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

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Abstract

How did Christianity expand in sub-Saharan Africa to become the continent's dominant religion? Using annual panel data on all Christian 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 shed light on the spatial dynamics and determinants of this religious diffusion process. Missions expanded into healthier, safer, more accessible, and more developed areas, privileging these locations first. Results are confirmed for selected factors using various identification strategies. This pattern has implications for extensive literature using missions established during colonial times as a source of variation to study the long-term economic effects of religion, human capital and culture. Our results provide a less favorable account of the impact of Christian missions on modern African economic development. We also highlight the risks of omission and endogenous measurement error biases when using historical data and events for identification.

JEL Codes: N3, N37, N95, Z12, O12, O15

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One of the most powerful cultural transformations in modern history has been the rapid expansion of Christianity to regions outside Europe. Adoption has been particularly fast in sub-Saharan Africa. While the number of Christians was low in 1900, their share 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). At current trends, Africans will comprise 42% of the global Christian population by 2060. Moreover, according to the World Values Survey, Sub-Saharan Africa is home to the world's most observant Christians in terms of church attendance, making it "the future of the world's most popular religion" (The Economist, 2015). What explains the unprecedented spread of Christianity in Africa? Why did it spread where it did? And what implications follow when studying the economic impact of Christianity?

The economics behind the expansion of Christianity, and church planting in particular, remains poorly understood. There are two potentially conflicting views supported by ample qualitative evidence. One narrative describes missionaries as explorers and adventurers crossing political boundaries and whose objective was to save souls no matter the costs (Oliver, 1952; Johnson, 1969; Cleall, 2009). Their knowledge of the area was limited and their locational choices were often erratic, but once settled, missions remained there permanently. Wantchekon et al. (2015, p. 714), for example, nicely describes how a series of historical accidents led missionaries to settle left rather than right of a river in Benin. An alternