. The ensuing peace treaty of 1875 transformed the Gold Coast into a formal protectorate. In 1896, another war with Ashanti forced the kingdom to become a British protectorate and protection was extended to the northern areas. Railroad construction began in 1898, which helped the British to consolidate their control over Ghana and lowered transport costs for commodity exports. In our analysis, we focus on five turning points: 1751, 1850, 1875, 1897, and 1932 (our last year of data).

Missionary Expansion. Figure 3 shows the number of missions, main stations, and mission schools from 1840 (first year with 10 missions) to 1932. For a long time, Ghanaians showed little interest in Christianity. Evangelization efforts intensified when Presbyterian missionaries and Methodist missionaries reached the Gold Coast in 1828 and 1835, respectively. By 1850, only 904 Ghanaians had converted and 21 mission stations existed (Isichei, 1995, p. 169) (Miller, 2003,

[15] Since we use survey data, data is only available for 3,110-6,6387 cells depending on the outcome.

p. 23). Mass evangelization did not take off until the 1870s, when 67 missions served about 6,000 Ghanaians. Catholic missions started their conversion efforts from 1880 onwards. Missions provided the majority of formal schooling in colonial Ghana (Cogneau and Moradi, 2014). By 1932, the number of missions had expanded to 1,775 with about 340,000 followers (9% of Ghana's population). The Christian share has since grown to 41% in 1960 (Ghana Census Office, 1960) and 71% in 2010 (Ghana Statistical Service, 2012). As indicated by Figure 3, early missions qualitatively differ from later missions in that many were main stations and had a school.

Constraints. Most missions were initially established along the coast (see Figures 4(a)-4(b)). The Ashanti Kingdom was hostile to missionary activities and their boundary acted as an institutional barrier. Missions expanded into the interior after the peace treaty of 1875 (Figures 4(b)-4(c)). Access to the interior was also facilitated by rail and road building from the early 20th century onwards (Figure 4(d)). Malaria inhibited the diffusion of the gospel. Malaria struck Europeans soon after arrival, earning the West African coast its reputation as the "White Man's Grave" (Curtin, 1961). This changed after the 1840s, when quinine became the cure and prophylaxis for malaria.[16] Figure 5(a) confirms the very high mortality rates among European missionaries. In the post-quinine era, defined here as post-1840, we observe a marked decline in European mortality. As shown in Figure 5(b), the likelihood of European missionaries surviving more than three years during the pre-quinine era in Ghana was about 30%, whereas in the post-quinine era it was over 75%. Missions responded to quinine and increased the presence of European mission staff post-1840 (Figure 5(a)). However, despite quinine, the number of European missionaries remained below 100 until 1932 (Cardinall, 1932). With this small European representation, it is difficult to imagine how 1.2 million Ghanians were evangelized by 1960. Employing African converts as missionaries was a cost-efficient strategy to spread the gospel. Firstly, Africans acquired immunity to malaria during childhood (Curtin, 1973, p.197). As Figure 5(b) reveals, African missionary mortality was significantly lower than for Europeans in both pre- and post-quinine eras. Secondly, their salaries were lower and they spread the gospel in the local vernacular (Schlatter, 1916; Agbeti, 1986, p. 57). By 1890, there were four African missionaries for every European.[17]

[16] Fischer (1991, p.73-76) notes that a Basel missionary carried quinine in his medical chest as early as 1833. Curtin (1973, p.355) explains that European soldiers in West Africa took quinine from 1847 onwards. Sill (2010, p. 86) mentions that quinine became a regular medication after 1854.

[17] By 1918, European missionaries constituted 2% and 8% of total Methodist and Presbyterian mission staff respectively (Parsons, 1963, p. 4), (Sundkler and Steed, 2000, p. 717). Using our databases of missions and missionaries, we find that the ratio of mission stations to European missionaries increased substantially over time. For this reason, it may be misleading to rely on measures of European missionary activities only.

Financing the Mission. Protestant missionary societies initially depended on private donations. These were coming from Western congregations and philanthropists (Miller, 2003; Quartey, 2007). However, this source of income was limited. Moreover, the societies' declared goal was to develop self-supporting African churches, so African congregations had to contribute to the costs. The construction and operation of missions was often financed exclusively by the local community and school fees constituted a substantial part of the mission-school budget (Frankema, 2012).[18]

Missionary expansion became associated with trade, and the cultivation of cash crops: cocoa, kola, palm oil/kernels and rubber (Debrunner, 1967, p.54, 132 and 203). For example, cocoa farming dramatically increased incomes from the 1890s onwards (Hill, 1963a; Austin, 2003). By 1911, Ghana was the world's leading producer. Debrunner (1967, p. 54) made it clear: "Cocoa money helped the African Christians to pay school fees and church taxes and to pay off old debts from the building of schools and chapels". Consequently, the "Ghana Churches and the Christians became very dependent on cocoa for their economic support" (Sundkler and Steed, 2000, p. 216).

4. Specifications for the Determinants and Effects of Missions

For both Ghana and Africa, we first analyze the *determinants* of missionary expansion. We then study the *contemporary effects* of the missions, depending on which controls are included. Our hypothesis is that not including the right controls leads to overestimating the effects of missions.

Determinants: Cross-Sectional Regressions for Ghana. For 2,091 cells and the periods 1751-1850, 1850-1875, 1875-1897, and 1897-1932, we run repeated regressions of the form:

$$M_{c,t} = \alpha + \rho M_{c,t-s} + X_c\beta_t + u_{c,t} \tag{1}$$

$M_{c,t}$ is a dummy equal to one if there is a mission in cell c in the end year $t = \{1850, 1875, 1897, 1932\}$. Other measures of missionary activity are the log number of missions (+1 to avoid dropping cells with none) and dummies equal to one if there is a main station or a mission school. X_c is our vector of *time-invariant* locational factors. As we control for missions in the start year t-s ($M_{c,t-s}$), the coefficients β_t capture the long-difference effects of the factors on missionary expansion in each period. Note that we do not capture causal effects with this analysis. Our goal is to identify factors that may have driven missionary expansion over time. In particular, we develop identification strategies for selected factors in this cross-sectional framework.

Determinants: Panel Regressions for Ghana. For the same 2,091 cells and selected *time-varying*

[18] Catholic mission societies only expanded from the 1880s onwards and were financially less constrained as they partially relied on the financial backing of the Vatican (Spitz, 1924; Debrunner, 1967).

locational factors $X_{c,t}$, we run these regressions for the mission variable $M_{c,t}$:

$$M_{c,t} = \alpha' + \beta' X_{c,t} + \omega_c + \lambda_t + v_{c,t} \quad (2)$$

ω_c and λ_t are cell fixed effects and year fixed effects respectively. They control for time-invariant heterogeneity at the cell level and national trends over time. Given the cell fixed effects, we study what causes changes in missions *within* cells over time. We also develop identification strategies to obtain causal effects in this panel framework. Standard errors are clustered at the cell level.

Determinants: Cross-Sectional Regressions for Africa. For 203,574 cells in 43 sub-Saharan African countries, we have cross-sectional data only. For cells c in country g, we study the effects of *time-invariant* factors $X_{c,g}$ on a dummy equal to one if there is a mission ($M_{c,g}$) in 1900 or 1924:

$$M_{c,g} = \alpha'' + X_{c,g}\beta_{SSA} + \kappa_g + u_{c,g} \quad (3)$$

We include country fixed effects (κ_g) to account for national characteristics. We also develop identification strategies for selected factors in this cross-sectional framework.

Long-Term Effects: Cross-Sectional Regressions for Ghana and Africa. We run a regression analogous to earlier studies, correlating a dummy equal to one if the location had a mission ($M_{c,g}$) in 1900 or 1924 and present-day measures of local economic development ($D_{c,g,today}$):

$$D_{c,g,today} = a''' + \rho M_{c,g} + X_{c,g}\zeta + \kappa'_g + w_c \quad (4)$$

We then examine how the coefficient ρ varies when we include: (i) No controls $X_{c,g}$; (ii) The controls used in studies on Africa; and (iii) Our full set of determinants from equation 1 or 3.

5. Main Results on the Determinants of Missions

We now study the factors that determined missionary expansion. In line with our conceptual framework, mission societies chose healthier, safer, more accessible, and more developed areas.

5.1. Cross-Sectional Results for Ghana

Table 1 presents the long-difference effects of the variables of interest on missionary expansion in four periods: 1751-1850 (column 1), 1850-1875 (2), 1875-1896 (3) and 1897-1932 (4).

Geography. In the earliest periods, missions avoided high-risk malaria areas and settled at their port of entry, in close proximity to the coast (columns 1 and 2). While coastal proximity remained a crucial factor for missionary expansion throughout all periods (columns 1-4), malaria ceased to be a significant barrier to missionary expansion in the late 19th century (columns 3-4).[19]

Political Conditions. African resistance to British colonialism obstructed missionary advancement. It was only after the British had defeated the Ashanti Kingdom and annexed its territory in 1875 that missionaries expanded northwards outside the Gold Coast Colony (columns 3-4). Once pacified, the cross followed the flag. Missionaries also avoided large pre-colonial cities.

Transportation. While earlier missions expanded along trade routes during the 19th century (columns 1-2), later missions opened in proximity to railroads and roads once built in the late 19th century (columns 3-4). The negative effects for rivers in the early years (columns 1-2) mirror the effects for malaria, since river floodplains provide breeding grounds for mosquitoes.

Population. Missions concentrated in dense urban areas (columns 1-4). Missionary expansion appears to have followed urban population patterns between 1891, 1901 and 1931. Once urban demand was partly satisfied, missions spread into densely populated rural areas (columns 3-4).

Economic Activities. Former slave markets/activities did not attract missions (columns 1-3). Instead, expansion took place in cash crop growing areas, around palm oil and kola plantations and cocoa farms. By the 20th century, missions also settled around mines (column 4).

Summary. Results suggest that mission placement was not random (R-squared as high as 0.61 in columns 2 and 4) and that locational choices were driven by costs and benefits. These effects are not necessarily causal, so their causality will be investigated in the next subsection.

Intensive Margin. Conditional on a dummy for having a mission, cells with better locational factors saw an increase in number of missions (Web Appendix Table 2) or the likelihood of having a main station (Web Appendix Table 3) or a school (Web Appendix Table 4). In particular, we find more missions/main stations/schools in more accessible, populated and developed areas.

Denomination-Level Data. Results generally hold if we run the same regression but transform the data set into a pooled data set of missionary expansion for four Christian denominations (N = 2,091 x 4 = 8,364): Methodist, Presbyterian, Catholic and other. This allows us to add denomination fixed effects and four dummies for whether there was a mission of the same denomination or a different denomination in the cell or a neighboring cell in the start year of each period (see Web Appendix Table 5). We then extend this model to study if local characteristics have different effects for Catholics and Protestants by interacting the characteristics with a dummy if the dependent variable captures Catholic expansion. We also examine the differential effects of

[19] Malaria and the tsetse index from Alsan (2015) are strongly correlated (0.86). We thus do not control for tsetse.

local characteristics across Protestant denominations. Web Appendix Table 6 shows significant differences. This suggests that in Ghana at least, comparing the mission locations of different denominations may not inform on the causal contemporary effects of missions.

5.2. Investigation of Causality

5.2.1. Cross-Sectional Results

Pre-Determined Variables. Most expansion occurred after 1875 (see Figure 3). By then, many variables in Table 1, such as historical malaria, coastal and hydrological geography, African resistance, historical trade routes or slave-exporting activities, were exogenous by construction (e.g., distance to the coast) or pre-determined (e.g., historical malaria).[20]

Within-Ethnic Group Variation. Another strategy used in the literature is to include ethnic group fixed effects (N = 35, from the Murdock (1967) map) so as to control for pre-colonial conditions (Michalopoulos and Papaioannou, 2014). Web Appendix Table 7 shows results generally hold when doing so. Since neighboring cells could still differ in unobservables, we use the following identification strategies for malaria, railroads, and cash crops.[21]

Difference-in-Difference (DiD) for Malaria. Section 3. described how European missionary mortality dropped after quinine was introduced circa 1840. We test this pattern more formally in Table 2. For 2,091 cells c and 115 years t from 1783-1897, we regress a dummy if there is a mission in cell c in year t on the historical malaria index of cell c interacted with a dummy if the year t is after 1840, while simultaneously including cell fixed effects and year fixed effects. We choose our third turning point – 1897 – as the final year of the post-treatment window, and to have a pre-treatment window of equal length we chose 1783 as our start year. Due to the fixed effects, historical malaria and the post-1840 dummy are dropped from the regression.

Missions expanded in higher-risk malaria areas after 1840 (column 1). In column 2, malaria is also interacted with a dummy if the year t is between 1810 and 1839. This separates the pre-treatment window into two subperiods of 30 years, and shows malaria had no differential effect between the two, thus implying parallel trends. The effect holds but is lower when adding ethnic group-year

[20] Almost all trade routes circa 1850 were surveyed by colonial administrators. The only exception is a route surveyed by a missionary in 1886. This route is endogenous if the establishment of a mission motivated the survey. Also, trade routes differed from slave routes, so they do not capture the particular effects of the slave trade. Web Appendix Table 8 shows results hold if we drop the route surveyed by a missionary and control for proximity to slave routes.

[21] While historical malaria from Depetris-Chauvin and Weil (2018) was by construction determined before colonization, there could be reverse causality between rail/cash crops and missions. For example, missionaries could have used their influence to alter the lay out of the railroads built by the colonial government and could have pushed for the cultivation of crops in their areas. There are also obvious omission biases, even if we include all our controls.

or district (as of 1931)-year fixed effects to compare neighboring cells over time (columns 3-4).

For the 2,091 cells and the years 1846-90, we also know whether a European or African missionary was serving at each mission. We run the same DiD model as before. However, because we need enough pre-treatment years, we use 1850 as the cut-off year instead of 1840. Doing so, we explore if European or African missionaries disproportionately entered higher malaria areas in the later (1850-90) versus early (1846-49) years. While we do not have the data to capture the pre-quinine vs. post-quinine years, the results from columns 4-6 suggest that expansion into malarial areas was driven by African missionaries. This is in line with the fact that relying on African missionaries was more cost-efficient for mission societies. The introduction of quinine was important because it allowed enough European missionaries to live on the coast, from where they could routinely visit and supervise African missionaries in areas that were previously too lethal for Europeans.[22]

Cross-Sectional Strategies for the Railroads. Once the British had consolidated their control over Ghana in 1896, they sought to build transport infrastructure to permit military domination and boost trade (Gould, 1960; Luntinen, 1996). By 1932, they had built three railroad lines (see Web Appendix Figure 1): (i) A western line in 1898-1903: British capitalists lobbied to connect two gold fields to the port of Sekondi (see Figure 4(a) for the location of the cities mentioned here). The line was later extended to Kumasi, the capital of the annexed Ashanti Kingdom, to facilitate quick dispatch of troops; (ii) An eastern line in 1908-1923: The goal of the line was to connect the colonial capital Accra on the coast to Kumasi. Several additional motivations were cited for its construction: the export of cash crops, the exploitation of goldfields, and the development of tourism; and (iii) A central line in 1927: The line was built parallel to the coast to connect fertile land as well as a diamond mine. Evangelization was never mentioned as a determining factor.

Five alternative routes were proposed before the first line was built. We can address concerns regarding endogeneity by using these lines as a placebo check of our identification strategy. Presumably random events such as a war and the retirement or premature death of colonial governors explain why the construction of these routes did not go ahead.[23]

Web Appendix Table 9 runs the same regression model as Table 1 except we now include four

[22]Results are robust to using other cut off years (not shown, but available upon request).

[23]See Web Appendix Figure 1 for a map of these. Cape Coast-Kumasi (1873): Proposed to link Cape Coast to Kumasi to send troops fight the Ashantis. The project was dropped because the war came to a halt. Saltpond-Kumasi (1893): Advocated by Governor Griffith who retired, and his successor had other ideas. Apam-Kumasi and Accra-Kumasi (1897): A conference was to be held in London to discuss the proposals by Governor Maxwell, but he died on the boat to London. Accra-Kpong (1898): Advocated by Governor Hodgson who retired, and his successor had other ideas.

dummies for whether the cell was within 0-10, 10-20, 20-30 and 30-40 km from a railroad built in 1897-1932 (instead of one 0-10 km dummy). Results show that railroads had an effect until 30 km in 1897-1932, but no effect before, thus confirming parallel trends. In Panel A of Table 3, we use the same model but now aggregate the rail dummies into one 0-30 km dummy. Row 1 shows a baseline effect of 0.082**. There is no effect of the 0-30 km rail dummy in the periods before 1897-1932 (rows 2-4). The main result is robust to: (i) Adding 34 ethnic group or 38 district (1931) fixed effects (rows 5-6); (ii) Confining the rail dummy to the more exogenous western line only (row 7). Its goal was to connect a port, two mines, and the Ashanti capital Kumasi, without consideration for locations in between. Since we include the controls of Table 1 – dummies for whether there is a port / mine / large city – we capture the independent effects of these locations, and identification relies on cells connected by chance; (iii) Using cells within 0-30 km of a placebo line, for which no spurious effect is found (row 8); and (iv) Instrumenting the 0-30 km rail dummy by a dummy equal to 1 if the cell is within 30 km from the Euclidean minimum spanning tree between the main nodes of the triangular rail network: Sekondi, Kumasi and Accra (see Figure 4(a)). We drop the nodes and control for the log distance to those cities to rely on cells connected by chance (row 9).

Timing of Rail Building. In Panel B of Table 3, for 2,091 cells c in years 1897-1932, we study the effect of the 0-30 km rail dummy for cell c in year t on whether the same cell c has a mission in year t, while adding cell fixed effects and year fixed effects (standard errors clustered at the cell level). Row 1 shows a strong effect (0.179***). Rows 2-3 show there is no effect when adding one or two leads of the rail dummy (rows 2-3). Rows 4-5 show the contemporaneous effect of railroads in t on missions in t is captured by lags of the rail dummy. These results suggest that missions followed railroads. Rows 6-7 show results hold when adding 34 ethnic group or 38 district fixed interacted with year effects, to compare connected and unconnected neighboring cells over time.

Timing of Cash Crop Expansion. Cash crops destined for export were an important source of income during the colonial era (Austin, 2003). Dickson (1969, p. 143-178) explains that Ghana has experienced various commodity export booms and busts, mostly as a result of new crop diffusion and changing world demand: palm oil (1860s-1910s), rubber (1890s-1910s), kola (1900s-1920s), gold (1900s-1930s) and cocoa (1900s-1930s). Data on exports for the period 1846-1932 (no data available before) confirms this (see Web Appendix Figure 2). We thus explore the relationship between cash crop cultivation, as a proxy for African incomes, and the expansion of missions. The fact that each commodity boom happened at different times and affected different areas of Ghana facilitates identification. We exclude gold in our baseline analysis because gold mines were owned by Europeans, so African incomes did not increase as much.

In the absence of data on annual crop production in each cell, we study the reduced-form effects of a Bartik-type instrumental variable (IV) predicting labor demand for each cash crop sector s in cell c and year t. Bartik IVs are used to generate exogenous labor demand shocks by averaging national employment growth across sectors using local sectoral employment shares as weights (Bartik, 1991; Goldsmith-Pinkham et al., 2018). We use a modified version of Bartik IVs: (i) We know the national export value of crop s in year t for the 1846-1932 period (earlier data not available); (ii) We know in which cells c crop s was produced at one point in 1846-1932. Since there are four crops, there are four production dummies; (iii) We know the number of producing cells for crop s; (iv) Assuming that each producing cell was producing an equal amount, we predict the export value of crops s in cell c in year t; (v) Our exogenous measure of crop income in cell s and year t is then log export value of *all* crops s in cell c and year t; and (vi) When studying its effects on missions, we add cell fixed effects, which capture the time-invariant production dummies, and year fixed effects, which capture the variations in national export values.

Row 1 of Table 4 shows a strong positive effect (0.028***) of log predicted cash crop export value. Results hold if we: (i) Use each crop's export value, and thus each crop's boom and bust, one by one (palm oil, rubber, kola and cocoa; see rows 2-5); and (ii) Substitute the production dummies with suitability dummies (no suitability map found for kola) when constructing the Bartik (row 6). No spurious effects are found when adding one or two leads of the Bartik (rows 7-8), but the contemporaneous effect of cash crops in t on missions in t are captured by lags of the Bartik (rows 9-10). This suggests missions followed cash crops. Rows 11-12 show results hold when adding ethnic group or 1931 district fixed effects interacted with year fixed effects. In row 13 we use first-differences to show that the effect was driven by positive changes in cash crops rather than negative changes.[24] Cash crop booms led to the establishment of missions. Once there was a bust, missions did not disappear, possibly due to sunk costs.[25]

[24]We transform the fixed effects model into a first-difference model, keeping the year fixed effects (the cell fixed effects are removed by the first-difference transformation). We then interact the log change in cash crop value with a dummy if it is negative, and report in the table the cumulative effects for both positive and negative changes.

[25]Results hold if we (Web Appendix Table 10): (i) Add gold; (ii) Control for distance to the Presbyterian mission of Aburi (and the Presbyterian sphere of influence), which encouraged Ghanaians to grow cash crops (Hill, 1963a); (iii) Use other measures of suitability; and (iv) Use alternative deflator series to construct cash crop value at constant prices.

5.3. Dynamics of Missionary Expansion

The previous section investigated the causal effects of malaria, railroads, and cash crops. This section highlights the spatio-economic dynamics of missionary expansion.

We construct a measure that summarizes how "attractive" a location was to missionaries. More precisely, for the 2,091 cells, we regress the mission dummy in 1932, $M_{c,1932}$, on the determinants of mission placement X_c of Table 1. We then obtain the predicted probability $\widehat{M_{c,1932}} = X_c B$, or *locational score*, that the cell had a mission in 1751-1932. The regression coefficients B serve as weights of how important each factor has been over the period 1751-1932. Figure 6(a) then plots a quadratic fit of the average score for four groups of cells in 1840-1932 (we use 1840 because it is the first year with 10 missions): i) cells with a mission in both $t-1$ and t ("remains 1"); ii) cells with no missions in $t-1$ but a mission opening in t ("becomes 1"); (iii) cells with a mission in $t-1$ that exits in t ("becomes 0"); and (iv) cells with no missions in both $t-1$ and t ("remains 0").

We find that the best locations received missions first, and that marginally less good locations were increasingly added to the existing stock of mission locations. Indeed, cells with surviving missions ("remains 1") rank consistently higher than cells that gain or lose missions ("becomes 1" or "becomes 0") and their scores significantly exceed those of the "remains 0" group. Scores decrease over time, because cells of the "becomes 1" group become less and less attractive over time. Because switchers are among the best locations of the cells with no missions, the scores of the "remains 0" group also decrease over time.[26] Note that results are not mechanically driven by the choice of the year 1932 to determine the regression coefficients/weights. We verify results hold if we (not shown, but available upon request): (i) Use the period 1751-1840 to estimate the importance of each factor and then study the predicted scores in 1840-1932; and (ii) Use the urbanization rate in 1931 as the dependent variable instead of the mission dummy in 1932.

5.4. Cross-Sectional Results for Africa

Cross-Sectional Results. In Table 5, for 203,574 cells in 43 sub-Saharan African countries, we regress a dummy if there is a mission in the mission maps of Beach (1903), supposedly representing the year 1900 (column 1), or Roome (1925), supposedly representing the year 1924 (column 3), on various characteristics proxying for geography, political conditions, transportation, population, and economic activities, as well as country fixed effects.

[26]When regressing the scores of the "remains 1", "becomes 1", "becomes 0", and "remains 0" groups on the year, we find a significant negative effect: -0.003*** (R^2 = 0.90), -0.005*** (0.46), -0.006*** (0.44), and -0.001*** (0.89), respectively. The high R2 values imply that the best-ness of a location is predicted by the year it gained or lost a mission.

As explained in Section 2., the controls used for Africa are as close as possible to those for Ghana, even though they necessarily differ due to data availability issues. We find that: (i) Missionaries chose locations with healthier environments (malaria, tsetse);[27] (ii) Missionaries avoided large pre-colonial cities and ethnic areas that were colonized later, two potential measures of African resistance. They also avoided Muslim centers, our measure of religious resistance. They favored centralized ethnic areas in Beach (1903) but avoided them in Roome (1925); (iii) Transportation played an important role: ports and coastal proximity facilitated initial access, while navigable rivers, lake proximity, explorer routes, and railroads enabled internal diffusion; (iv) Missionaries preferred large colonial cities and dense urban areas, and to a lesser extent dense rural areas; and (v) We find positive effects for pre-colonial slavery and slave export intensity. Richer areas through cash crop exports and European mining also attracted missions.[28]

Overall, much like in Ghana, missionaries chose healthier, safer, more accessible, populated, and developed areas. However, the adjusted R-squared for these regressions are relatively low, at 0.03-0.06 vs. 0.35-0.61 for Ghana (see Table 1). This is due to two reasons. First, the locations of the missions mapped in Beach (1903) and Roome (1925) are mismeasured due to inaccuracies in the georefencing of atlas missions.[29] This creates classical measurement error that reduces the explanatory power of our variables. When combining the cells into 2x2 and 3x3 cells, the adjusted R-squared increases to 0.14-0.15 (not shown). Second, our set of controls is not fully complete. For Ghana, we were able to compile a rich data set, but such data does not exist for the whole of Africa. When using the all-Africa regressions for Ghanaian observations only, the R-squared remains low, at 0.12-0.21 (not shown). However, if we use 2x2 and 3x3 cells for Ghanaian observations, the R-squared increases to 0.39-0.46 (not shown), closer to what we had before.[30]

Pre-Determined Variables and Within-Ethnic Group Variation. In Africa, some countries have seen major expansions of missions as early as the 1790s (Sierra Leone) and 1800s (South Africa), so the controls are not necessarily pre-determined for these countries. Web Appendix Table 11

[27] We include the tsetse fly index of Alsan (2015) for Africa because the correlation between malaria and tsetse is weaker in Africa (0.46) than in Ghana (0.86), thus suggesting that tsetse may have had an independent effect.

[28] While it has been argued that missionaries valued converting polygamous communities, we find mixed results.

[29] Taking a sample of 109 missions that were reported in both Beach and Roome and digitized by Cagé and Rueda (2016) and Nunn (2010) respectively, we found an average distance of 20.3 km between their georeferenced locations (see Web Appendix Figure 4). In a grid level analysis this distance amounts to 2 cells.

[30] For example, we use the pre-colonial explorer routes digitized by Nunn and Wantchekon (2011). This is an imperfect measure of pre-missionary era trade routes. For Ghana, this database returns 581 km of explorer routes (percentage of grids within 10 km of a route = 4.8%), whereas our sources indicate 6,526 km of trade routes (30.0%). For Madagascar, Nunn and Wantchekon (2011) do not record any explorer routes, whereas a different source suggests that all mission stations are clustered along explorer routes and the coast (see Web Appendix Figure 3).

shows most results hold when dropping the ten countries that we have identified as early mission fields (see the notes under the table for details), to focus on countries that received missions late enough. Another strategy is to include 1,158 country-ethnic group fixed effects (variables defined at the group level are then dropped). When doing so, most significant effects remain so and a few effects become insignificant (see columns (2) and (4) of Table 5).

Causal Effects for Malaria, Railroads and Cash Crops. For the whole of Africa we cannot implement the same identification strategies as for Ghana because we do not have panel data. With respect to malaria, quinine became the regular treatment around the same time for all colonies. Regarding railroads, Web Appendix Table 13 shows that the results of Table 5 hold if we use a 0-30 km rail dummy (instead of a 0-10 km rail dummy) as well as the same identification strategies as for Ghana (spatial fixed effects, military and mining lines, placebo lines, instrumentation with Euclidean minimum spanning tree between the major cities).[31] Regarding cash crops, we already use Bartik-based measures of log predicted cash crop export value. More precisely, for seven important cash crops in Africa (cocoa, coffee, cotton, groundnut, palm oil, tea and tobacco), we define each cell as suitable for cultivation if the land suitability index from IIASA and FAO (2012) reports a value higher than 0. We then proceed using the country's total export value for each colony circa 1900 or 1924.[32]

Denomination-Level Data. Web Appendix Table 12 shows that cross-sectional results hold if we repeat the analysis but transform the data set into a pooled data set of missionary expansion for two denominations in 1924 (N = 203,574 x 2 = 407,148): Protestants and Catholics. This allows us to add denomination fixed effects. Using the same model, we then study locational differences between Catholics and Protestants by interacting the locational characteristics with a dummy if the dependent variable captures Catholic expansion. The table shows significant

[31]Most lines were built late, hence the larger (longer-term) effects for 1924. These effects hold if we (Web Appx. Table 13): (i) Include country-ethnic group or district (2000) fixed effects; (ii) Use military or mining lines only, since their goal was to connect two locations without consideration for locations in between, for example a large pre-colonial city/mine and a port. Since we add the controls of 5, we capture the independent effects of locations that mattered for military domination or mining, and identification relies on cells connected by chance; and (iii) Instrument the rail dummy by a dummy if the cell is within 30 km from the Euclidean minimum spanning tree between the capital, largest and second largest cities circa 1900, while simultaneously dropping these cities and controlling for the log distance to them. We also find no spurious effects when using placebo lines planned in 1916-1922 but never built (they have a significant effect on the Roome (1925) missions in 1924 but the effect is ten times smaller than the effect for the lines built).

[32]We estimate the export value of crop s in cell c in colony d in year t as the total export value of crop s in colony d in year t divided by the number of suitable cells for crop s in colony d. We then obtain for each cell c in year t the sum of export values across all crops s. One caveat is that land suitability is based on current conditions, so suitability has changed over time. However, it is unlikely that missions were behind such changes. Since the Bartiks are constructed using suitability maps, we verify results hold when simultaneously controlling for the suitability indexes of the seven crops (not shown). The country fixed effects then capture the aggregate effects of the export of each crop in each year.

differences. This finding suggests that for Africa at least, comparing the mission locations of different denominations may not inform on their causal long-term effects.

6. Implications for Long-Run Economic Development

A large strand of the literature uses Christian missions in the past as a source of exogenous local variation in religion and human capital to study their long-term effects. In addition, historical atlases have become the standard source of mission data (see Web Appendix Table 1). However, we showed they only cover a small fraction of mission activities. What are the implications of our findings for the study of long-run development? In this section, we shed light on two sources of endogeneity, omitted variable bias and measurement error, and show how they interact, thereby leading to upward-biased estimates of the long-term effects of missions in the past.

6.1. Omitted Variable Bias

Omitted variable bias is always a concern for identification. We showed that missionaries chose where to locate. How developed and central a locality was played an important role for missionary settlement. We believe previous studies underestimated the complexity of the missionary expansion process, and they did not have the same wealth of data at their disposal, which limited their set of controls. We also showed that missionary choices are time dependent. More thought thus needs to be put into the timing of control variables.[33] The timing issue is particularly difficult to address in studies covering the entire continent. The onset of Christian expansion varied across countries and the distribution of missions at any given point in time reflects different stages of the diffusion process. This also relates to the study of denominations. Catholics were a latecomer to the religious market in Africa. We showed for Ghana that denominations differ in location characteristics. This may reflect the different timing of entry. In such context, comparing denominations may not be a valid identification strategy. However, we also found that missions stay on after busts, which may provide a good context for identification.

6.2. Endogenous Measurement Error

Mission atlases significantly underreport missions. We focus on two widely used atlases: Beach (1903), showing Protestant missions in 1900 (first used by Cagé and Rueda, 2016), and Roome (1925), reporting Catholic and Protestant missions in 1924 (introduced by Nunn, 2010). For Ghana,

[33]For example, we showed that railroads attracted missions only once they were built. Hence, it is important to accurately align the timing of the transportation network to the missions. Similarly, malaria is an important control only until quinine became widely used and African missionaries were recruited.

both atlases show far fewer missions than our data obtained from ecclesiastical census returns: 26 vs. 304 (i.e., 91% are missing) in 1900 and 23 vs. 1,213 (98%) in 1924 (see Figures 2(a)-2(b)). For sub-Saharan Africa, the extent of misreporting is of a similar scale: Beach (1903) and Roome (1925) omitted 93% and 98% of missions (see Figure 1(b)).[34]

How may relying on mission atlases cause identification issues? For any model $y = \alpha + \beta M + X\gamma + \epsilon$, let M be based on the location of missions in our data, while $\widetilde{M}$ is obtained from atlases. We consider M as the actual reflection of missions measured without error, whereas $\widetilde{M}$ represents the same construct measured with error, so that $\widetilde{M} = M + u$ with u being the measurement error. The classical errors in variables model assumes that u is uncorrelated with; i) the true value of M; ii) the true values of other variables X, and; iii) the equation error ϵ.

If the omissions of missions are random, measurement error is classical, which leads to attenuation bias and gives conservative estimates of the contemporary effect of missions. In our case and in most studies, a mission dummy is used. With a misclassified binary variable, the measurement error and the true values of the variable are mechanically correlated (Aigner, 1973; Bollinger, 1996). If the true mission dummy is one (zero), measurement error can only be negative (positive). However, this case of non-classical measurement error also leads to attenuation bias. Now, if the measurement error – in our case, the misclassification of missions – is correlated with omitted variables that are themselves correlated with present-day outcomes ($cov(u, \epsilon) \neq 0$), estimated contemporary effects could be upward-biased (Mahajan, 2006; Nguimkeu et al., 2017). For example, atlases could have selected mission locations that were better for Europeans in ways unobserved by the econometrician, and these factors that attracted Europeans could also make these locations more attractive to locals today. Finally, if there is already an omitted variable bias, and if the measurement error is correlated with the omitted variables causing this bias, the omitted variable bias will be magnified by the endogenous measurement error.

For Ghana, we have unique data on atlas missions and ecclesiastical (census) missions, and an extensive set of controls. First, we shed light on selection biases in mission atlases.

Selection Bias. Which missions find their way into atlases? Examining the distribution of missions in Ghana reveals two stylized facts that point to non-random selection (see Figures 2(a) and 2(b)). First, the atlases miss most hinterland missions. Second, Roome (1925) does not capture

[34]Omissions are also high across movements and denominations: Beach (1903) misses 89% of Methodist missions and 92% of Presbyterian missions whereas Roome (1925) misses 97% of Protestant missions and 99% of Catholic missions. Other atlases compare as follows: 25 vs. 432 Protestant missions (i.e., 94% of missions are missing) in 1908 (Bartholomew et al., 1911) and 6 vs. 49 Catholic missions (88%) in 1913 (Streit, 1913).

the strong expansion of missions between 1900 and 1924. It is as if atlases did not update their data. We investigate this further. Figure 6(b) plots the coefficients of correlation between a dummy equal to one if there is an atlas mission (1900, 1924) and a dummy equal to one if there is a mission in our data in each year (1840-1932) for the 2,091 cells. Correlations are high for earlier years, at 0.8 for Beach (1903) and 0.4 for Roome (1925).[35] While the atlases indicate to show missions in 1900 and 1924, they actually show the early missions. Atlas missions also differ qualitatively. In Web Appendix Table 14, for the 2,091 cells, we regress a dummy equal to one if there is an atlas mission on cell-level mission characteristics derived from our data for the years 1900 and 1924. The correlations indicate that atlases do not only capture early missions, but also main mission stations and those with schools. Overall, atlases endogenously select "better" missions. One would therefore expect that atlas-based data lead to higher contemporary effects.

6.3. Omitted Variables, Measurement Error and Contemporary Effects in Ghana

How do omitted variables and measurement error affect contemporary effects? We run a regression analogous to earlier studies, correlating a dummy equal to one if the location had a mission in the colonial past on a contemporary measure of local economic development (see eq. 4 in Section 4.). Given the lack of data on incomes at the local level, we use log average night light intensity in 2000-01, as it is now standard in the literature (Henderson et al., 2012; Michalopoulos and Papaioannou, 2013). Unlike most studies, we have data on all missions in many years.

We first investigate whether contemporary effects vary with the observation date of the missions when missions are measured correctly. While the reference to the year 1900 and 1924 in the mission atlases is factually wrong, it may still be correct that early missions have a larger causal effect than the missions that follow thereafter. For example, missions may promote growth, and growth effects could have accumulated over a longer period of time for early missions. Alternatively, early missions may have received more investments, i.e. they could have been main stations or had a school. In contrast, a possibility consistent with upward bias is that early missions were created in better locations and these remain more developed today relative to other locations. Better mission locations may have in turn endogenously received more investments.

We thus study how the effect of our mission dummy varies depending on the year in which it is defined, from 1840 (first year with 10 missions) to 1932. Figure 6(c) shows that unconditional

[35] When combining cells into 2x2 or 3x3 cells to account for inaccuracies in the geocoding of atlas missions, the correlation of earlier years is 0.9 for Beach (1903) and 0.7-0.8 for Roome (1925) (not shown but available upon request).

effects are high, at 4.2 on average (mean = -3.3). In other words, having a mission increases night lights by 420%. Alternatively, one standard deviation in the mission dummy is associated with a 0.48 standard deviation in log night lights. Effects are also higher for earlier years. However, once we add the controls from Table 1, the effects are much lower, mostly insignificant, and not downward-sloping. Thus, the stronger effects for earlier missions are likely because better locations received missions first, which is underlined by our results in Section 5.3..

Table 6 shows the effects on night lights for the actual mission dummy (row 1) and for the atlas mission dummy (row 2), both defined in 1900 (columns (1)-(3); same year as Beach (1903)) and in 1924 (columns (4)-(6); Roome (1925)). We study how point estimates vary when we add: (i) no controls; (ii) the standard controls used in the literature;[36]; and (iii) our controls from Table 1.

Using the actual mission dummy (row 1), we find large unconditional effects, at 3.39-4.01 (columns (1) and (4)). Alternatively, one standard deviation in the mission dummy is associated with a 0.39-0.46 standard deviation in log night lights. Adding the standard controls reduces these effects by 20-30%, to 2.74-2.84 (columns (2) and (5)). Finally, adding our controls reduces the effects by 80-90%, to 0.41-0.68 (columns (3) and (6)). Having a mission thus increases night lights by 41-68%, which may appear as strong effects. However, one standard deviation in the mission dummy is only associated with a 0.05-0.08 standard deviation in log night lights.

Comparing the unconditional effects in rows 1 and 2, one can then see that atlas missions (row 2) have significantly stronger effects than census missions (row 1), by about 25% for Beach (1903) (column (1)) and 40% for Roome (1925) (column (4)). Had omissions been exogenous and given a binary regressor, they should have had smaller effects instead. Using the methodology of Bound et al. (2001), we find that the effects should have been attenuated by 6% for Beach (1903) and 22% for Roome (1925) (not shown but available upon request). The difference implies endogenous measurement error. Adding the standard controls contributes to bridging the gap in the effects between the misclassified atlas dummy and the actual dummy (columns (2) and (5)). This indicates the importance of controls in correcting for endogenous measurement error when using

[36]We merge the lists of controls from Nunn (2010) and Cagé and Rueda (2016). Nunn (Table 1, 2010) follows Johnson (1967) and uses: (i) *European explorer routes before colonization*; (ii) *19th century railroads*; (iii) *soil quality*; (iv) *access to a water source*; and (v) *slave exports*. For Ghana: (i) There were no explorers before official colonization, so there is no variation across cells; (ii) The first railroad was opened in 1901, so there is no variation across cells; (iii) We control for soil fertility; (iv) We add a dummy if the cell is within 10 km from a navigable river (there were no lakes then); and (v) We control for slave export intensity. Cagé and Rueda (Table 1, 2016) use the controls from Nunn (2010) and: (vi) *rainfall*; (vii) *distance to the coast*; (viii) *malaria ecology*; (ix) *initial population density*; and (x) *dummies if large cities in 1400 or 1800*. For Ghana: (vi) We control for rainfall; (vii) We control for distance to the coast; (viii) We control for malaria; (ix) We control for population density in 1800; and (x) We add a dummy if there was a large city in 1800 (none in 1400).

atlases.[37] Adding our more complete set of controls further bridges the gap for Roome (1925) (column (6)), but not for Beach (1903) (column (3)).[38]

Overall, our controls noticeably reduce the effects of both the actual dummy (row 1) and the atlas dummy (row 2). Our controls thus have the double advantage of minimizing both omitted variable bias *and* endogenous measurement error. The effects remain significant in columns (3) and (6) of row 1, but that is for 1900 and 1924. Figure 6(c) already showed that the effects were often insignificant when using other years to define the dummy. Our controls are also incomplete and imperfectly measured so the effect could be lower with better controls.[39]

Other Outcomes. Web Appendix Table 16 shows, for the atlas years 1900 and 1924, the effects of the actual mission dummy and the atlas dummy on other measures of local development: (i) The urbanization rate (%) of the cell in 2000, here defined as the population share of cities of more than 1,000 inhabitants; and (ii) The share of employment in non-agriculture (%) in 2000. Unconditional effects are stronger when using the misclassified atlas dummy. Adding our controls significantly reduces the gap in the effects between the atlas dummy and our mission dummy, consistent with endogenous measurement error, and the effects generally, consistent with omitted variable bias.

The literature identified Christianity and education as mechanisms by which missions affect development. In Table 7, we examine for the atlas years 1900 (columns (1)-(3)) and 1924 (columns (4)-(6)) the effects of the actual mission dummy (Panel A) and the atlas mission dummy (Panel B) on proxies of these mechanisms. Rows 1-2 show the effects on the population shares of Christians first including (mean = 53.3%) and then excluding pentecostal denominations (mean = 28.2%), which spread in Africa in the late 20th century (Jenkins, 2016). We note that the contemporary effect on Christianity is weaker when including pentecostal denominations (columns (3) and (6) of row 1 in Panel A), which must have spread in areas without historical missions. Rows 3-4 show the effects on adult literacy (mean = 34.7%) and the share of adults having completed secondary education (mean = 7.5%). With exogenous measurement error, the unconditional effects should be

[37] With exogenous measurement error, adding controls should lead to an even stronger attenuation bias (Bound et al., 2001). When adding the standard controls, the estimated attenuation bias increases to 23% for Beach (1903) and 49% for Roome (1925). The smaller effects with the controls are thus also consistent with endogenous measurement error.

[38] Alternatively, if we simultaneously include the actual mission dummy and the atlas mission dummy, the atlas dummy shows a stronger effect, at 2.44***-2.97*** when no controls are included, 2.11-2.44*** when the standard controls are included, and 0.56***-0.63* when our controls are included (not shown but available upon request).

[39] Web Appendix Table 15 shows, for 1900 and 1924, the unconditional effects and the conditional effects of the atlas dummy when adding four dummies for whether the missions in our data were created in the two pre-1875 periods and were main stations or had a school in 1900/1924. With the standard controls, there are direct effects of these measures on night lights. With our controls, these effects almost all disappear, so our controls capture endogenous mission quality.

smaller with the atlas dummy. On the contrary, they are not significantly different for Christianity and literacy and are significantly higher for secondary education (see columns (1) and (4) of Panel B vs. columns (1) and (4) of panel A), consistent with endogenous measurement error. Our controls also strongly reduce the effects, consistent with omitted variable bias.

6.4. Omitted Variables, Measurement Error and Contemporary Effects in Africa

We do not have the same comprehensive data on the location of all missions for the 43 African countries. We thus rely on atlas missions here, and study how contemporary effects vary for Africa when we add standard controls or our controls from Table 5 (country fixed effects included; N = 203,574). Row 3 of Table 6 shows the results. The unconditional effects imply that a mission increases night lights by 2.1-2.2% (mean: -4.3). Alternatively, one standard deviation in the mission dummy is associated with a 0.10-0.14 standard deviation in log night lights. Adding standard controls reduces the effects by 10-15%, at 1.83-1.90 (columns (2) and (5)), whereas adding our controls reduces them by 40-45%, at 1.24-1.28 (columns (3) and (6)). Having a mission increases night lights by 124-128%, which may appear as strong effects. However, one standard deviation in the mission dummy is only associated with a 0.06 standard deviation in log night lights.

Overall, the unconditional effects with the atlas dummy are twice lower for Africa than for Ghana (2.1-2.2 vs. 4.7-5.0) but the conditional effects with our controls are higher (1.2-1.3 vs. 0.4-0.7). One reason could be the more imperfect set of controls used for Africa.[40]

Other Outcomes. Unlike for Ghana, for Africa, we only have data on cities above 10,000 inhabitants in 2000. We thus use the log total population of 10,000+ cities, dropping cells without a city. We also do not have data on structural change, but know average household wealth in each cell circa 2000 from the DHS. Using these development outcomes instead (see Web Appendix Table 16), and the same variables as for Ghana to proxy for mechanisms (see Panel C of Table 7), we find that contemporary effects are also reduced for the Africa sample when adding our controls, consistent with endogenous measurement error and omitted variable bias.

[40]For example, we use the pre-colonial explorer routes digitized by Nunn and Wantchekon (2011). This is an imperfect measure of pre-missionary era trade routes. For Ghana, this database returns 581 km of explorer routes (percentage of grids within 10 km of a route = 4.8%), whereas our sources indicate 6,526 km of trade routes (30.0%). For Madagascar, Nunn and Wantchekon (2011) do not record any explorer routes, whereas a different source suggests that all mission stations are clustered along explorer routes and the coast (see Web Appendix Figure 3).

6.5. Discussion of Other Econometric Setups

Several studies use individual-level data and examine whether coming from ethnic groups that were historically more exposed to missions is associated with contemporary outcomes. This analysis requires an identification strategy that provides exogenous variation in historical exposure across ethnicities. The territories occupied by the 780 ethnic groups in Africa are large (mean: 260 cells), so they are more likely to vary in unobservables. Moreover, it is unclear how to measure observable group-level differences driving the placement of missions. For example, it is not obvious how to measure railroad access for 260 cells. Ethnic homelands also have different shapes. For the 780 groups, the number of cells ranges from as low as 1 cell to as much as 3,505 cells. Finally, the studies control for historical missions in the locations where individuals live, capturing the effect of missions through their ancestors only. In itself, it endogenously selects migrants and does not address endogenous group-level differences in historical exposure.

7. Christianity, Modernization, and Economic Development in Africa

Our results have several implications for the relationship between religion and development.

According to the secularization hypothesis, religiosity decreases with education, urbanization, and economic development (Weber, 1905). Indeed, economic growth raises the opportunity costs of participating in time-intensive religious activities (McCleary and Barro, 2006b). We find the opposite in Ghana and in Africa: more developed places adopted Christianity first. Ghana was relatively poor at the start of Christianization. Incomes grew significantly as Ghana transformed in the late 19th century into a cash-crop economy driven by growing demand from global markets (Hill, 1963b; Austin, 2007). Per capita incomes almost doubled between 1870 and 1913, and almost tripled by 1950 (Maddison, 2008). Highly enterpreneurial African farmers migrated to new areas where cash crops could be grown, as well as to towns to exploit new economic opportunities (Hill, 1963b; Dickson, 1969). There are various interpretations that reconcile our results with the secularization hypothesis.

First, our results do not exclude the possibility that it was the poorest individuals in the richest places who converted to Christianity, which Wantchekon et al. (2015) shows for Benin. While we do not have data on who converted and why, this explanation seems unlikely. It may be true that in the beginnings, when the number of Christians was very small, converts often were ex-slaves and social outcasts (Hastings, 1994; Maxwell, 2016). By the mid-19th century, when evangelization efforts gradually led to mass conversions, Christianity had broadened its appeal, in particular among members of the commercial elite, such as cash crop farmers and merchants in Ghana (Debrunner, 1967). Moreover, our conceptual framework explained that mission expansion required financially capable members to contribute to church activities.

Second, Barro and McCleary (2003) argue that if participating in religious activities increases wages, for example because religion and human capital are complements, growth and religiosity could go hand in hand. In Africa, colonial regimes ran few schools directly. Christian missions took on this role and provided the bulk of formal education (e.g., writing, reading and maths) which commanded a wage premium in the colonial economy (Frankema, 2012). This meant that Christianity and education were complements in line with Barro and McCleary (2003). However, we showed that this complementarity weakened over time, as missions were increasingly opened without providing schooling of adequate levels, suggesting that Christianity indeed spread without African demand for formal education. Hence, this cannot be the full story. Missions also provided other services. For example, they expanded social networks for converts. In Christian communities of today, Glaeser and Sacerdote (2008) show how educated persons could be more religious if participating in religious services helps to build social capital. Similarly, Auriol et al. (2017) show how religious donations serve an insurance function.

Third, Christianity both disrupted the monopoly of, and spread at the expense of, African traditional religions. By switching religious beliefs, people may have remained as religious as they were before, or may have become even more religious, consistent with the religion-market model (see McCleary and Barro (2006a) for a survey).[41]

Fourth, African traditional religions reinforced the power of chiefs, making them the custodian of the well-being of the community.[42] Christianity offered in its ideology of individualism and its alliance with colonial rule a legitimization to escape the chiefs' and elders' traditional authority (Ekechi, 1971; Der, 1974; Maxwell, 2016; Peel, 2000). Our results are in line with this interpretation. We find that Christianity spread after the defeat of the Ashanti Kingdom in 1874, after which it became clear that European colonial rule would define the long-term political status quo. Over

[41]Using cross-country data, McCleary and Barro (2006b) actually find that state religions tend to increase religiosity. However, they explain this effect by the subsidies that flow to organized religion.

[42]For example, chiefs owned and could allocate land use rights in any way they saw fit. Pauw (1996, p.375) writes: "Land is not individually owned, nor can land be sold by one individual to another. Land is the communal possession of all. The chief or leader is the custodian of the land who has the responsibility to designate portions for individual use. When no longer used, or if the land is abused, it reverts back to the leader for redistribution."

time, Christianity became institutionalized and churches consolidated their grip on society by heavily relying on African missionaries.

Finally, there were spiritual needs in a world where established systems of meaning are disrupted by changing social and economic circumstances, and not the least by new technologies (e.g., steam locomotives). Africans sought a measure of conceptual control over these forces by turning to the new ideas and tools offered by Christianity (Maxwell, 2016). It has been argued that African traditional religions, based on community and communitarian ownership, constrained individual ownership and restricted the pursuit of self-interest (Pauw, 1996; Alolo, 2007).[43] Therefore, Christianity may have been for converts a more this-worldly religion, possibly the same way Protestantism challenged the political monopoly and economic conservatism of Catholicism during the Reformation (Weber, 1905; Ekelund et al., 2002; McCleary and Barro, 2006b).

Another important finding is that the contemporary effects of colonial missions on religion, education and economic development in Africa are relatively small once endogenous location choices are more accurately taken into account. We do not doubt that there were benefits at the individual level. During colonial times, education was linked to mission schools (Frankema, 2012) and Christian conversion was a factor of social mobility (Wantchekon et al., 2015; Meier zu Selhausen et al., 2018). While we still find positive correlations between historical missions and religion as well as educational levels today, there are forces at play against economic persistence.

First, the post-World War II period saw a large expansion in public education, often in areas that did not have schools at independence. This considerably weakened the position of Christian churches as the gatekeepers of education.

Second, Pentecostalism is on the rise in Africa, where its largest number of followers can be found today (Jenkins, 2016). We find positive correlations between historical missions and Christianity today, but correlations are much weaker when using a measure of Christianity that includes Pentecostals. This indicates that persistence is not transferred to new denominations. In addition, Pentecostalism may place less emphasis on investment in education than Mainline Protestantism (Barro and McCleary, 2017). Consequently, newer Christian missions on the African continent might have even smaller economic benefits than the ones of the colonial period.

[43] Pauw (1996, p.374) writes: "An individual's behaviour is largely determined, one might even say pre-determined by the dictates of the community. [...] Ethical principles are spelt out in terms of the well being of the community and of the maintaining of harmony and equilibrium. Thus, taking too much initiative, or succeeding in reaping much better harvests than others, or becoming disproportionately rich through business enterprises, disturbs the cosmic balance."

Third, even if we find positive correlations for the proposed mechanisms, it has been suggested that the link between those mechanisms and macroeconomic development indicators is weak at the country level. Pritchett (2001) does not find any effect of the post-independence expansion in education on GDP per capita, which stagnated or declined in Africa in the second half of the 20th century. The same can be said about Christianity. Despite the increase in Christianity, most African countries remained low-income countries.[44] They certainly have not experienced the same economic transformation which the Reformation eventually led to in Europe (e.g., Weber, 1905).

The bottom line of our results is that Christianization was driven by economics and went along with modernization in Africa. Religion itself, however, may not have substantially contributed to developmental differences within African countries today.

8. Concluding Discussion

Extensive literature has emerged that uses the establishment of colonial missions as a natural experiment to study the effects of human capital, religion and culture on economic outcomes today. This literature belongs to broader literature studying the long-term effects of historical events and/or using historical shocks as a source of exogenous variation in institutions, human capital or culture. In this paper, we show that missions' spatial expansion was driven by various economic and non-economic factors in Ghana and Africa. Our results have several implications for economic development: (i) The diffusion of religion, education and culture appears to depend on spatial patterns of economic development; (ii) The use of endogenously located colonial missions as a historical shock may lead to an overly optimistic account of the importance of colonial missions for contemporary development; and (iii) Endogenous measurement errors in historical data may have consequences for the analysis of the long-term effects of historical shocks.

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[44] Barro and McCleary (2003) finds that economic growth may respond positively or negatively on religiosity.

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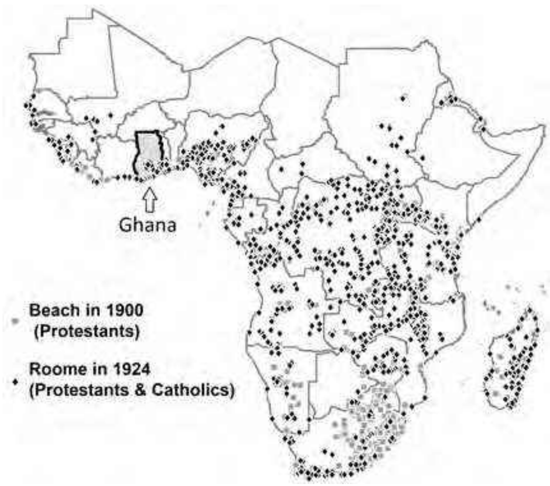
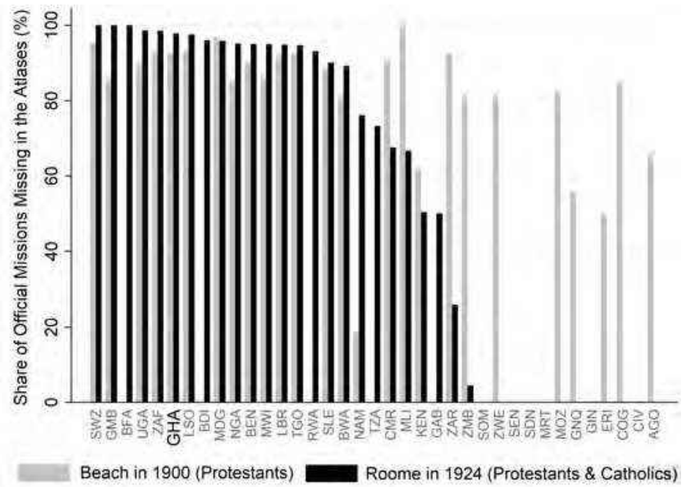
Figure 1: Missions in Sub-Saharan Africa: Mission Atlases vs. Official Sources

(a) Missions Reported in Mission Atlases



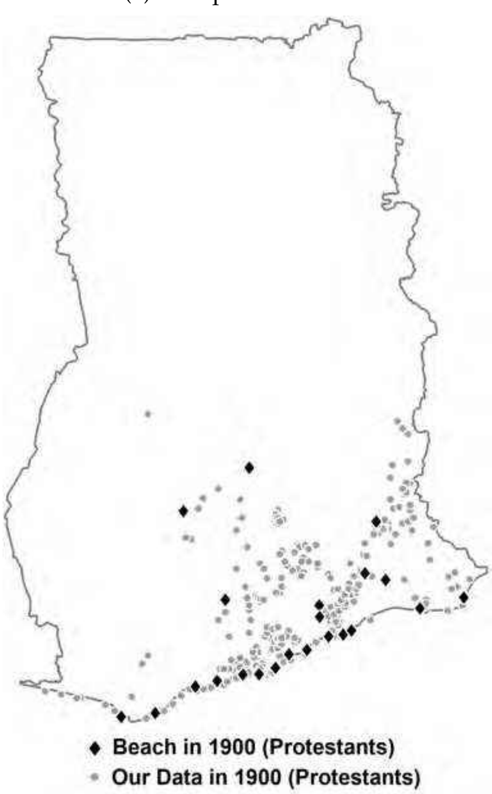
(b) Share of Omitted Missions in Mission Atlases



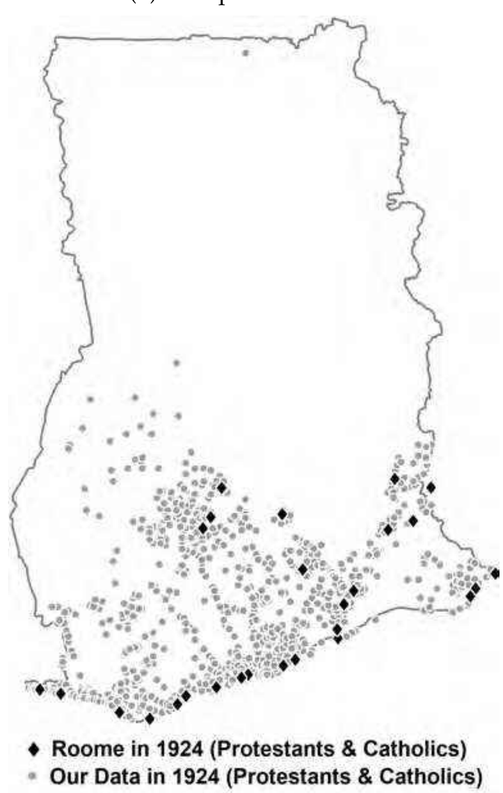
Notes: Subfigure 1(a) shows for 43 sub-Saharan African countries the Protestant missions in 1900 from Beach (1903) (N = 677) and the Protestant and Catholic missions in 1924 from Roome (1925) (N = 1,212). Subfigure 1(b) shows when the data is available the share of missions in official sources that are missing in Beach (1903) (for Protestants only in 1900) and Roome (1925) (for both Protestants and Catholics in 1924). See Web Data Appendix for data sources.

Figure 2: Missions in Ghana: Mission Atlases vs. Official Sources

(a) Comparison in 1900

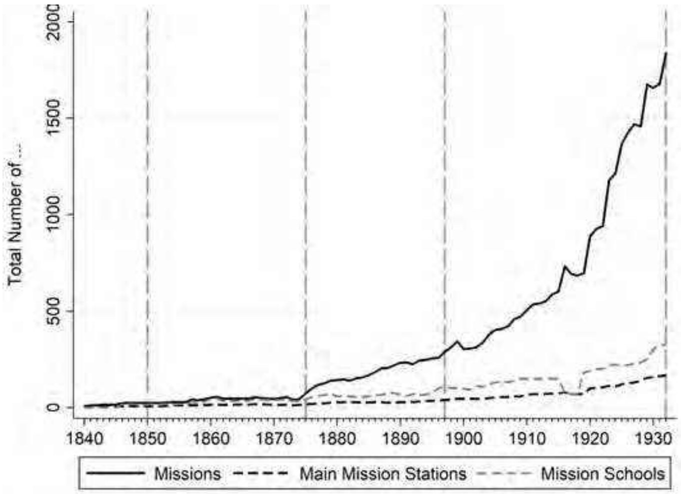


(b) Comparison in 1924



Notes: Subfigure 2(a) shows the 1900 missions in Beach (1903) (N = 24) and in our data (304). Subfigure 2(b) shows the 1924 missions in Roome (1925) (N = 24) and in our data (1,213). See Web Appendix for data sources.

Figure 3: Evolution of the Number of Missions and their Types in Ghana, 1840-1932

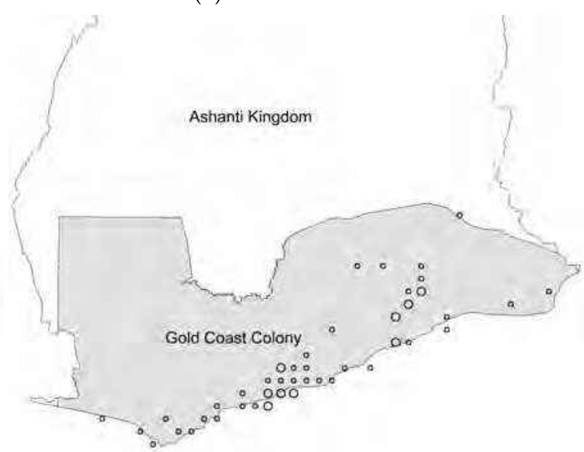


Notes: The figure shows for Ghana the evolution of the total number of missions / main mission stations / mission schools, annually from 1840 to 1932. Ghana consists of 2,091 cells. See Web Appendix for data sources.

Figure 4: Location of Missions in Ghana for Selected Years

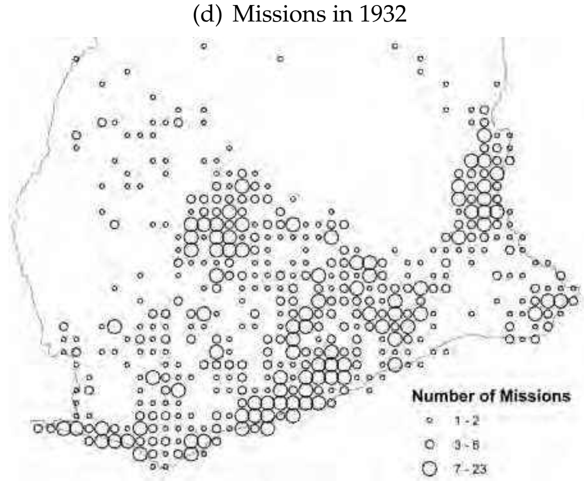
(a) Missions in 1850

(b) Missions in 1875



(c) Missions in 1897

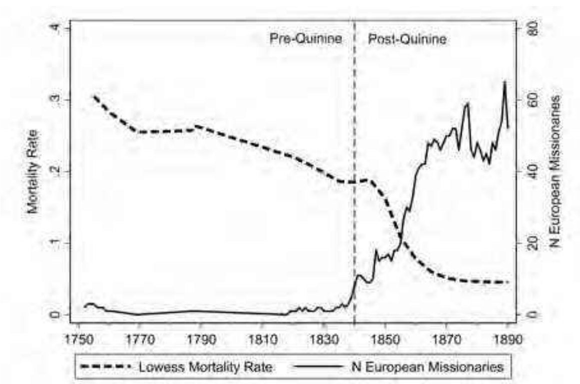
(d) Missions in 1932



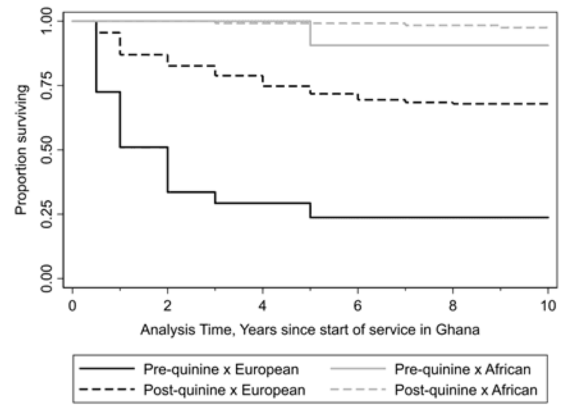
Notes: The subfigures show the location of all missions (Protestant and Catholic) in Ghana for selected turning points in the history of Ghana: 1850, 1875, 1897 and 1932. See Web Data Appendix for data sources.

Figure 5: Mortality of European and Native Missionaries in Ghana, 1750-1890

(a) Mortality and Number of European Missionaries



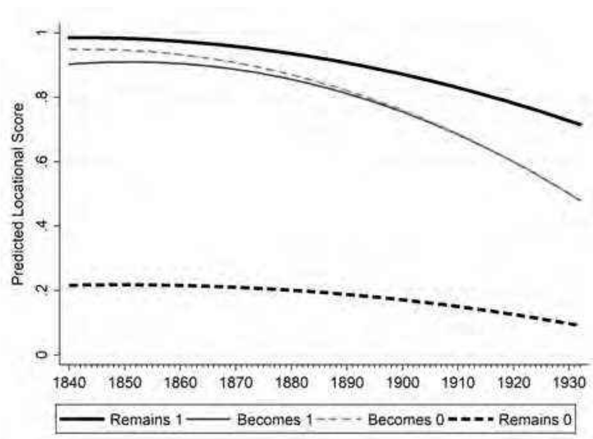
(b) Kaplan-Meier Survival Analysis of Missionaries



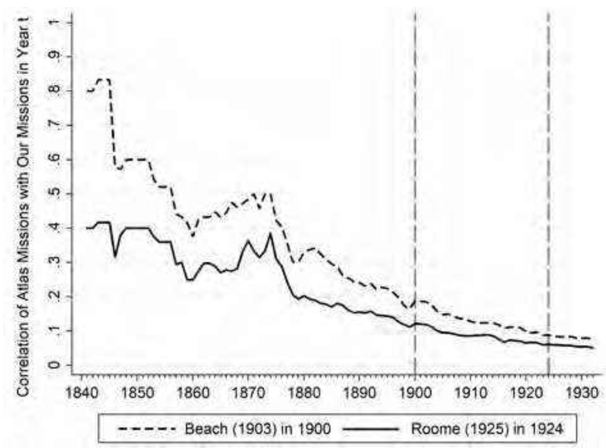
Notes: Subfigure 5(a) shows mortality rates and the number of European male missionaries in 1751-1890. The post-quinine era is defined as post-1840. Subfigure 5(b) shows survival probabilities of European and African missionaries pre- and post-quinine (data for 1751-1890 period). See Web Appendix for data sources.

Figure 6: Omitted Variable Bias and Endogenous Measurement Error in Ghana

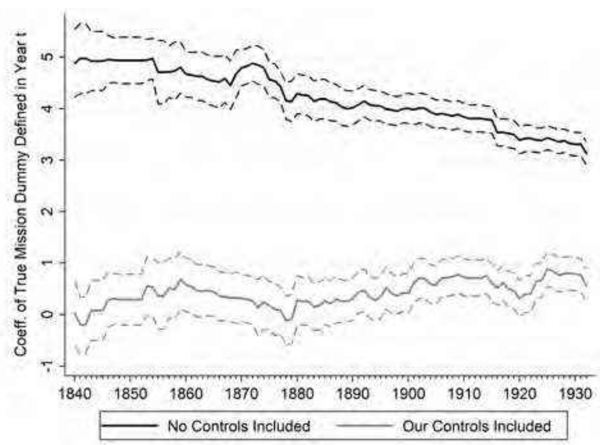
(a) Locational Factors and Likelihood of Having Missions



(b) Correlation between Atlas Missions and Our Missions



(c) Long-Term Effects of the True Mission Dummy



Notes: Subfigure 6(a) shows a quadratic fit of the mean predicted locational score for four groups of cells in each year. Subfigure 6(b) shows the coefficient of correlation between a dummy if there is a mission in the cell in 1900 in Beach (1903) or 1924 in Roome (1925) and the true mission dummy in year t. Subfigure 6(c) shows the effect of the true mission dummy defined in year t on log avg. night light intensity in 2000-01. See Web Appendix for data sources.

Table 1: CORRELATES OF MISSIONARY EXPANSION, LONG-DIFFERENCES

Dependent Variable:	Dummy if Mission in the Cell in Selected Year:			
	1850	1875	1897	1932
	(1)	(2)	(3)	(4)
Dummy if Any Mission in ... / 1850 / 1875 / 1897		0.602***	0.392***	0.232***
		[0.069]	[0.080]	[0.037]
Historical Malaria Index	-0.004**	-0.005**	0.008*	-0.010
	[0.002]	[0.002]	[0.005]	[0.006]
Dummy if Port in the Cell 1850	0.166	0.212**	0.129	-0.159**
	[0.107]	[0.101]	[0.079]	[0.075]
Log Distance to Coast	-0.017*	-0.027***	-0.035*	-0.102***
	[0.009]	[0.010]	[0.018]	[0.020]
Dummy if Large Pre-Colonial City 1800	0.018	-0.230*	0.001	-0.341***
	[0.043]	[0.121]	[0.152]	[0.047]
Dummy if Headchief Town 1901	-0.007	0.053	-0.011	0.008
	[0.032]	[0.041]	[0.044]	[0.038]
Dummy if Outside Gold Coast Colony 1850	0.004	0.009	0.040*	0.135***
	[0.008]	[0.008]	[0.022]	[0.036]
Dummy if Largest or 2nd Largest City 1901	0.761***	-0.327**	0.132	0.015
	[0.076]	[0.131]	[0.176]	[0.055]
Dummy if Navigable River 10 Km	-0.024***	-0.023***	0.037**	0.022
	[0.006]	[0.008]	[0.019]	[0.024]
Dummy if Ashanti Trade Route 1850 10 Km	0.011*	0.014**	-0.004	0.006
	[0.006]	[0.006]	[0.011]	[0.015]
Dummy if Non-Ashanti Trade Route 1850 10 Km	0.012***	0.012**	0.002	0.026*
	[0.004]	[0.005]	[0.011]	[0.015]
Dummy if Railroad 1932 10 Km	-0.018	-0.017	0.067*	0.079**
	[0.011]	[0.019]	[0.040]	[0.040]
Dummy if Road 1930 10 Km	-0.003	-0.004	0.010	0.034**
	[0.002]	[0.004]	[0.008]	[0.015]
Log Urban Population 1891	0.015***	0.026***	0.008	0.001
	[0.005]	[0.006]	[0.008]	[0.006]
Log Urban Population 1901	-0.000	0.007**	0.024***	-0.011*
	[0.003]	[0.003]	[0.006]	[0.006]
Log Urban Population 1931	0.001	0.001	0.007**	0.033***
	[0.001]	[0.001]	[0.003]	[0.004]
Log Rural Population 1901	0.001	0.000	0.017***	0.032***
	[0.002]	[0.002]	[0.004]	[0.006]
Log Rural Population 1931	-0.001**	-0.002***	-0.002*	0.016***
	[0.000]	[0.001]	[0.001]	[0.002]
Log Normalized Slave Exports 15th-19th Centuries	0.000	-0.004*	-0.004	0.041***
	[0.002]	[0.002]	[0.006]	[0.007]
Dummy if Slave Market 1800 50 Km	0.005	-0.008*	-0.035***	0.003
	[0.003]	[0.004]	[0.010]	[0.015]
Dummy if Palm Oil Plantation 1900-1936 50 Km	0.018	0.029*	0.089***	0.082**
	[0.013]	[0.017]	[0.033]	[0.036]
Dummy if Kola-Producing Cell 1932	-0.025***	-0.017	0.042*	0.073**
	[0.009]	[0.011]	[0.025]	[0.035]
Dummy if Rubber Plantation 1900-1936 50 Km	0.004	0.008	0.005	0.048
	[0.013]	[0.012]	[0.032]	[0.035]
Dummy if Cocoa-Producing Cell 1927	0.006	0.008	0.073***	0.096***
	[0.011]	[0.010]	[0.025]	[0.035]
Dummy if Mine (Central Location) 1932 50 Km	-0.016	-0.006	-0.042*	0.148***
	[0.011]	[0.013]	[0.025]	[0.036]
R-squared	0.35	0.61	0.50	0.61

Notes: For 2,091 cells and period [t-1;t], we regress a dummy if there is a mission in t on a dummy if there is a mission in t-1 and characteristics proxying for geography, political conditions, transportation, population and economic activities (separated by dashed horizontal lines). We do not report the coefficients of land area, rainfall, altitude, ruggedness, soil fertility, and a dummy if it was surveyed by the 1901 Census. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 2: MALARIA AND MISSIONARY EXPANSION, INVESTIGATION OF CAUSALITY

Dep. Var.: Dummy if ... in Cell c in Year t:	Mission (Period: 1783-1897)				Missionary (Period: 1846-1890)		
					Any	European	African
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Historical Malaria × Dummy Post-1840	0.018***	0.018***	0.006***	0.006***			
	[0.002]	[0.002]	[0.000]	[0.002]			
Historical Malaria × Dummy 1810-1840		0.000					
		[0.000]					
Historical Malaria × Dummy Post-1850					0.012***	0.001	0.012***
					[0.001]	[0.001]	[0.001]
Cell Fixed Effects	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y
34 Ethnic Group FE x 115 Year FE	N	N	Y	N	N	N	N
38 District 1931 FE x 115 Year FE	N	N	N	Y	N	N	N

Notes: Columns (1)-(4): For 2,091 cells c and 115 years t (1783-1897), we regress a dummy if there is a mission in cell c in t on historical malaria interacted with a dummy if the year is after 1840 (incl.). Column (2): We interact historical malaria with a dummy if year is between 1810 (incl.) and 1840 (excl.). Columns (5)-(7): For 2,091 cells c and 40 years t (1846-1890), we regress a dummy if there is a missionary / European missionary / African missionary in cell c in t on historical malaria interacted with a dummy if the year is after 1850 (incl.). Robust SE's clustered at the cell level: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 3: RAILROADS AND MISSIONARY EXPANSION, INVESTIGATION OF CAUSALITY

Panel A: Long-Differences	Dependent Variable: Dummy if Mission in 1932:		
Effect of Dummy Railroad 1932 0-30 Km (Including the Controls of Table 1 Incl. Dummy if Mission in 1897			
	Coeff.	SE	Obs.
1. Baseline	0.082**	[0.040]	2,091
2. Dep.Var.: Dummy Mission 1897, Ctrl Dummy Mission 1875	-0.008	[0.015]	2,091
3. Dep.Var.: Dummy Mission 1875, Ctrl Dummy Mission 1850	0.008	[0.015]	2,091
4. Dep.Var.: Dummy Mission 1850, Ctrl Dummy Mission 1751	-0.011	[0.028]	2,091
5. Including Ethnic Group Fixed Effects (N = 34)	0.103**	[0.045]	2,091
6. Including District in 1931 Fixed Effects (N = 38)	0.092**	[0.045]	2,091
7. Railroad 0-30 Km Dummy Defined Using Western Line Only	0.119**	[0.052]	2,091
8. Railroad 0-30 Km Dummy Defined Using Placebo Lines Only	0.028	[0.037]	2,091
9. IV: 30 Km from Straight Lines (Drop+Ctrl Nodes; IV F=115)	0.163*	[0.087]	2,088

Panel B: Panel Analysis	Dependent Variable: Dummy if Mission in Year t:		
Effect of Dummy Railroad 0-30 Km in Year t (Including Cell Fixed Effects and Year Fixed Effects)			
	Coeff.	SE	Obs.
1. Baseline Effect in Year t	0.179***	[0.019]	75,276
2. Overall Effect of Leads if Adding 1 Lead	0.011	[0.019]	73,185
3. Overall Effect of Leads if Adding 2 Leads	0.014	[0.022]	71,094
4. Baseline Effect in Year t if Adding 1 Lag	0.010	[0.018]	73,185
Overall Effect of Lags if Adding 1 Lag	0.171***	[0.021]	
5. Baseline Effect in Year t if Adding 2 Lags	0.006	[0.019]	71,094
Overall Effect of Lags if Adding 2 Lags	0.178***	[0.021]	
6. Including Ethnic Group FE (N = 34) x Year FE (T = 36)	0.143**	[0.021]	75,276
7. Including District in 1931 FE (N = 38) x Year FE (T = 36)	0.122***	[0.024]	75,276

Notes: Panel A: For 2,091 cells, we regress a dummy if there is a mission in 1932 on a dummy if there is a mission in 1897 and the other controls of Table 1. Row 6: The instrument is a dummy if the cell is within 30 Km from the straight lines Sekondi-Kumasi and Accra-Kumasi (dropping these three nodes + controlling for log Euclidean distance to these three nodes). *Panel B:* For 2,091 cells c and 36 years t (1897-1932), we regress a dummy if there is a mission in cell c in t on a dummy if cell c is within 30 km of a railroad in t. Robust SE's (clustered at the cell level in Panel B): * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 4: CASH CROPS AND MISSIONARY EXPANSION, INVESTIGATION OF CAUSALITY

Dependent Variable:	Dummy if Mission in Year t:		
Effect of Log Predicted Cash Crop Export Value in Year t (Including Cell Fixed Effects and Year Effects)			
	Coeff.	SE	Obs.
1. Based on Palm Oil, Rubber, Kola & Cocoa Production	0.028***	[0.002]	181,917
2. Based on Palm Oil Production Only	0.031***	[0.005]	181,917
3. Based on Rubber Production Only	0.020***	[0.002]	181,917
4. Based on Kola Production Only	0.043***	[0.004]	181,917
5. Based on Cocoa Production Only	0.042***	[0.002]	181,917
6. Based on Palm Oil, Rubber & Cocoa Suitability	0.023***	[0.002]	181,917
7. Overall Effect of Leads when Leads Added: 1 Lead	-0.003	[0.002]	179,826
8. Overall Effect of Leads when Leads Added: 2 Leads	-0.002	[0.002]	177,735
9. Baseline Effect in Year t when Lags Added: 1 Lag	-0.001	[0.002]	179,826
Overall Effect of Lags when Lags Added: 1 Lag	0.030***	[0.002]	
10. Baseline Effect in Year t when Lags Added: 2 Lags	-0.002	[0.002]	177,735
Overall Effect of Lags when Lags Added: 2 Lags	0.029***	[0.002]	
11. Including Ethnic Group FE (N = 34) x Year FE (T = 87)	0.024***	[0.002]	181,917
12. Including District in 1931 FE (N = 38) x Year FE (T = 87)	0.027***	[0.003]	181,917
13. 1st Difference: Effect if Non-Negative Change	0.003***	[0.001]	179,826
1st Difference: Effect if Negative Change	0.002	[0.002]	

Notes: For 2,091 cells c and 87 years t (1846-1932), we regress a dummy if there is a mission in cell c in t on log predicted cash crop export value in cell c in t. Rows 1-6: Using alternative ways to construct the predicted value of cash crop exports. Rows 7-10: Adding leads or lags of cash crop value. Row 13: Regressing the change in a dummy if there is a mission in cell c on the change in log predicted cash crop export value in cell c, interacting the change in cash crop value with a dummy if the change is negative. Robust SE's clustered at the cell level: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 5: CORRELATES OF MISSIONARY EXPANSION, LONG-DIFFERENCES, AFRICA

Dependent Variable:	Dummy if Mission in the Cell in:			
	Beach in 1900		Roome in 1924	
	(1)	(2)	(3)	(4)
Historical Malaria Index	-0.025***	0.032	-0.048***	-0.002
	[0.006]	[0.030]	[0.011]	[0.029]
Tsetse Index	-0.003**	-0.004	-0.008***	-0.011**
	[0.001]	[0.005]	[0.002]	[0.005]
Dummy if Slave Port in the Cell 1800-1900	0.046**	0.041*	0.131***	0.122***
	[0.022]	[0.022]	[0.031]	[0.031]
Log Distance to Coast	-0.003***	-0.003***	-0.003***	-0.003***
	[0.000]	[0.001]	[0.000]	[0.001]
Dummy if Large Pre-Colonial City 1400	-0.031***	-0.030***	0.050	0.047
	[0.008]	[0.009]	[0.042]	[0.037]
Dummy if Large Pre-Colonial City 1800	0.015	0.020	0.068	0.079*
	[0.026]	[0.021]	[0.044]	[0.043]
Dummy if Largest or 2nd Largest City 1901	0.058***	0.058***	0.173***	0.173***
	[0.020]	[0.020]	[0.029]	[0.024]
Year of Colonization	-0.000		-0.000***	
	[0.000]		[0.000]	
Dummy if Centralized State (Murdock)	0.002***		-0.001**	
	[0.000]		[0.001]	
Log Distance to Muslim Center	-0.001	0.000	0.002***	0.002**
	[0.000]	[0.001]	[0.000]	[0.001]
Dummy if Navigable River 10 Km	0.003***	0.003**	0.012***	0.011***
	[0.001]	[0.001]	[0.002]	[0.003]
Dummy if Lake 10 Km	0.001	0.001	0.011***	0.010***
	[0.002]	[0.002]	[0.003]	[0.004]
Dummy if Explorer Route 10 Km	0.001	0.001*	0.002**	0.001
	[0.001]	[0.001]	[0.001]	[0.001]
Dummy if Railroad 1900 / 1924 10 Km	0.014***	0.014***	0.023***	0.022***
	[0.004]	[0.005]	[0.002]	[0.003]
Log Population Density 1800	-0.000	-0.000**	0.000	0.000*
	[0.000]	[0.000]	[0.000]	[0.000]
Log City Pop. ca 1900 (Loc.≥10,000)	0.011***	0.010***	0.002	0.002
	[0.003]	[0.003]	[0.003]	[0.003]
Log Urban Population 1900	0.002***	0.002***	0.006***	0.007***
	[0.000]	[0.000]	[0.001]	[0.001]
Log Rural Population 1900	0.001***	0.001***	0.000***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Slavery (Murdock)	0.001**		0.003***	
	[0.001]		[0.001]	
Log Normalized Slave Exports 15th-19th Centuries	0.001		0.006***	
	[0.001]		[0.001]	
Log Predicted Cash Crop Export Value 1900 / 1924	0.001***	0.001*	0.000**	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Mine 1900 / 1924 50 Km	-0.001	-0.000	0.004*	0.003
	[0.002]	[0.002]	[0.002]	[0.002]
Dummy if Polygamy (Murdock)	-0.001***		0.001**	
	[0.000]		[0.001]	
Fixed Effects	Country	Cntry-Ethnic	Country	Cntry-Ethnic
Adj. R-squared	0.03	0.05	0.04	0.06

Notes: For 203,574 cells in 43 sub-Saharan Africa countries, we regress a dummy if there is a mission in Beach in 1900 (columns (1)-(2)) or a mission in Roome in 1924 (columns (3)-(4)) on characteristics proxying for geography, political conditions, transportation, population and economic activities (separated by dashed horizontal lines). We do not report the coefficients of land area, rainfall, altitude, ruggedness, soil fertility, a dummy if the main ethnic group in the cell before colonization according to Murdock (1959) does not have information on state centralization, slavery and polygamy in Murdock (1959), a dummy if we know the year of the anthropological study used by Murdock (1959) to create his data, and a dummy if the year of the study strictly precedes 1900 / 1924. Robust SE's (clustered at the country-ethnic group level in columns (2) and (4)): * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Appendix for data sources.

Table 6: Long-Term Economic Effects of Missions for Mission Map Years

	Dependent Variable: Log Night Light Intensity in the Cell circa 2000:					
Controls Included:	None (1)	Standard (2)	Ours (3)	None (4)	Standard (5)	Ours (6)
Panel A: Effect of Actual Mission Dummy (Ghana):	Col. (1)-(3): 1900			Col. (4)-(6): 1924		
1. *Ghana Sample* (N = 2,091)	4.01***	2.84***	0.41**	3.39***	2.74***	0.68***
	[0.15]	[0.17]	[0.20]	[0.12]	[0.14]	[0.17]
Panel B: Effect of Atlas Mission Dummy (Ghana):	Col. (1)-(3): 1900 (Beach, 1903)			Col. (4)-(6): 1924 (Roome, 1925)		
2. *Ghana Sample* (N = 2,091)	4.98***	3.14***	0.69**	4.68***	3.21***	0.67*
	[0.23]	[0.23]	[0.29]	[0.25]	[0.26]	[0.38]
3. *Africa Sample*: All Countries (N = 203,574)	2.12***	1.83***	1.28***	2.18***	1.90***	1.24***
	[0.11]	[0.10]	[0.09]	[0.08]	[0.08]	[0.07]
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Ghana sample: Sample of 2,091 cells in Ghana. *Africa sample*: Sample of 203,574 cells in 43 sub-Saharan African countries. "Standard": Controls identified as regularly used in the literature. "Ours": All controls of Table 1 for Ghana and all controls of Table 5 for Africa. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 7: Long-Term Effects of Missions for Mission Map Years, Religion and Education

Controls Included:	None (1)	Standard (2)	Ours (3)	None (4)	Standard (5)	Ours (6)
Panel A: Effect of Actual Mission Dummy (Ghana):	Col. (1)-(3): 1900			Col. (4)-(6): 1924		
1. Population Share of Christians (Broad) 2000	30.4***	6.6***	2.2	33.4***	8.0***	2.4*
	[1.1]	[1.3]	[1.6]	[0.9]	[1.0]	[1.2]
2. Population Share of Christians (Strict) 2000	13.4***	6.8***	5.5***	13.6***	6.4***	6.8***
	[1.0]	[1.4]	[1.5]	[0.7]	[1.0]	[1.2]
3. Literacy Rate of Adults 2000	30.7***	12.0***	3.0*	30.0***	13.7***	4.1***
	[1.1]	[1.4]	[1.6]	[0.7]	[0.9]	[1.1]
4. Completion Rate Sec. Educ. of Adults 2000	8.6***	5.5***	1.9**	6.6***	4.3***	1.5***
	[0.6]	[0.6]	[0.7]	[0.3]	[0.4]	[0.5]
Panel B: Effect of Atlas Mission Dummy (Ghana):	Col. (1)-(3): 1900 (Beach, 1903)			Col. (4)-(6): 1924 (Roome, 1925)		
1. Population Share of Christians (Broad) 2000	30.0***	4.8**	4.8	28.7***	3.8	0.7
	[1.4]	[2.4]	[3.4]	[2.5]	[3.1]	[3.6]
2. Population Share of Christians (Strict) 2000	11.9***	4.9**	1.5	14.0***	7.0**	3.5
	[2.0]	[2.5]	[2.9]	[3.0]	[3.4]	[3.2]
3. Literacy Rate of Adults 2000	30.8***	8.3***	3.4	30.1***	10.4***	4.8
	[2.7]	[2.8]	[3.7]	[2.8]	[3.1]	[3.0]
4. Completion Rate Sec. Educ. of Adults 2000	12.0***	7.7***	3.2	9.6***	6.1***	2.0
	[1.8]	[1.7]	[2.1]	[1.5]	[1.4]	[1.3]
Panel C: Effect of Atlas Mission Dummy (Africa):	Col. (1)-(3): 1900 (Beach, 1903)			Col. (4)-(6): 1924 (Roome, 1925)		
1. Population Share of Christians (Broad) 2000	10.7***	7.1***	3.7*	7.5***	4.7***	2.1
	[2.1]	[2.1]	[2.0]	[1.4]	[1.3]	[1.4]
2. Population Share of Christians (Strict) 2000	6.3***	3.3	2.0	6.0***	3.9***	3.1**
	[2.1]	[2.3]	[2.3]	[1.4]	[1.5]	[1.5]
3. Literacy Rate of Adults 2000	23.8***	10.5**	-1.6	38.6***	28.5***	18.8***
	[4.5]	[4.1]	[4.5]	[2.7]	[2.6]	[2.7]
4. Completion Rate Sec. Educ. of Adults 2000	10.1***	5.7***	0.7	17.1***	13.3***	9.3***
	[1.8]	[1.8]	[1.8]	[1.0]	[1.0]	[1.0]

Notes: Panels A-B (Ghana): Sample of 1,895 cells (rows 1-4). Panel C (32 African countries): Sample of 5,967 cells (rows 1-2), 4,391 cells (row 3) and 6,387 cells (row 4). "Standard": Controls identified as regularly used in the literature. "Ours": Controls of Table 1 for Ghana and controls of Table 5 for Africa. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

WEB APPENDIX: NOT FOR PUBLICATION

Contents

1. Web Data Appendix

1.1. Spatial Units for Ghana

We assemble data for 2,091 grid cells of 0.1x0.1 degrees (11x11 km).

1.2. Mission Location Data for Ghana

Our main source of mission church data are the *Ecclesiastical Returns* that missionary societies submitted to the colonial administration on an annual basis and that were published in the *Blue Books of the Gold Coast* 1844-1932 (Gold Coast, various years). Hence, the data refers to "officially" recognised mission stations. Information is incomplete for some years and denominations:

Missing Ecclesiastical Returns. For certain years ecclesiastical returns are unavailable:

- 1751-1843: The Blue Books of the Gold Coast start in 1844. However, the early beginnings of missionary work in Ghana are particularly well-documented and we reconstructed the period 1751-1843 from a variety of secondary sources (Schlatter, 1916; Wiltgen, 1956; Bartels, 1965; Odamtten, 1978; Hastings, 1994; Isichei, 1995).
- 1862-66: Blue Books were not available at The National Archives in the United Kingdom. This was a time of a rather stable environment for missionary work - despite the Second Anglo-Ashanti War (1863-1864) that did not see much fighting. Most of the mission stations in 1861 also existed in 1867, which we took. We consulted Wesleyan Methodist Church (various years), Schlatter (1916) and Schreiber (1936) for the Methodist, Basel and Bremen Missions respectively, to confirm dates of new openings and closures.
- 1873-74: During the Third Anglo-Ashanti war (1873-74), many mission stations were abandoned and destroyed. We reconstructed the history of each mission station using a variety of sources (Hay, 1874; Schlatter, 1916; Debrunner, 1967).

- 1917-1919: The Blue Books did not publish ecclesiastical returns. It was impossible to reconstruct the history of each mission station from secondary sources. In 1916, the number of missions already exceeded 700. We therefore interpolated assuming that missions that existed in 1916 and 1920 also existed 1917-1919. The number of Methodist missions stagnated to 311 and 322 in 1916 and 1920 respectively. The assumption seems therefore unproblematic in this case. As for the Basel and Bremen Missions, German and Swiss priests and missionaries were interned during World War I and deported when the war came to an end. The Scottish Mission then took over their missions in 1920. We observe a fall in the number of missions between 1914 and 1915, from 302 to 215. However, we believe that most of these churches operated during the 1917-1919 period, even if under difficult conditions, under the supervision of African personnel. The number of Catholic missions, in contrast, increased from 154 to 256 in 1916 and 1920 respectively. In this case, we ignore the expansion underestimating the number of Catholic missions in 1917-1919.

Incomplete Ecclesiastical Returns. For some years, the Blue Books report the main stations but do not report the outstations (Basel Mission: 1882, 1885-1887, 1891-1896; Methodist Mission: 1847-56, 1880-1887, 1900-1903). We reconstructed the missing information following three simple rules. Firstly, we assume that missions exist if according to the Blue Books they existed in the year before and the year after the gap in the reporting.[1] Secondly, if any mission school was reported in the Blue Books, we assume that the corresponding mission station was also in operation.[2] This assumption is unproblematic, because this is what we overwhelmingly observe: we only found 256 location-years where a school was reported without a mission station out of a total of 6,342 location-years where both a school and a mission were reported. Thirdly, we complemented the Blue Book data with information reported in the Minutes of the Methodist Conferences (Wesleyan Methodist Church, various years). We did not add more church locations from this source, but rather restricted the coding to those missions reported in the Blue Books at least once.

Obsolete Ecclesiastical Returns. We checked whether mission societies updated their returns on a yearly basis and found that this did apparently not occur for the Basel Mission 1911-1913 and the Methodist Mission for the years 1911-12, 1913-14, 1923-24, 1925-27 and 1930-31. We did not attempt to rectify this. In the case of the Basel Mission, 1911-1913 was a time of stagnation, hence measurement errors will be small. In the Methodist case, it was a time of expansion, hence the years 1912, 1914, 1924, 1926, 1927 and 1931 may suffer from underreporting.

Missing Mission Societies. The Catholic White Fathers in the Northern Territories started reporting only in 1930. We reconstructed their mission locations in 1906-1929 using detailed qualitative evidence provided in Debrunner (1967) and Der (1974).

British Togoland. German Togoland was occupied by British forces in 1914 and the Western part came under British administration in 1922. British Togoland were only included in the Gold Coast Blue Books from 1920 onwards. We reconstructed the mission stations located in later British

[1] For example, the Methodist mission of Komenda was listed in the ecclesiastical returns for the year 1899 and 1904, but not for 1900-1903, as it was an outstation of Elmina. It is likely that Komenda continued to exist, particularly because the period 1900-03 was a time of expansion.

[2] The church data comes from the Ecclesiastical Returns published in the Blue Books. The school data is listed separately. In addition, the school data comes from the reports of the Education Department (Coast, various years).

Togoland from a wide range of German sources. For the years 1890, 1893-1896, 1899-1904, 1918 we used information from the "Deutsches Kolonialblatt" (des Auswärtigen Amtes, various years) and the "Deutsches Kolonial-Handbuch (Fitzner, 1901). For the year 1911, we used a map that showed the location of Bremen mission stations (Reimer, 1911). We assumed that all those mission stations also existed 1912-14. We complemented the remaining years using the information of when mission stations were established from Schreiber (1936). We assumed that mission stations existed unless Schreiber (1936) or the other sources such as Groves (1955) pointed to the contrary.

Data Quality Checks and Robustness. We assessed data quality by comparing our data with information in Bartels (1965), Debrunner (1967) and the *Encyclopedia of Missions* by Dwight et al. (1904) for the period 1840-1900. We were able to match 38 missions. The sources largely agree. The difference in the start-up year averages 3 years, which means that churches show up earlier in the Blue Books (the standard deviation being 10.7). We also compared the Blue Book data with stations recorded in the*Minutes of the Wesleyan Methodist Conference* in 1846, 1857, 1867 and 1879 for which the ecclesiastical returns in the Blue Books are complete. We found 104 agreements and 95 deviations, 79 of which are due to the Blue Books listing stations that the Minutes did not list and this is mostly due to the year 1879 when the Minutes stopped comprehensive reporting of out-stations. From the 18 stations that the Minutes reported (and the Blue Books did not), 9 were classified as "vacant, agent wanted". This points to the Blue Books as a source of missions where clerical services were actually offered rather than planned to be offered. For the remaining 8 stations, the sources diverged in the start-up-year. Only one place was never listed in the Blue Books (Heginewah - which incidentally might rather be a misspelled place name).

Geographic Coordinates. We georeferenced the location of the churches using Agency (2016), a map indexing localities in the 1901 Census (Guggisberg, 1908) and map drawings of missionaries Basel Mission (2016). Overall, we could identify 2,096 of the 2,161 church locations. The attrition rate of 3% is concentrated in the late years (27 mission stations with missing geographic coordinates were established after 1929) and is likely due to issues of changes and misspellings of location names, a frequent issue in Ghanaian Census taking (Cogneau and Moradi, 2014).

1.3. Main Mission Stations for Ghana

We retrieved main mission stations using the information in the ecclesiastical returns published in the Blue Books of the Gold Coast. The sources use the term "out-station" explicitly until the 1870s when terms like circuit or district became standard. Typically, the main station ("circuit town", or "principal town of the area in which the other villages are situated") is listed first and printed in capital letters. Mission circuits generally do not follow administrative boundaries. We find that the number of out-stations per main station generally increases over time. We also find that the average distance to the main station remains relatively stable over time. Hence, over time the system of out-stations becomes generally denser within the area of a circuit.

1.4. Mission Schools for Ghana

The data on mission schools 1846-1932 comes from the Blue Books and the annual reports of the Education Department. From 1878 until 1887 the Gold Coast administration supported schooling activities with lump sum payments to mission societies. Afterwards, grants were paid to schools individually (Williamson, 1952). As of the Education Ordinance of 1882, schools were inspected annually. From 1888 capitation grants were paid proportional to average attendance and students' grades in "Reading and Writing of the English Language and Arithmetic" (Coast, 1920). Later on, more subjects had to be taught, the syllabus was regulated and teachers were required to have minimum qualifications. With the Education Ordinance No 21 of 1925 stricter requirements for "unassisted schools" came into effect in 1927. We created three school variables. The first variable includes all schools that were listed in the Blue Books 1844-1905. On the one hand, this variable is affected by omissions, because mission societies were not required to report to the government. On the other hand, it also includes schools of dubious quality - those that did not meet the minimum requirements and therefore remained unassisted. The second variable includes assisted schools only. In 1885 the Blue Books started to name the assisted schools of the Wesleyan Methodist Mission. In 1888 the Basel Mission, Catholic Mission and other missions followed. The data can be considered very reliable, grants were even stated for each assisted school separately. We combined the two school series at the starting date of the "assisted school only" variable. We dealt with a number of inconsistencies that arose. Between 1875 and 1879 the Methodist Mission reported a very large and implausible increase in schools. We believe that these were schools of poor quality. A low salary teacher was often listed as the only expense of those schools. Most of them disappeared in 1880 and they were not meeting minimum requirements to gain the assisted status in 1885. Hence, we dropped those Methodist mission schools that were not reported in 1872 and 1880. Similarly, in 1887 the Basel Mission reported 69 schools, but in 1888 only 39 became assisted. We dropped those schools that did not exist 1883-87 and were not assisted in 1888.[3]

1.5. European and African Missionaries in Ghana

We created a database of missionaries stationed in the Gold Coast 1751-1890 from a variety of sources (Schott, 1879; Reindorf and Christaller, 1895; Schlatter, 1916; Schreiber, 1936; Martin and Sheldon, 1964; Debrunner, 1967; Agbeti, 1986; Anderson, 1999; Altena, 2003; Miller, 2003; Sill, 2010; Société des Missions Africaines, 2016; Basel Mission, 2016; Gold Coast, various years). In particular, we recorded male missionaries' name, period of service, year of birth, year and country of death, and the mission society. Observations stop in 1890, because the Blue Books discontinue reporting names of missionaries. Data on every European missionary of the Methodist Mission, Basel Mission, Bremen Mission, Anglican Church SPG, United Brethren, Moravian Mission and the Roman Catholic SMA are complete. African missionaries (i.e. catechists, evangelists, teachers and priests/pastors) are less well-documented and possibly not entirely representative. Overall, we compiled a database of 338 European missionaries and 172 African missionaries.

1.6. Determinants of Mission Locations and Outcomes for Ghana

Geography

- **Disease Ecology:** We use the historical malaria index created by Depetris-Chauvin and Weil (2018) and the tsetse-fly suitability index created by Alsan (2015). Using GIS we estimate average historical malaria intensity and tsetse-fly suitability for each cell.

[3]For the years 1847-1918 we did not find adequate sources to reconstruct school locations of those parts of German Togoland that became British Togoland.

- **Ports:** The locations of ports circa 1850 are obtained from Dickson (1969). We create a dummy equal to one if a cell contains a port circa 1850.
- **Distance to the Coast:** We use GIS to obtain the Euclidean distance (km) to the coast.

Political Conditions

- **Pre-Colonial Cities:** Large pre-colonial cities circa 1800 are described in Chandler (1987). We create a dummy equal to one if the cell contains a large pre-colonial city circa 1800.
- **Headchief Town:** We obtain a map of head-chief towns in 1901 from Guggisberg (1908). We then create a dummy equal to one if the cell contains a head-chief town.
- **Colonial Boundaries:** From Dickson (1969) we derive the boundary of the Gold Coast Colony established by the British circa 1850. We create a dummy equal to one if the cell is outside the Gold Coast Colony circa 1850.
- **Largest Colonial Cities:** We obtain the largest and second largest cities from the 1901 *Population Census*. We create a dummy equal to one if the cell contains one of these cities.

Transportation

- **Rivers:** The southern part of Ghana is not short of water sources and almost every grid cell contains a river or stream. We therefore focused on measures that exhibit variation. We thus obtained and recreated in GIS a map of the "major rivers" of Ghana from Dickson (1969, p.237). As not all major rivers are in fact navigable, we then select in the map rivers that are classified as navigable using the transport technologies of 1850-1930 (steamship, canoe) all year or part of the year. Finally, we use GIS to calculate the Euclidean distance (km) from each grid cell centroid to the closest navigable river in 1890.
- **Historical Trade Routes:** We obtained from (Dickson, 1969) maps of Ashanti and non-Ashanti trade routes circa 1850. We then recreated these maps in GIS and calculated the Euclidean distances (km) from each cell centroid to the closest trade routes.
- **Colonial Railroads and Roads:** Roads and railroads are largely drawn from the GIS database used in (Jedwab and Moradi, 2016). For each railway line, we know when construction started and finished, and when each station was opened. From the same sources, we know the lines that were planned but not built. We calculate for each cell the Euclidean distance (km) from the cell centroid to each real or placebo line. We calculate for each cell the Euclidean distance (km) from the cell centroid to each real or placebo line. Lastly, we create a set of cell dummies equal to one if the cell centroid is less than X km away from the line: 0-10, 10-20, 20-30 and 30-40 km (or 0-30 km). We also create a dummy if the cell is within 30 km from the straight lines Sekondi-Kumasi and Accra-Kumasi. We also have a GIS database of the road network circa 1930 (Survey H.Q. Accra 1930). We calculated the distance from each grid cell's centroid to a class 1/2/3 road.

Population

- **Population:** Population data is taken from Jedwab and Moradi (2016). Using census gazetteers, we compiled a GIS database of towns above 1,000 inhabitants in 1891, 1901 and 1931. We also collected rural population data for 1901 and 1931. While we have exhaustive urban data for all years, we only have georeferenced rural population data for Southern

Ghana in 1901. We thus create a dummy if any locality in the cell was surveyed by the 1901 census. We then used this data to obtain the urban population of each cell in 1891, 1901 and 1931 and the rural population of each cell in 1901 and 1931.[4]

Economic Activities

- **Slavery:** We use the log number of slaves exported per land area during the Atlantic and Indian Ocean slave trades from Nunn and Wantchekon (2011) and create dummies if the cell is within 50 km of the location of slave markets in 1800 Ghana as mapped in Osei (2014). We also compute the log distances to slave markets and slave routes from Osei (2014).
- **Cash Crops:** From the Government of the Gold Coast (1928a) we obtained a precise map that displays dots for each 100 tons of cocoa production in 1927.[6] We then use GIS to reconstruct total cocoa production (tons) for each cell in 1927. We then create a dummy if the cell produces cocoa. For the other crops, we obtain production areas from Dickson (1969, p.149,p.153). For palm oil and rubber, we create a dummy equal to one if the cell is within 50 km from an important palm oil/rubber plantation. For Kola, we know if the cell belongs to a kola-producing area. We obtain soil suitability from the *1958 Survey of Ghana Classification Map of Cocoa Soils for Southern Ghana*, Survey of Ghana, Accra, as well as Gyasi (1992, p.40) and Globcover (2009).[7] Finally, their total export value (in constant 1932 British Pounds) during the 1846-1932 period comes from Frankema et al. (2018).
- **Mining:** Location of mines is taken from Dickson (1969). The total export value (in constant 1932 British Pounds) of gold during the 1846-1932 period comes from Frankema et al. (2018).

Other Controls

- **Precipitation:** Climate data comes from *Terrestrial Air Temperature and Precipitation: 1900-2007 Gridded Monthly Time Series, Version 1.01*, University of Delaware (Matsuura and Willmott, 2015). We obtain mean annual precipitation (mms) in 1900-1960 for each cell.
- **Altitude and Ruggedness:** Topography comes from SRTM3 data and is measured at 3 arc-second resolution (ca. 90m x 90m). We estimate for each 0.1 x 0.1 grid cell the mean and standard deviation of altitude (meters). The standard deviation captures ruggedness.
- **Land Area:** We use GIS to obtain total land area in the cell.
- **Soil Fertility:** Soil fertility comes from (FAO, 2015). We use GIS to obtain the cell mean.

[4]The 1891 census only reports towns of a certain size. Rural population is thus not available that year. For the year 1901, we know for each cell the number of large towns, towns (more than 500 inhabitants), head chief towns, large villages (100-500 inhabitants) and villages (less than 100 inhabitants). Using GIS, we can deduce for each cell the number of villages that are less than 100 inhabitants, the number of villages that have 100-500 inhabitants and the number of villages that have between 500-1,000 inhabitants. From the Ghana census, we know the average settlement size for each category and we reconstruct total rural population for each cell in 1901. For 1931, we have a map of the distribution of population for the whole country.[5] This map displays at a very fine spatial level settlements that have less than 500 inhabitants and settlements that have between 500 and 1,000 inhabitants. From the census, we know the average settlement size for each category, and we can reconstruct total rural population for each cell in 1931.

[6]We obtain 209,100 tons in total, which is very close to the national estimate of 210,600 tons (Gunnarsson, 1978).

[7]Using the map, we defined a cell as suitable for cocoa if it contains cocoa soils and highly suitable if more than 50% of its area consists of forest ochrosols, the best cocoa soils. Gyasi (1992, p.40) reproduces the "palm oil belt" from the 1935 *Gold Coast Atlas: Agricultural Products sheet*. Note that we also use the *Global Agro-Ecological Zones* (GAEZ) database compiled by (FAO, 2015) to define an additional measure of land suitability for both cocoa and palm oil cultivation.

- **Ethnic Group:** The cells belong to 35 ethnic group boundaries using the Murdock (1967) map recreated in GIS by Nunn and Wantchekon (2011).
- **District (1931):** The cells belong to 38 districts based on the district boundaries reported in the reports of the 1931 *Population Census*. We recreate these boundaries in GIS.
- **Aburi and the Basel Mission:** We also create a dummy equal to one if the cell is within 50 km from the Basel Mission established at Aburi (ca 1856) or is located within the "sphere of influence"of the Basel Mission in 1873 (Riis, 1879).

Present-day Outcomes for Ghana

- **Satellite data on night lights:** The source of the satellite data on night lights is (NOAA, 2012). We then estimate average light intensity for each cell, for the year 2000-2001 (we use two years due to measurement errors coming from clouds).
- **Social and economic development:** We also derive various socio-economic development outcomes using mostly individual-level data from the 2000 Population Census (Ghana Statistical Service, 2000), including: (i) the urbanization rate (%) of the cell, here defined as the population share of cities of more than 1,000 inhabitants; (ii) the share of employment in non-agriculture for each cell; (iii) the population shares of Christians broadly defined (excluding evangelists) or strictly defined (included evangelists); (iv) the literacy rate of adults; and (v) the share of adults that have completed secondary education.[8]

1.7. Spatial Units for Sub-Saharan Africa

We assemble data for 203,674 grid cells of 0.1x0.1 degrees (11x11 km) in 43 countries.

1.8. Mission Location Data for Sub-Saharan Africa

We derive the location of Christian mission stations in Sub-Saharan Africa from two mission atlases widely used in the literature: (1) Roome (1925) shows Protestant and Catholic European residence missions in 1924, digitized and geocoded by Nunn (2010). (2) Beach (1903) shows Protestant European residence missions in 1900, compiled by Cagé and Rueda (2016). We then create two dummies if there is a mission in a cell in mission map year 1900 and 1924.

1.9. Number of Missions in Sub-Saharan Africa and in the World

Using multiple sources, we obtain the number of missions for 37 Sub-Saharan African countries circa 1900 and 1924 and 4 Asian countries circa 1911-13.[9]

1.10. Determinants of Mission Locations and Outcomes for Sub-Saharan Africa

Geography

- **Disease Ecology:** We use the historical malaria index created by Depetris-Chauvin and Weil (2018) and the tsetse-fly suitability index created by Alsan (2015). Using GIS we estimate average historical malaria intensity and tsetse-fly suitability for each cell.

[8] Since we only have data for 10% of the population census, the most rural cells of our sample do not have enough observations to correctly estimate these shares. Data is available for 1,895 cells only (= 2,091 - 196 missing cells).

[9] The sources are: Cape of Good Hope (various years), Gold Coast (various years), Basutoland (various years), Bathurst (various years), Kenya (various years), Nigeria (various years), Rhodesia (various years), Nyasaland (various years), Leone (various years), Tanganyika (various years), Uganda (various years), Fitzner (1901), Dwight (1905), Belge (1925), of Nations (1925), Institut Géographique du Congo Belge (1949), Dunn (1992), Froise (1996), Bonfils (1999), Nangula (2013), Jones (2017) and Assoumou Nsi (2017).

- **Slave Ports:** The location of slave ports in the 1800-1900 period is constructed from the 2016 version of the *Trans-Atlantic Slave Trade Database* in Nunn and Wantchekon (2011). We create a dummy equal to one if a cell contains a slave port.
- **Distance to the Coast:** We use GIS to obtain the Euclidean distance (km) to the coast.

Political Conditions

- **Pre-colonial Cities:** Large pre-colonial cities circa 1400 and 1800 are described in Chandler (1987). We create dummies if the cell contains a large pre-colonial city circa 1400 and 1800.
- **Major Cities:** Data on the capital, largest and second largest cities of each country circa 1900 comes from (Jedwab and Moradi, 2016). We then create for each cell a dummy equal to one if the cell contains the largest city, the second largest city or the capital city.
- **Year of Colonization:** The year of colonization of each ethnic group (Murdock, 1967) is derived from (Henderson and Whatley, 2014). Using the Murdock (1967) map of ethnic boundaries from Nunn (2008), we assign a year of colonization to each cell.
- **State Centralization:** We use the data from Murdock (1967) and create a dummy equal to one if the cell was in an ethnic area with a centralized state before colonization (using the same definition as Gennaioli and Rainer (2007)).
- **Distance to Muslim Centers:** The locations of historical Muslim centers (incl. jihad towns) are derived from Sluglett (2014) and Ajayi and Crowder (1974). We then use GIS to obtain the Euclidean distance from each cell centroid to a Muslim Center.

Transportation

- **Rivers and Lakes:** We create two dummies equal to one if the cell is within 10 km from a "major navigable river" and a lake as mapped by Johnston (1915).
- **Explorer Routes:** Pre-colonial explorer routes are taken from Nunn and Wantchekon (2011). We create a dummy if the cell is within 10 km of an explorer route.
- **Railroads:** Railroads in 1900 and 1924 are obtained from Jedwab and Moradi (2016) who recreated a GIS database on the history of each railroad line that was built or planned but not built. We create a dummy equal to one if the cell is within 10 km of a railroad line.

Population

- **Population Density:** We obtain population density circa 1800 and urban and rural population circa 1900 from the *History Database of the Global Environment* (HYDE 3.1) by (Klein Goldewijk et al., 2010). Klein Goldewijk et al. (2010) do not rely on census data for earlier centuries, since there were no censuses then. Its population estimates are highly unreliable. We nonetheless use it for three controls to be consistent with the literature.
- **City Population:** We use the database of Jedwab and Moradi (2016) to obtain the list of cities above 10,000 inhabitants circa 1900. Jedwab and Moradi (2016) use colonial administrative sources. We then estimate the total urban population of each cell.

Economic Activities

- **Slavery:** We use the log number of slaves exported per land area during the Atlantic and Indian Ocean slave trades from Nunn and Wantchekon (2011). From Murdock (1967), we also know if slavery was practiced by the dominant ethnic group in the cell.

- **Predicted Cash Crop Export Value:** We obtain from the *Global Agro-Ecological Zones* (GAEZ) database compiled by (FAO, 2015) land suitability measures for seven major export crops: cocoa, coffee, cotton, groundnut, palm oil, rubber, tea and tobacco. We then obtain cash crops' national export value (in British Pounds) circa 1900 and 1924 from of Nations (1925); Francais (1925); Jewsiewicki (1977); Frankema et al. (2018); Alexopoulou (2018).
- **Mining:** The locations of mines in 1900 and 1924 come from Mamo et al. (2017) We create a dummy equal to one if the cell is within 50 km from a mine in 1900 and 1924.

Other Controls

- **Polygamy:** We create a dummy if the cell belongs to an ethnic group said to have practiced polygamy before colonization based on the data from Murdock (1967).
- **Murdock Data:** We create a dummy if the main ethnic group in the cell before colonization according to Murdock (1967) does not have information on state centralization, slavery and polygamy. We also create a dummy if we know the year of the anthropological study used by Murdock (1967) to create his data and two dummies for whether the anthropological survey he used to create his data strictly precedes 1900 or 1924.
- **Precipitation:** Climate data comes from *Terrestrial Air Temperature and Precipitation: 1900-2007 Gridded Monthly Time Series, Version 1.01*, University of Delaware (Matsuura and Willmott, 2015). We estimate average annual precipitation (mms) in 1900-1960 for each cell.
- **Altitude and Ruggedness:** Topography comes from SRTM3 data and is measured at 3 arc-second resolution (ca. 90m x 90m). We estimate for each 0.1 x 0.1 grid cell the mean and standard deviation of altitude (meters). The standard deviation captures ruggedness.
- **Land Area:** We use GIS to obtain total land area in the cell.
- **Soil Fertility:** Soil fertility comes from (FAO, 2015). We use GIS to obtain the cell mean.

Standard Historical Controls Used in the Literature:

- We merge the lists of controls from Nunn (2010) and Cagé and Rueda (2016) (see text above for a description of the sources used for each variable):
- **Nunn (Table 1, 2010)**: (i) *European explorer routes before colonization*; (ii) *19th century railroads*; (iii) *soil quality*; (iv) *access to a water source*; and (v) *slave exports*. For Ghana: (i) There were no European explorers before official colonization, so there is no variation across cells; (ii) The first railroad was opened in 1901, so there is no variation across cells; (iii) We control for soil fertility; (iv) We include a dummy if the cell is within 10 km from a navigable river (there were no lakes in Ghana then); and (v) We control for slave export intensity.
- **Cagé and Rueda (Table 1, 2016)** use the controls from Nunn (2010) as well as: (vi) *rainfall*; (vii) *distance to the coast*; (viii) *malaria ecology*; (ix) *initial population density*; and (x) *dummies if large cities in 1400 or 1800*. For Ghana: (vi) We control for rainfall; (vii) We control for distance to the coast; (viii) We control for malaria ecology; (ix) We control for initial population density in 1800; and (x) We add a dummy if there was a large city in 1800 (none in 1400).

Present-day Outcomes for Sub-Saharan Africa

- **Satellite data on night lights:** The source of the satellite data on night lights is (NOAA, 2012). We then estimate average light intensity for each cell, for the year 2000-2001 (we use two years due to measurement errors coming from clouds).

- **Social and Economic Development:** We also derive various socio-economic development outcomes for each cell. First, we use the database of Jedwab and Moradi (2016) to obtain the population of all cities above 10,000 inhabitants circa 2000. We then recreate total urban population for each cell. Second, we use the DHS individual-level data. Second, we recreate cell-level outcomes using individual-level data from the *Demographic and Health Surveys* (DHS) of 32 sub-Saharan African countries with GPS readings for the closest year to 2000.[10] The outcomes are the mean of the asset-based wealth index in the cell (the index goes from 1 to 5 where 1 is the poorest quintile and 5 is the richest quintile), the population shares of Christian (broadly and strictly defined, thus including and excluding evangelists), and the literacy rate and the secondary school completion rate of adults.

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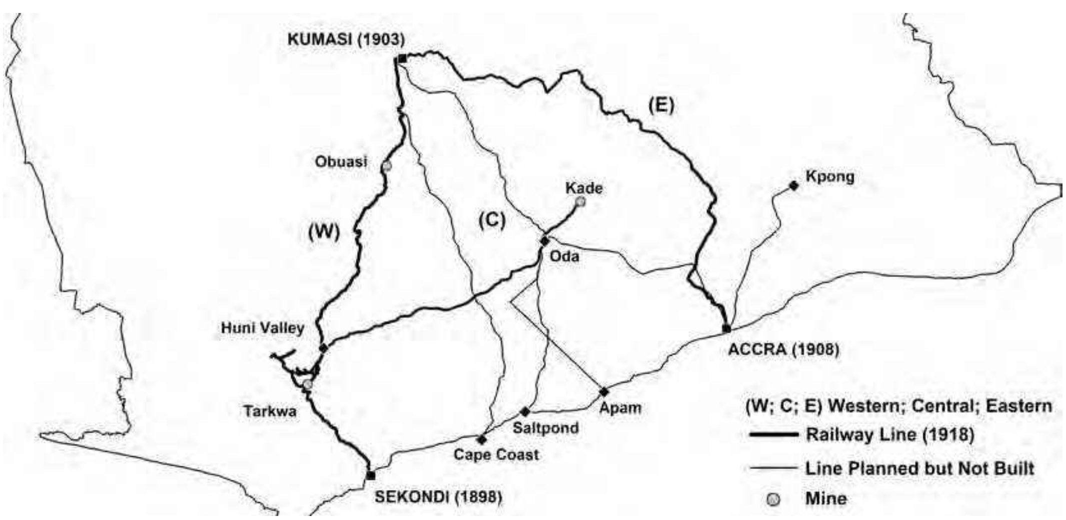
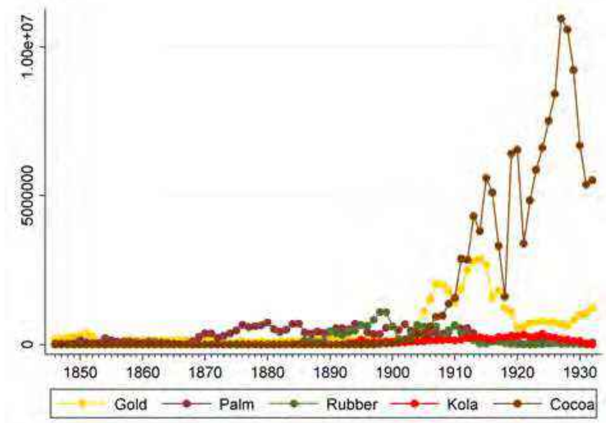
Figure 1: Built Railroads and Placebo Railroads in Ghana, 1897-1932



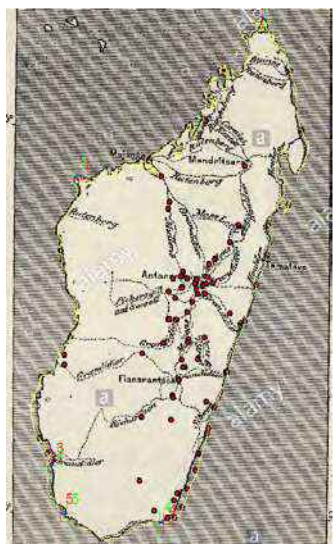
Notes: The map displays railroads in 1932: (i) The *Western Line*: The line connects two gold fields (Tarkwa and Obuasi) and the Ashante capital Kumasi to the port of Sekondi; (ii) The *Eastern Line*: The line connects the colonial capital Accra to Kumasi; and (iii) The Huni-Valley-Kade line built in 1926-27: The line was built parallel to the coast to connect fertile land and a diamond mine (Kade). There are five *lines that were planned but not built*: Cape Coast-Kumasi 1873, Saltpond-Kumasi 1893, Apam-Kumasi 1897, Accra-Kumasi 1897 and Accra-Kpong 1898. (W), (E) and (C) show the western route, the eastern route, and the central route respectively. See Web Data Appendix for data sources.

Figure 2: Export Revenues of the Five Main Primary Commodities in Ghana, 1846-1932



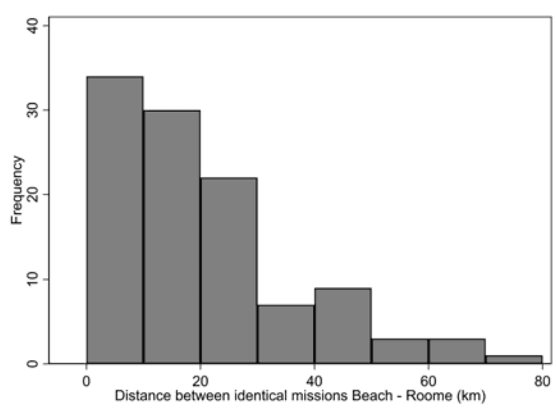
Notes: The figure shows the annual total export value of Ghana's five main primary commodities in 1846-1932 (in constant British pounds; data not available for earlier years). See Web Data Appendix for data sources.

Figure 3: Explorer Routes and Mission Stations in 1924 in Madagascar



Notes: The figure shows the routes used by European explorers (dotted lines with an explorer's name attached to it) and the location of the mission stations (circles) circa 1924 (taken from Roome (1925)).

Figure 4: Measurement Error in the Georeferencing of Mission Locations, sub-Saharan Africa



Notes: This graph shows for 109 sub-Saharan African missions the distribution of the Euclidean distance (in km) between the true locations (based on the country and the name of the missions) and the locations georeferenced in ArcGIS by Nunn (2010) and Cagé and Rueda (2016) based on the Beach (1903) and Roome (1925) atlas maps.

Table 1: 55 SELECTED STUDIES ON THE LONG-TERM EFFECTS OF COLONIAL MISSIONS, 2010-2018

Study	Location	Unit	Correlation	Outcome	Mission Years
Nunn (2010, 2014)**	SSA	Individual	+	Christianity, years of educ., gender attitudes	1924†
Gallego and Woodberry (2010)*	SSA	Regional	+	Literacy, years of educ.	1914, 1923
Nunn and Wantchekon (2011)**	SSA	Individual	o	Trust	1924†
Woodberry (2012)*	SSA	Cross-country	+	Democracy	1923
Lankina and Getachew (2012)***	India	District	+	Literacy	1901, 1911, 1921, 1931
Cogneau and Moradi (2014)**	Ghana	Individual	+	Literacy, religion, height	1902, 1925, 1938
Acemoglu et al. (2014)*	SSA, Asia, LAC	Cross-country	+	Years of educ.	1923
Dalton and Leung (2014)**	SSA	Ethnic	-	Historical polygamy	1924†
Chen et al. (2014)***	China	County	+	GDP/c, years of educ., child mortality	1920
Mantovanelli (2014)	SSA	Individual	+	HIV infection rates, HIV-related sexual behavior	1908, 1911†
Jones (2014)**	Canada	Individual	+/-	Religion, marriage, fertility, etc.	1920-1985
Dimico (2014)	SSA	Individual	+	Child malnutrition	1924†
Henderson and Whatley (2014)**	SSA	Ethnic	o	Polygamy, matrilineal descent, land inheritance	1924†
Wietzke (2014)**	Madagascar	District	+	Private schooling	1904
Fourie and Swanepoel (2015)**	South Africa	Individual	o	Years of educ.	1849†
Wietzke (2015)**	Madagascar	District	+/o	School supply, income	1904
Fenske (2015)**	SSA	District	-	Polygamy	1924†
Bai and Kung (2015)***	China	County	+	Urbanization, industrial firms	1920
Buzasi and Foldvari (2015)**	SSA	Ethnic	+	Language development	1924†
Okoye (2017)**	Nigeria	Ethnic	-	Trust	1924, 1928†
Owolabi (2015)*	Developing	Cross-counrty	o	Literacy, democracy	1923
Wantchekon et al. (2015)	Benin	Individual	+	Years of educ., social mobility, political activism, etc.	retrosp. interviews
Obikili (2016)	Nigeria	Province	+	Literacy	1924†
Mantovanelli and Calvi (2016)**	India	District	-	Literacy	1908, 1911†
Wuepper and Sauer (2016)**	Ghana	Individual	-	Performance of contract farming	1924†
Heldring (2016)**	Rwanda	District	na	Violence prosecution, violent events, state presence	1924, 1935†
Baten and Cappelli (2016)*	SSA	Cross-country	+	Numeracy growth	1923†
Ricart-Huguet (2016)*	SSA	District	+	Post-colonial minister shares	1923†
Mantovanelli and Calvi (2016)**	India	Individual	+	Nightlights	1908†
Cagé and Rueda (2016)**	SSA	Individual	o	Newspaper readership, trust, education, etc.	1900†
Boateng et al. (2017)**	Ghana	Individual	+	Years of educ., wealth	1924†
Waldinger (2017)	Mexico	Locality	+	Literacy, years of educ., religion	1542-1810†
Kudo (2017)**	Malawi	Individual	-/+	Polygamy, women's marriage age	1924†
Ricart-Huguet (2017)**	SSA	District	+	Pre-colonial trading post	1919-33
Lowes and Montero (2017)**	DR Congo	Concession	o	Rubber concession areas	1897, 1924, 1953†
Menon and McQueeney (2017)**	India	Individual	+	Height-for-age z-scores	1908, 1911†
Okoye (2017)**	Nigeria	Individual	+	Years of educ., occupational choices, wealth, etc.	1924, 1928†
Okoye and Pongou (2017)**	Nigeria	Individual	+	Years of educ, literacy, wealth, urban etc.	1924, 1928†
Okoye et al. (2017)**	Nigeria	Individual	+	Literacy, self-employment	1924, 1928†
Montgomery (2017)**	Tanzania	Individual	+	Years of educ., literacy	1914, 1924†
Alpino and Hammersmark (2017)	SSA	Individual	+	Development aid project allocation	1900, 1924†
Wuepper and Sauer (2017)**	Ghana	Individual	-	Social capital	1902, 1924, 1925, 1938†
Pierskalla et al. (2017)**	Germ. East Afr.	Grid cell	+	Colonial stations	1914
Dahlum and Wig (2017)**	SSA	Individual	+	Mass protests	1924†
Fenske and Zurimendi (2017)**	Nigeria	Individual	+	Educ., skills	1924†
Muscona et al. (2017)**	SSA	Individual	na	Lineage system, trust	1924†
Valencia Caicedo (2017)**	3 LAC	Municipality	+	Years of educ., literacy, income, skilled labor etc.	1609-1767
Cagé and Rueda (2017)**	SSA	Town	-	HIV prevalence	1900, 1929†
Barro and McCleary (2017)***	Guatemala	Department	+	Literacy, School enrollment	1880-2011
Castelló-Climent et al. (2018)**	India	District	+	Luminosity	1908, 1911†
Alesina et al. (2018)**	SSA	Individual	+	Social mobility	1900†
Michalopoulos et al. (2018)**	SSA	Individual	+	Education, wealth	1924†
Calvi and Mantovanelli (2018)**	India	Individual	+	BMI, height, health status	1908, 1911†
Anderson (forthcoming)**	SSA	Grid cell	o	Common law	1924†

Notes: * Study uses the share/number of European missionaries. ** Study uses mission locations. *** Study uses the share/number of Christian converts. † Study uses a mission atlas.

Table 2: CORRELATES OF THE TOTAL NUMBER OF MISSIONS, LONG-DIFFERENCES

Dependent Variable:	Log Number of Missions in the Cell in Selected Year:			
	1850	1875	1897	1932
	(1)	(2)	(3)	(4)
Log Number of Mission in ... / 1850 / 1875 / 1897		0.302**	0.595***	0.440***
		[0.121]	[0.076]	[0.050]
Dummy if Mission in Selected Year	0.740***	0.772***	0.832***	0.983***
	[0.033]	[0.040]	[0.026]	[0.028]
Historical Malaria Index	-0.000	0.001	0.005***	-0.019***
	[0.000]	[0.001]	[0.002]	[0.006]
Dummy if Port in the Cell 1850	-0.014	0.078	-0.120	0.137
	[0.015]	[0.057]	[0.078]	[0.112]
Log Distance to Coast	-0.001	0.002	0.013	-0.068***
	[0.001]	[0.003]	[0.009]	[0.021]
Dummy if Large Pre-Colonial City 1800	-0.102	-0.138	-0.112	0.061
	[0.076]	[0.105]	[0.089]	[0.152]
Dummy if Headchief Town 1901	0.001	0.006	0.004	0.171**
	[0.004]	[0.024]	[0.027]	[0.072]
Dummy if Outside Gold Coast Colony 1850	-0.001	-0.004	-0.015*	0.212***
	[0.001]	[0.004]	[0.009]	[0.036]
Dummy if Largest or 2nd Largest City 1901	0.258***	0.194	0.132	0.365*
	[0.083]	[0.162]	[0.174]	[0.214]
Dummy if Navigable River 10 Km	-0.001	-0.004*	-0.004	0.030
	[0.000]	[0.002]	[0.007]	[0.022]
Dummy if Ashanti Trade Route 1850 10 Km	0.000	0.001	0.002	0.044***
	[0.001]	[0.003]	[0.005]	[0.015]
Dummy if Non-Ashanti Trade Route 1850 10 Km	0.000	0.002*	0.001	-0.007
	[0.000]	[0.001]	[0.005]	[0.014]
Dummy if Railroad 1932 10 Km	-0.001	0.001	-0.011	0.092*
	[0.001]	[0.006]	[0.018]	[0.049]
Dummy if Road 1930 10 Km	-0.000	-0.001	-0.001	-0.012
	[0.000]	[0.001]	[0.002]	[0.010]
Log Urban Population 1891	0.000	0.002	0.001	0.014
	[0.001]	[0.002]	[0.004]	[0.009]
Log Urban Population 1901	-0.000	-0.001	0.005*	-0.004
	[0.001]	[0.002]	[0.003]	[0.006]
Log Urban Population 1931	0.000	0.000	-0.002*	0.014***
	[0.000]	[0.001]	[0.001]	[0.004]
Log Rural Population 1901	-0.000	0.001	0.003*	0.023***
	[0.000]	[0.001]	[0.002]	[0.005]
Log Rural Population 1931	0.000	-0.000**	-0.001	0.003*
	[0.000]	[0.000]	[0.000]	[0.001]
Log Normalized Slave Exports 15th-19th Centuries	-0.000	-0.003**	-0.004	0.010
	[0.000]	[0.001]	[0.003]	[0.007]
Dummy if Slave Market 1800 50 Km	0.000	0.001	-0.003	0.005
	[0.000]	[0.002]	[0.004]	[0.012]
Dummy if Palm Oil Plantation 1900-1936 50 Km	0.000	0.006	-0.001	0.093**
	[0.001]	[0.006]	[0.014]	[0.037]
Dummy if Kola-Producing Cell 1932	-0.000	-0.009**	0.001	0.039
	[0.001]	[0.004]	[0.011]	[0.031]
Dummy if Rubber Plantation 1900-1936 50 Km	-0.000	-0.010	0.001	0.141***
	[0.002]	[0.007]	[0.014]	[0.035]
Dummy if Cocoa-Producing Cell 1927	-0.000	0.009*	0.029***	0.144***
	[0.002]	[0.005]	[0.011]	[0.032]
Dummy if Mine (Central Location) 1932 50 Km	-0.003*	-0.008*	-0.014	0.034
	[0.001]	[0.004]	[0.011]	[0.034]
R-squared	0.97	0.92	0.92	0.88

Notes: For 2,091 cells and period $[t\text{-}1;t]$, we regress the log number of missions in t on the log number of missions in t-1, a dummy if there is a mission in t, and the variables of Table 1. We omit the coefficients of area, rainfall, altitude, ruggedness, soil fertility, and a dummy if it was surveyed by the 1901 Census. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 3: CORRELATES OF THE MAIN MISSION STATIONS, LONG-DIFFERENCES

Dependent Variable:	Dummy if Main Station in the Cell in Selected Year:			
	1850	1875	1897	1932
	(1)	(2)	(3)	(4)
Dummy if Main Station in ... / 1850 / 1875 / 1897		0.790***	0.673***	0.607***
		[0.064]	[0.090]	[0.067]
Dummy if Mission in Selected Year	0.308***	0.201***	0.073***	0.088***
	[0.110]	[0.064]	[0.022]	[0.018]
Historical Malaria Index	0.001	0.002	0.000	0.002
	[0.001]	[0.001]	[0.002]	[0.003]
Dummy if Port in the Cell 1850	-0.034	0.045	0.226**	0.110
	[0.053]	[0.084]	[0.101]	[0.113]
Log Distance to Coast	0.007*	0.003	0.019**	0.018
	[0.004]	[0.005]	[0.007]	[0.013]
Dummy if Large Pre-Colonial City 1800	-0.019	-0.182	0.172	-0.091*
	[0.013]	[0.138]	[0.154]	[0.054]
Dummy if Headchief Town 1901	-0.023*	0.047	0.028	0.088*
	[0.012]	[0.035]	[0.041]	[0.051]
Dummy if Outside Gold Coast Colony 1850	-0.009**	-0.007	0.006	-0.004
	[0.005]	[0.005]	[0.010]	[0.018]
Dummy if Largest or 2nd Largest City 1901	0.720***	-0.241*	0.247	-0.053
	[0.103]	[0.141]	[0.172]	[0.066]
Dummy if Navigable River 10 Km	0.001	0.007	-0.002	0.002
	[0.001]	[0.006]	[0.008]	[0.012]
Dummy if Ashanti Trade Route 1850 10 Km	-0.000	0.001	-0.002	-0.003
	[0.003]	[0.004]	[0.005]	[0.009]
Dummy if Non-Ashanti Trade Route 1850 10 Km	0.002	-0.000	0.006	0.008
	[0.001]	[0.002]	[0.004]	[0.009]
Dummy if Railroad 1932 10 Km	-0.008*	-0.003	-0.007	0.061*
	[0.004]	[0.010]	[0.017]	[0.034]
Dummy if Road 1930 10 Km	-0.001	0.001	-0.001	0.004
	[0.001]	[0.001]	[0.002]	[0.005]
Log Urban Population 1891	-0.001	0.001	0.004	0.013**
	[0.002]	[0.002]	[0.004]	[0.006]
Log Urban Population 1901	0.002	0.002	0.007**	0.014**
	[0.002]	[0.002]	[0.003]	[0.006]
Log Urban Population 1931	-0.000	-0.001	-0.001	0.007***
	[0.000]	[0.001]	[0.001]	[0.003]
Log Rural Population 1901	0.002*	-0.002	0.002	-0.003
	[0.001]	[0.002]	[0.002]	[0.003]
Log Rural Population 1931	-0.000*	0.000	-0.001**	-0.001
	[0.000]	[0.000]	[0.000]	[0.001]
Log Normalized Slave Exports 15th-19th Centuries	-0.000	-0.000	-0.000	-0.006
	[0.001]	[0.002]	[0.002]	[0.005]
Dummy if Slave Market 1800 50 Km	0.002	-0.004	-0.001	-0.001
	[0.001]	[0.003]	[0.004]	[0.008]
Dummy if Palm Oil Plantation 1900-1936 50 Km	0.008	-0.007	0.035***	-0.001
	[0.005]	[0.012]	[0.012]	[0.023]
Dummy if Kola-Producing Cell 1932	-0.008**	-0.001	-0.014	0.008
	[0.004]	[0.006]	[0.010]	[0.023]
Dummy if Rubber Plantation 1900-1936 50 Km	-0.011	-0.008	-0.013	0.026
	[0.008]	[0.008]	[0.013]	[0.022]
Dummy if Cocoa-Producing Cell 1927	0.014**	0.004	0.009	0.064***
	[0.006]	[0.006]	[0.011]	[0.021]
Dummy if Mine (Central Location) 1932 50 Km	-0.002	0.006	0.011	-0.041*
	[0.004]	[0.008]	[0.011]	[0.023]
R-squared	0.58	0.57	0.56	0.45

Notes: For 2,091 cells and period [t-1;t], we regress a dummy if there is a main station in t on a dummy if there is a main station in t-1, a dummy if there is a mission in t, and the variables of Table 1. We omit the coefficients of area, rainfall, altitude, ruggedness, soil fertility, and a dummy if it was surveyed by the 1901 Census. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 4: CORRELATES OF THE MISSION SCHOOLS, LONG-DIFFERENCES

Dependent Variable:	Dummy if Mission School in the Cell in Selected Year:			
	1850	1875	1897	1932
	(1)	(2)	(3)	(4)
Dummy if Mission School in ... / 1850 / 1875 / 1897		0.348**	0.351***	0.205***
		[0.139]	[0.091]	[0.074]
Dummy if Mission in Selected Year	0.677***	0.475***	0.198***	0.152***
	[0.109]	[0.091]	[0.036]	[0.020]
Historical Malaria Index	-0.000	0.000	-0.006*	0.023***
	[0.001]	[0.001]	[0.003]	[0.004]
Dummy if Port in the Cell 1850	0.113**	-0.028	0.283***	0.254***
	[0.050]	[0.100]	[0.088]	[0.094]
Log Distance to Coast	-0.006	-0.000	0.005	0.052***
	[0.004]	[0.006]	[0.012]	[0.016]
Dummy if Large Pre-Colonial City 1800	0.033*	-0.125	-0.100	-0.088
	[0.019]	[0.105]	[0.064]	[0.084]
Dummy if Headchief Town 1901	0.022**	-0.016	0.085**	0.035
	[0.010]	[0.041]	[0.035]	[0.056]
Dummy if Outside Gold Coast Colony 1850	0.003	-0.002	-0.013	0.053**
	[0.005]	[0.006]	[0.010]	[0.026]
Dummy if Largest or 2nd Largest City 1901	0.289***	0.025	-0.073	0.309***
	[0.102]	[0.153]	[0.081]	[0.116]
Dummy if Navigable River 10 Km	-0.000	0.001	0.011	0.035**
	[0.001]	[0.005]	[0.011]	[0.016]
Dummy if Ashanti Trade Route 1850 10 Km	0.003	-0.004	-0.001	-0.006
	[0.003]	[0.005]	[0.007]	[0.011]
Dummy if Non-Ashanti Trade Route 1850 10 Km	-0.003**	0.006*	-0.002	-0.011
	[0.001]	[0.003]	[0.007]	[0.011]
Dummy if Railroad 1932 10 Km	0.007*	0.003	-0.001	0.005
	[0.004]	[0.012]	[0.023]	[0.038]
Dummy if Road 1930 10 Km	0.000	0.002	-0.007	0.010
	[0.001]	[0.002]	[0.004]	[0.007]
Log Urban Population 1891	0.000	0.005	0.018***	0.013*
	[0.002]	[0.003]	[0.006]	[0.007]
Log Urban Population 1901	-0.005***	-0.001	0.004	0.023***
	[0.002]	[0.002]	[0.004]	[0.006]
Log Urban Population 1931	0.001*	-0.001	0.001	0.008***
	[0.001]	[0.001]	[0.001]	[0.003]
Log Rural Population 1901	-0.002**	0.001	0.002	0.008**
	[0.001]	[0.001]	[0.002]	[0.004]
Log Rural Population 1931	0.000	-0.000	-0.001	-0.003***
	[0.000]	[0.000]	[0.001]	[0.001]
Log Normalized Slave Exports 15th-19th Centuries	0.000	-0.002	-0.006**	0.003
	[0.001]	[0.002]	[0.003]	[0.006]
Dummy if Slave Market 1800 50 Km	0.000	0.001	-0.003	-0.020**
	[0.002]	[0.003]	[0.005]	[0.010]
Dummy if Palm Oil Plantation 1900-1936 50 Km	-0.011*	0.002	0.036*	0.029
	[0.006]	[0.010]	[0.019]	[0.028]
Dummy if Kola-Producing Cell 1932	0.004	-0.010	0.009	0.020
	[0.004]	[0.007]	[0.014]	[0.027]
Dummy if Rubber Plantation 1900-1936 50 Km	0.015*	-0.016*	-0.027	0.070***
	[0.008]	[0.010]	[0.017]	[0.026]
Dummy if Cocoa-Producing Cell 1927	-0.003	0.009	-0.010	0.085***
	[0.006]	[0.008]	[0.013]	[0.025]
Dummy if Mine (Central Location) 1932 50 Km	-0.008	-0.002	-0.027*	-0.050**
	[0.006]	[0.010]	[0.016]	[0.024]
R-squared	0.79	0.65	0.57	0.45

Notes: For 2,091 cells and period [t-1;t], we regress a dummy if there is a school in t on a dummy if there is a school in t-1, a dummy if there is a mission in t, and the variables of Table 1. We omit the coefficients of area, rainfall, altitude, ruggedness, soil fertility, and a dummy if it was surveyed by the 1901 Census. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 5: CORRELATES OF MISSIONS, LONG-DIFF., DENOMINATION-LEVEL DATA

Dependent Variable:	Dummy if Mission of Denomination in the Cell in Year:			
	(1) 1850	(2) 1875	(3) 1897	(4) 1932
Dummy Mission Same Denom. .../1850/1875/1897		0.639***	0.468***	0.406***
		[0.073]	[0.068]	[0.036]
Dummy Mission Other Denom. .../1850/1875/1897		-0.043*	-0.016	0.095***
		[0.026]	[0.025]	[0.026]
DummyMissionSameDenom.15Km.../1850/1875/1897		0.231***	0.295***	0.220***
		[0.060]	[0.050]	[0.030]
DummyMissionOtherDenom.15Km.../1850/1875/1897		-0.005	0.012	-0.154***
		[0.025]	[0.029]	[0.022]
Historical Malaria Index	-0.001*	-0.001*	0.004***	-0.001
	[0.000]	[0.001]	[0.001]	[0.003]
Dummy if Port in the Cell 1850	0.052*	0.035	0.078**	0.031
	[0.028]	[0.026]	[0.033]	[0.057]
Log Distance to Coast	-0.004*	-0.002	0.004	-0.022**
	[0.002]	[0.002]	[0.005]	[0.010]
Dummy if Large Pre-Colonial City 1800	-0.027	-0.097	-0.105***	-0.049
	[0.023]	[0.062]	[0.040]	[0.084]
Dummy if Headchief Town 1901	-0.006	0.019*	-0.002	0.075***
	[0.008]	[0.011]	[0.015]	[0.027]
Dummy if Outside Gold Coast Colony 1850	0.001	-0.002	0.004	0.088***
	[0.002]	[0.002]	[0.006]	[0.018]
Dummy if Largest or 2nd Largest City 1901	0.284***	0.009	0.322***	-0.022
	[0.054]	[0.082]	[0.051]	[0.097]
Dummy if Navigable River 10 Km	-0.006***	-0.003	0.014**	0.013
	[0.002]	[0.002]	[0.006]	[0.011]
Dummy if Ashanti Trade Route 1850 10 Km	0.003**	0.003*	-0.003	0.016**
	[0.001]	[0.001]	[0.003]	[0.008]
Dummy if Non-Ashanti Trade Route 1850 10 Km	0.003***	0.002*	0.000	0.006
	[0.001]	[0.001]	[0.003]	[0.007]
Dummy if Railroad 1932 10 Km	-0.004	-0.009*	0.013	0.094***
	[0.003]	[0.005]	[0.011]	[0.026]
Dummy if Road 1930 10 Km	-0.001	-0.001	0.002	0.000
	[0.001]	[0.001]	[0.002]	[0.006]
Log Urban Population 1891	0.004***	0.007***	0.002	0.003
	[0.001]	[0.001]	[0.002]	[0.004]
Log Urban Population 1901	-0.000	0.003***	0.009***	-0.004
	[0.001]	[0.001]	[0.002]	[0.003]
Log Urban Population 1931	0.000	-0.001	0.004***	0.019***
	[0.001]	[0.000]	[0.001]	[0.003]
Log Rural Population 1901	0.000	-0.000	0.001	0.017***
	[0.000]	[0.000]	[0.001]	[0.002]
Log Rural Population 1931	-0.000*	-0.000**	-0.000	0.005***
	[0.000]	[0.000]	[0.000]	[0.001]
Log Normalized Slave Exports 15th-19th Centuries	-0.000	-0.001	-0.000	0.012***
	[0.000]	[0.001]	[0.002]	[0.004]
Dummy if Slave Market 1800 50 Km	0.001	-0.002	-0.010***	0.001
	[0.001]	[0.001]	[0.003]	[0.007]
Dummy if Palm Oil Plantation 1900-1936 50 Km	0.003	0.005	0.014	0.061***
	[0.003]	[0.005]	[0.010]	[0.020]
Dummy if Kola-Producing Cell 1932	-0.006***	-0.003	0.013*	0.062***
	[0.002]	[0.003]	[0.008]	[0.018]
Dummy if Rubber Plantation 1900-1936 50 Km	0.002	0.000	0.001	0.041**
	[0.003]	[0.004]	[0.010]	[0.018]
Dummy if Cocoa-Producing Cell 1927	0.001	0.004	0.024***	0.081***
	[0.003]	[0.003]	[0.007]	[0.018]
Dummy if Mine (Central Location) 1932 50 Km	-0.005*	-0.001	-0.011	0.086***
	[0.003]	[0.003]	[0.007]	[0.019]
Denomination Fixed Effects; Observations	Y; 8,364	Y; 8,364	Y; 8,364	Y; 8,364

Notes: Pooled regressions for 2,091 cells x 4 denominations (Methodist, Presbyterian, Catholic, and other) = 8,364 observations. We add four denomination fixed effects. We do not report the coefficients of land area, rainfall, altitude, ruggedness, soil fertility, and a dummy if it was surveyed by the 1901 Census. Robust SE's clustered at the cell level: * p<0.10, ** p<0.05, *** p<0.01.

Table 6: CORRELATES OF MISSIONS, LONG-DIFF., DENOMINATION-SPECIFIC EFFECTS

Dependent Variable:	Dummy if Mission in the Cell in Selected Year:					
	1897	1932	1850	1875	1897	1932
Effect of Interaction with Dummy if:	*Catholic*	*Catholic*	*Presb.*	*Presb.*	*Presb.*	*Presb.*
	(1)	(2)	(3)	(4)	(5)	(6)
Historical Malaria Index	-0.005**	-0.034***	0.005***	0.007***	0.029***	0.023***
	[0.002]	[0.007]	[0.002]	[0.002]	[0.005]	[0.007]
Dummy if Port in the Cell 1850	0.328***	0.025	-0.174	-0.222*	-0.158	-0.008
	[0.116]	[0.098]	[0.113]	[0.126]	[0.123]	[0.140]
Log Distance to Coast	-0.021**	-0.080***	0.028***	0.011	0.032	0.021
	[0.008]	[0.022]	[0.009]	[0.011]	[0.021]	[0.023]
Dummy if Large Pre-Colonial City 1800	-0.157	-0.134***	-0.179	0.202	0.192	-0.117
	[0.161]	[0.051]	[0.160]	[0.135]	[0.194]	[0.098]
Dummy if Headchief Town 1901	0.013	0.092*	-0.041	-0.000	-0.017	-0.009
	[0.032]	[0.055]	[0.033]	[0.052]	[0.059]	[0.064]
Dummy if Outside Gold Coast Colony 1850	-0.007	0.152***	-0.024***	-0.011	0.044*	0.027
	[0.009]	[0.038]	[0.009]	[0.008]	[0.024]	[0.045]
Dummy if Largest or 2nd Largest City 1901	0.404*	-0.135*	-0.430	0.245	0.140	0.071
	[0.212]	[0.075]	[0.320]	[0.159]	[0.217]	[0.147]
Dummy if Navigable River 10 Km	-0.017*	0.050**	0.015**	0.020**	-0.001	0.038
	[0.010]	[0.025]	[0.006]	[0.009]	[0.022]	[0.024]
Dummy Ashanti Trade Route 1850 10 Km	0.004	-0.017	-0.005	-0.004	-0.001	0.001
	[0.005]	[0.017]	[0.006]	[0.007]	[0.013]	[0.018]
Dummy Non-Ashanti Trade Route 1850 10 Km	-0.001	0.003	-0.003	-0.005	-0.022*	-0.054***
	[0.005]	[0.016]	[0.004]	[0.005]	[0.012]	[0.017]
Dummy if Railroad 1932 10 Km	-0.033**	-0.039	0.004	0.050**	0.072	-0.208***
	[0.016]	[0.049]	[0.012]	[0.023]	[0.047]	[0.060]
Dummy if Road 1930 10 Km	-0.002	0.026*	-0.000	0.001	0.030***	-0.006
	[0.003]	[0.013]	[0.003]	[0.003]	[0.008]	[0.014]
Log Urban Population 1891	-0.004	-0.014*	-0.012**	0.000	-0.006	-0.007
	[0.004]	[0.007]	[0.005]	[0.007]	[0.009]	[0.009]
Log Urban Population 1901	-0.007***	0.010	0.006*	-0.002	0.007	0.013*
	[0.003]	[0.007]	[0.003]	[0.003]	[0.007]	[0.007]
Log Urban Population 1931	-0.008***	-0.004	0.002	-0.003	0.003	-0.012*
	[0.002]	[0.006]	[0.002]	[0.003]	[0.004]	[0.007]
Log Rural Population 1901	-0.001	0.005	-0.001	-0.001	0.005	-0.000
	[0.001]	[0.004]	[0.001]	[0.001]	[0.003]	[0.005]
Log Rural Population 1931	0.000	0.012***	-0.000	0.001*	-0.001	-0.001
	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.002]
Log Norm. Slave Exports 15th-19th Centuries	0.005*	0.042***	-0.001	0.001	0.003	0.013*
	[0.003]	[0.007]	[0.002]	[0.003]	[0.007]	[0.008]
Dummy if Slave Market 1800 50 Km	0.020***	0.079***	-0.003	-0.002	-0.015	-0.023
	[0.005]	[0.016]	[0.004]	[0.006]	[0.011]	[0.018]
Dummy if Palm Oil Plantation 1900-36 50 Km	-0.046***	-0.069*	0.005	-0.042**	-0.020	-0.069
	[0.018]	[0.040]	[0.014]	[0.020]	[0.038]	[0.047]
Dummy if Kola-Producing Cell 1932	-0.020*	-0.167***	0.001	-0.006	0.019	0.080*
	[0.011]	[0.036]	[0.009]	[0.013]	[0.029]	[0.047]
Dummy if Rubber Plantation 1900-36 50 Km	0.013	0.184***	-0.032**	0.011	0.039	0.152***
	[0.015]	[0.039]	[0.015]	[0.013]	[0.035]	[0.045]
Dummy if Cocoa-Producing Cell 1927	-0.030***	0.047	0.015	0.012	0.027	-0.005
	[0.010]	[0.035]	[0.011]	[0.012]	[0.027]	[0.044]
Dummy if Mine (Central Loc.) 1932 50 Km	0.015	-0.062	0.011	-0.012	-0.002	-0.189***
	[0.011]	[0.041]	[0.011]	[0.016]	[0.029]	[0.046]
Denomination FE; Observations	Y; 8,364	Y; 8,364	Y; 8,364	Y; 8,364	Y; 8,364	Y; 8,364

Notes: Columns (1)-(2): Pooled regressions for 2,091 cells x 4 denominations (Methodist, Presbyterian, Catholic, other). We interact the locational characteristics with a dummy equal to one if the dependant variable is for Catholic missions (*Catholic*). Columns (3)-(6): Pooled regressions for 2,091 cells x 2 denominations (Methodist, Presbyterian). We interact the locational characteristics with a dummy equal to one if the dependant variable is for Presbyterian missions (*Presb.*). Columns (1)-(6): We add four/two denomination fixed effects. We do not report the coefficients of four dummies for whether there was a mission of the same denomination or a different denomination in the cell or a neighboring cell in the start year, land area, rainfall, altitude, ruggedness, soil fertility, and a dummy if it was surveyed by the 1901 Census. Robust SE's clustered at the cell level: * p<0.10, ** p<0.05, *** p<0.01.

Table 7: CORRELATES OF MISSIONARY EXPANSION, LONG-DIFFERENCES, ETHNIC FE

Dependent Variable:	Dummy if Mission in the Cell in Selected Year:			
	1850	1875	1897	1932
	(1)	(2)	(3)	(4)
Dummy if Any Mission in ... / 1850 / 1875 / 1897		0.573***	0.390***	0.211***
		[0.074]	[0.080]	[0.037]
Historical Malaria Index	-0.007***	-0.005	0.012	-0.025**
	[0.003]	[0.004]	[0.008]	[0.012]
Dummy if Port in the Cell 1850	0.158	0.200**	0.134	-0.137*
	[0.102]	[0.101]	[0.083]	[0.073]
Log Distance to Coast	-0.018	-0.037**	-0.018	-0.065***
	[0.013]	[0.016]	[0.026]	[0.025]
Dummy if Large Pre-Colonial City 1800	0.035	-0.216*	0.023	-0.311***
	[0.047]	[0.116]	[0.163]	[0.047]
Dummy if Headchief Town 1901	-0.007	0.058	-0.008	0.009
	[0.029]	[0.040]	[0.044]	[0.036]
Dummy if Outside Gold Coast Colony 1850	0.011	0.015*	0.039*	0.101***
	[0.010]	[0.009]	[0.023]	[0.036]
Dummy if Largest or 2nd Largest City 1901	0.742***	-0.318**	0.097	-0.049
	[0.072]	[0.130]	[0.185]	[0.055]
Dummy if Navigable River 10 Km	-0.015***	-0.018**	0.040**	0.034
	[0.005]	[0.008]	[0.019]	[0.025]
Dummy if Ashanti Trade Route 1850 10 Km	0.009	0.012**	-0.003	0.013
	[0.006]	[0.006]	[0.011]	[0.016]
Dummy if Non-Ashanti Trade Route 1850 10 Km	0.010***	0.010*	0.006	0.033**
	[0.004]	[0.005]	[0.011]	[0.015]
Dummy if Railroad 1932 10 Km	-0.012	-0.024	0.081**	0.076*
	[0.012]	[0.018]	[0.041]	[0.042]
Dummy if Road 1930 10 Km	-0.003	-0.002	0.003	0.009
	[0.003]	[0.004]	[0.009]	[0.015]
Log Urban Population 1891	0.014***	0.025***	0.008	0.004
	[0.004]	[0.006]	[0.007]	[0.006]
Log Urban Population 1901	-0.001	0.008**	0.023***	-0.010*
	[0.003]	[0.003]	[0.006]	[0.006]
Log Urban Population 1931	0.001	-0.001	0.019***	0.032***
	[0.002]	[0.002]	[0.004]	[0.006]
Log Rural Population 1901	0.001	0.001	0.007**	0.035***
	[0.001]	[0.001]	[0.003]	[0.004]
Log Rural Population 1931	-0.001	-0.001**	-0.001	0.015***
	[0.001]	[0.001]	[0.001]	[0.002]
Log Normalized Slave Exports 15th-19th Centuries	-	-	-	-
Dummy if Slave Market 1800 50 Km	0.005	-0.008	-0.032***	-0.004
	[0.005]	[0.005]	[0.011]	[0.017]
Dummy if Palm Oil Plantation 1900-1936 50 Km	0.010	0.027	0.078**	0.067*
	[0.014]	[0.019]	[0.035]	[0.039]
Dummy if Kola-Producing Cell 1932	-0.028***	-0.023*	0.031	0.114***
	[0.010]	[0.012]	[0.025]	[0.036]
Dummy if Rubber Plantation 1900-1936 50 Km	0.008	0.023*	-0.027	0.019
	[0.015]	[0.014]	[0.033]	[0.039]
Dummy if Cocoa-Producing Cell 1927	-0.003	0.007	0.059**	0.088**
	[0.011]	[0.011]	[0.025]	[0.037]
Dummy if Mine (Central Location) 1932 50 Km	-0.015	-0.014	-0.015	0.139***
	[0.010]	[0.016]	[0.029]	[0.041]
Ethnic Group Fixed Effects (N = 34)	Y	Y	Y	Y

Notes: For 2,091 cells and period [t-1;t], we regress a dummy if there is a mission in t on a dummy if there is a mission in t-1 and characteristics proxying for geography, political conditions, transportation, population and economic activities (separated by dashed horizontal lines). We do not report the coefficients of land area, rainfall, altitude, ruggedness, soil fertility, and a dummy if it was surveyed by the 1901 Census. Robust SE's: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Appendix for data sources.

Table 8: HISTORICAL TRADE ROUTES AND MISSIONARY EXPANSION, ROBUSTNESS

Dependent Variable:	Dummy if Any Mission in the Cell in Selected Year:			
	(1) 1850	(2) 1875	(3) 1897	(4) 1932
Panel A: Excl. Trade Route Surveyed by Missionary + Extra Controls for Slave Trade				
Dummy if Ashanti Trade Route 1850 10 Km	0.011	0.012**	-0.007	0.005
	[0.0065]	[0.0059]	[0.0111]	[0.0156]
Dummy if Non-Ashanti Trade Route 1850 10 Km	0.013***	0.012**	0.000	0.030*
	[0.0045]	[0.0052]	[0.0109]	[0.0157]
Other Controls from Table 1	Y	Y	Y	Y

Notes: For 2,091 cells and each period [t-1;t], we regress a dummy if there is a mission in t on a dummy if there is a mission in t-1 and the variables of Table 1. We exclude a non-Ashanti trade route surveyed by a missionary (Ramseyer in 1886) and add log distances to slave markets and slave routes circa 1800 to the included "Dummy Slave Market 1800 50 Km". Robust SE's: * p<0.10, ** p<0.05, *** p<0.01.

Table 9: RAILROAD DUMMIES AND MISSIONARY EXPANSION, LONG-DIFFERENCES

Dependent Variable:	Dummy if Mission in the Cell in Selected Year:			
		Columns (2)-(4): Pre-Railroad Period		
	(1) 1932	(2) 1850	(3) 1875	(4) 1897
Panel A:				
Dummy Railroad 1932 0-10 Km	0.136***	-0.016	-0.006	0.026
	[0.051]	[0.020]	[0.022]	[0.047]
Dummy Railroad 1932 10-20 Km	0.028	-0.025	0.019	-0.091**
	[0.055]	[0.019]	[0.019]	[0.037]
Dummy Railroad 1932 20-30 Km	0.150***	-0.001	0.037	-0.019
	[0.052]	[0.023]	[0.023]	[0.041]
Dummy Railroad 1932 30-40 Km	0.070	-0.017	0.025	-0.043
	[0.055]	[0.023]	[0.027]	[0.038]
Panel B:	0.082**	-0.008	0.008	-0.011
Dummy Railroad 1932 0-30 Km	[0.040]	[0.015]	[0.015]	[0.028]
Other Controls from Table 1	Y	Y	Y	Y

Notes: For 2,091 cells and each period [t-1;t], we regress a dummy if there is a mission in t on a dummy if there is a mission in t-1 and characteristics proxying for geography, political conditions, transportation, population and economic activities (see Table 1). Since we include a lag of the dependent variable, these cross-sectional regressions can be interpreted as long-difference regressions. *Panel A:* Using four railroad dummies (0-10, 10-20, 20-30 and 30-40 Km) instead of one railroad dummy (0-10 Km) as in Table 1. *Panel B:* Using one railroad dummy based on 0-30 Km. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 10: CASH CROPS AND MISSIONARY EXPANSION, ROBUSTNESS CHECKS

Dependent Variable:	Dummy if Mission in Year t:		
Effect of Log Predicted Cash Crop Export Value in Year t (Incl. Cell Fixed Effects and Year Effects)			
	Coeff.	SE	Obs.
1. Baseline	0.028***	[0.002]	181,917
2. Also Including Gold in Natural Resource Exports	0.033***	[0.002]	181,917
3. Dummies if Aburi 50 Km & Basel's Sphere of Influence	0.026***	[0.002]	181,917
4. Using GAEZ Suitability for Cocoa and Palm Oil	0.031***	[0.002]	181,917
5. Combined UK-Ghana Deflator	0.028***	[0.002]	181,917
6. Ghana Deflator, Assuming No Inflation Pre-1900	0.025***	[0.002]	181,917

Notes: For 2,091 cells c and 87 years t (1846-1932), we regress a dummy if there is a mission in cell c in t on the log of the predicted value of cash crop exports in cell c in t. Row 2: Including the predicted value of gold exports in year t in the predicted value of natural resource exports in year t. Row 3: Adding dummies if the cell is within 50 Km from the Basel Mission established at Aburi (ca 1856) or in the "sphere of influence" of the Basel Mission (map from 1873), both interacted with year fixed effects. Row 4: Using instead GAEZ data to define land suitability for both cocoa and palm oil cultivation. Rows 5-6: Using alternative deflator series to construct cash crop export value at constant prices. Robust SE's clustered at the cell level: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 11: CORRELATES OF MISSIONARY EXPANSION, AFRICA, NO EARLY MISSION FIELDS

Dependent Variable:	Dummy if Mission in the Cell in:			
	Beach in 1900		Roome in 1924	
	(1)	(2)	(3)	(4)
Historical Malaria Index	-0.025***	-0.010	-0.048***	-0.036***
	[0.006]	[0.006]	[0.011]	[0.011]
Tsetse Index	-0.003**	0.000	-0.008***	-0.005**
	[0.001]	[0.001]	[0.002]	[0.002]
Dummy if Slave Port in the Cell 1800-1900	0.046**	0.054*	0.131***	0.141***
	[0.022]	[0.028]	[0.031]	[0.045]
Log Distance to Coast	-0.003***	-0.002***	-0.003***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Large Pre-Colonial City 1400	-0.031***	-0.019***	0.050	0.020
	[0.008]	[0.006]	[0.042]	[0.051]
Dummy if Large Pre-Colonial City 1800	0.015	0.019	0.068	0.083
	[0.026]	[0.049]	[0.044]	[0.080]
Dummy if Largest or 2nd Largest City 1901	0.058***	0.052***	0.173***	0.164***
	[0.020]	[0.018]	[0.029]	[0.033]
Year of Colonization	-0.000	-0.000*	-0.000***	-0.000**
	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Centralized State (Murdock)	0.002***	0.000	-0.001**	-0.001
	[0.000]	[0.000]	[0.001]	[0.001]
Log Distance to Muslim Center	-0.001	-0.001***	0.002***	0.001
	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Navigable River 10 Km	0.003***	0.004***	0.012***	0.011***
	[0.001]	[0.001]	[0.002]	[0.002]
Dummy if Lake 10 Km	0.001	0.001	0.011***	0.010***
	[0.002]	[0.001]	[0.003]	[0.003]
Dummy if Explorer Route 10 Km	0.001	0.001	0.002**	0.001
	[0.001]	[0.000]	[0.001]	[0.001]
Dummy if Railroad 1900 / 1924 10 Km	0.014***	0.011**	0.023***	0.026***
	[0.004]	[0.005]	[0.002]	[0.003]
Log Population Density 1800	-0.000	0.000	0.000	0.000**
	[0.000]	[0.000]	[0.000]	[0.000]
Log City Pop. ca 1900 (Loc.≥10,000)	0.011***	0.004	0.002	0.001
	[0.003]	[0.003]	[0.003]	[0.005]
Log Urban Population 1900	0.002***	0.000	0.006***	0.005***
	[0.000]	[0.000]	[0.001]	[0.001]
Log Rural Population 1900	0.001***	-0.000**	0.000***	0.000
	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Slavery (Murdock)	0.001**	0.001***	0.003***	0.002***
	[0.001]	[0.000]	[0.001]	[0.001]
Log Normalized Slave Exports 15th-19th Centuries	0.001	0.001**	0.006***	0.004***
	[0.001]	[0.001]	[0.001]	[0.001]
Log Predicted Cash Crop Export Value 1900 / 1924	0.001***	0.001***	0.000**	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Mine 1900 / 1924 50 Km	-0.001	-0.001	0.004*	0.007***
	[0.002]	[0.002]	[0.002]	[0.003]
Dummy if Polygamy (Murdock)	-0.001***	0.001**	0.001**	0.001**
	[0.000]	[0.000]	[0.001]	[0.001]
Drop Early Mission Fields ; Observations	N; 203,574	Y; 167,179	N; 203,574	Y; 167,179
Fixed Effects	Country	Country	Country	Country

Notes: For 203,574 cells in 43 sub-Saharan Africa countries, we regress a dummy if there is a mission in Beach in 1900 (columns (1)-(2)) or a mission in Roome in 1924 (columns (3)-(4)) on characteristics proxying for geography, political conditions, transportation, population and economic activities (separated by dashed horizontal lines). In columns (2) and (4), we drop 10 countries that were early mission fields based on our own readings (Obs. = 167,179): Gambia, Ghana, Lesotho, Liberia, Madagascar, Mozambique, Nigeria, Senegal, Sierra Leone and South Africa. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 12: CORRELATES OF MISSIONARY EXPANSION, AFRICA, MOVEMENT-LEVEL DATA

Dependent Variable:	Dummy if Any Mission in the Cell in Roome in 1924:		
	(1) Pooled	(2) Pooled	
		Baseline	$\times$ *Catholic*
Historical Malaria Index	-0.022***	-0.041***	0.038***
	[0.006]	[0.008]	[0.008]
Tsetse Index	-0.004***	-0.007***	0.005***
	[0.001]	[0.002]	[0.001]
Dummy if Slave Port in the Cell 1800-1900	0.062***	0.063**	-0.002
	[0.017]	[0.025]	[0.034]
Log Distance to Coast	-0.002***	-0.002***	0.000
	[0.000]	[0.000]	[0.000]
Dummy if Large Pre-Colonial City 1400	0.032	0.033	-0.002
	[0.026]	[0.036]	[0.045]
Dummy if Large Pre-Colonial City 1800	0.044	0.041	0.007
	[0.029]	[0.038]	[0.044]
Dummy if Largest or 2nd Largest City 1901	0.117***	0.129***	-0.025
	[0.020]	[0.026]	[0.028]
Year of Colonization	-0.000***	-0.000***	-0.000
	[0.000]	[0.000]	[0.000]
Dummy if Centralized State (Murdock)	-0.001*	-0.001***	0.002***
	[0.000]	[0.000]	[0.001]
Log Distance to Muslim Center	0.001***	0.001***	0.001**
	[0.000]	[0.000]	[0.000]
Dummy if Navigable River 10 Km	0.006***	0.008***	-0.003*
	[0.001]	[0.002]	[0.002]
Dummy if Lake 10 Km	0.005***	0.003	0.005*
	[0.002]	[0.002]	[0.003]
Dummy if Explorer Route 10 Km	0.001**	0.000	0.001
	[0.000]	[0.001]	[0.001]
Dummy if Railroad 1900 / 1924 10 Km	0.012***	0.019***	-0.013***
	[0.001]	[0.002]	[0.002]
Log Population Density 1800	0.000	0.000	-0.000
	[0.000]	[0.000]	[0.000]
Log City Pop. ca 1900 (Loc.$\geq$10,000)	0.001	0.000	0.001
	[0.002]	[0.003]	[0.003]
Log Urban Population 1900	0.004***	0.005***	-0.003***
	[0.000]	[0.000]	[0.001]
Log Rural Population 1900	0.000***	0.000**	-0.000
	[0.000]	[0.000]	[0.000]
Dummy if Slavery (Murdock)	0.001***	0.002***	-0.001
	[0.000]	[0.001]	[0.001]
Log Normalized Slave Exports 15th-19th Centuries	0.003***	0.004***	-0.002***
	[0.000]	[0.001]	[0.001]
Log Predicted Cash Crop Export Value 1900 / 1924	0.000**	0.001***	-0.001***
	[0.000]	[0.000]	[0.000]
Dummy if Mine 1900 / 1924 50 Km	0.002*	0.004**	-0.004*
	[0.001]	[0.002]	[0.002]
Dummy if Polygamy (Murdock)	0.001**	0.000	0.000
	[0.000]	[0.000]	[0.000]
Fixed Effects	Country, Movement	Country, Movement	
Number of Obs.	407,148	407,148	

Notes: For 2 denominations (Protestant, Catholic) x 203,574 cells in 43 sub-Saharan African countries, we regress a dummy if there is a mission in 1924 on characteristics proxying for geography, political conditions, transportation, population and economic activities. We add movement fixed effects. In column 2, we also interact the characteristics with a dummy equal to one if the dependent variable is for Catholic missions (*Catholic*). Robust SE's clustered at the cell level: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Appendix for data sources.

Table 13: RAILROADS AND MISSIONS, AFRICA, INVESTIGATION OF CAUSALITY

Dependent Variable: Dummy if Mission	Defined in 1900		Defined in 1924	
Effect of Dummy Rail 0-30 Km	Defined in 1900		Defined in 1924	
	Coeff.	SE	Coeff.	SE
1. Rail 0-30 Km	0.005***	[0.002]	0.023***	[0.002]
2. Including Country-Ethnic Group Fixed Effects (N = 1,158)	0.006**	[0.003]	0.022***	[0.003]
3. Including District ca 2000 Fixed Effects (N = 3,284)	0.006**	[0.003]	0.020***	[0.003]
4. Rail 0-30 Km Dummy Using Military-Mining Lines Only	0.006***	[0.002]	0.006***	[0.002]
5. Rail 0-30 Km Dummy Using 1916 & 1922 Placebo Lines Only	0.001	[0.001]	0.002**	[0.001]
6. IV: 30 Km from EMST Network (Drop+Ctrl Nodes; IV F = 558/899)	0.025*	[0.013]	0.048***	[0.009]
Controls of Table 5	Y	Y	Y	Y

Notes: For 203,574 cells, we regress a dummy if there is an Atlas mission in 1900 (col. (1)-(2)) or 1924 (col. (3)-(4)) on characteristics proxying for geography, political conditions, transportation, population and economic activities (see Table 5, except that that the railroad dummy is defined for 0-30 km instead of 0-10 km). Rows 2-3: Adding 1,158 ethnic group or 3,284 district (2000) FE. Row 4: Rail dummy based on lines built for military domination and mining only (note that the controls capture factors that make locations important for military domination or mining). Row 5: Rail dummy based on lines planned but never built (based on maps from 1916 and 1922). Row 6: The instrument is a dummy if the cell is within 30 Km from the Euclidean minimum spanning tree network based on 128 nodes being the capital, largest and second largest cities of each country ca 1900 (dropping the nodes + controlling for log Euclidean distance to the nodes of the same country). Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 14: CORRELATES OF BEACH (1900) AND ROOME (1924) MISSIONS

Dependent Variable:	Dummy if Any Mission in Cell c in...					
	Beach in 1900			Roome in 1924		
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy if Mission in Year t	0.16***	0.04**	0.01	0.06***	0.01*	-0.02***
	[0.03]	[0.02]	[0.02]	[0.01]	[0.01]	[0.01]
Dummy if Created in 1751-1850		0.53***	0.11		0.46***	0.33***
		[0.11]	[0.12]		[0.11]	[0.10]
Dummy if Created in 1851-1875		0.21***	-0.04		0.22***	0.13**
		[0.08]	[0.05]		[0.07]	[0.06]
Dummy if Main Station in Year t			0.60***			0.16***
			[0.10]			[0.05]
Dummy if School in Year t			0.03			0.09***
			[0.06]			[0.03]
R-squared	0.15	0.37	0.62	0.05	0.28	0.38

Notes: For 2,091 cells c, we regress a dummy if there is a mission in cell c in Beach (1900) or Roome (1924) on the mission characteristics in the cell the same year (1900 or 1924) in our data set. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 15: LONG-TERM EFFECTS OF MISSIONS AND MISSION TYPES FOR MAP YEARS

	Dependent Variable: Log Night Light Intensity in the Cell circa 2000:					
Controls Included:	None (1)	Standard (2)	Ours (3)	None (4)	Standard (5)	Ours (6)
	Col. (1)-(3): 1900 (Beach, 1903)			Col. (4)-(6): 1924 (Roome, 1925)		
Dummy if Atlas Mission in Year t	3.438***	2.446***	0.372*	2.836***	2.349***	0.660***
	[0.210]	[0.221]	[0.211]	[0.141]	[0.155]	[0.174]
Dummy if Created 1751-1850	1.816***	1.004***	0.453	1.746***	1.098***	0.418
	[0.396]	[0.370]	[0.328]	[0.280]	[0.285]	[0.287]
Dummy if Created 1851-1875	1.657***	1.032**	0.461	1.629***	1.115***	0.483*
	[0.469]	[0.408]	[0.300]	[0.344]	[0.302]	[0.266]
Dummy if Main Station in Year t	0.087	0.114	0.040	0.560*	0.628**	0.145
	[0.330]	[0.316]	[0.296]	[0.289]	[0.291]	[0.249]
Dummy if School in Year t	-0.171	0.112	-0.180	0.848***	0.644**	-0.001
	[0.297]	[0.281]	[0.264]	[0.275]	[0.284]	[0.234]

Notes: Sample of 2,091 cells in Ghana. "Standard": Controls identified as regularly used in the literature. "Ours": All controls of Table 1 for Ghana and all controls of Table 5 for Africa. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 16: Long-Term Economics Effects of Missions for Mission Map Years, Other Outcomes

Controls Included:	None (1)	Standard (2)	Ours (3)	None (4)	Standard (5)	Ours (6)
Panel A: Effect of True Mission Dummy (Ghana):	Col. (1)-(3): 1900			Col. (4)-(6): 1924		
1. Urbanization Rate 2000	43.2***	34.7***	5.3*	39.3***	37.3***	10.1***
	[2.2]	[2.5]	[3.1]	[1.6]	[1.9]	[2.4]
2. Employment Share Non-Agriculture 2000	27.9***	21.7***	3.4*	19.6***	18.3***	3.8***
	[1.7]	[1.7]	[1.9]	[1.1]	[1.1]	[1.2]
Panel B: Effect of Atlas Mission Dummy (Ghana):	Col. (1)-(3): 1900 (Beach, 1903)			Col. (4)-(6): 1924 (Roome, 1925)		
1. Urbanization Rate 2000	53.0***	36.8***	8.3	48.3***	35.8***	2.2
	[4.0]	[4.3]	[5.7]	[4.8]	[4.7]	[4.7]
2. Employment Share Non-Agriculture 2000	41.3***	30.1***	8.2*	33.2***	25.3***	3.9
	[3.9]	[3.4]	[4.3]	[4.3]	[3.8]	[3.4]
Panel C: Effect of Atlas Mission Dummy (Africa):	Col. (1)-(3): 1900 (Beach, 1903)			Col. (4)-(6): 1924 (Roome, 1925)		
1. Log Urban Population ca. 2000	0.9***	0.6***	0.1	1.1***	0.9***	0.6***
	[0.2]	[0.2]	[0.2]	[0.1]	[0.1]	[0.1]
2. Average DHS Wealth Index ca. 2000	0.8***	0.6***	0.1	1.0***	0.8***	0.4***
	[0.1]	[0.1]	[0.1]	[0.1]	[0.1]	[0.1]

Notes: Panels A-B (Ghana): Sample of 2,091 cells (row 1) and 1,895 cells (row 2). Panel C (Africa): Samples of 3,110 cells (row 1; 43 countries) and 6,387 cells (row 2; 32 countries). "Standard": Controls identified as regularly used in the literature. "Ours": Controls of Table 1 for Ghana and controls of Table 5 for Africa. Robust SE's: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Appendix for data sources.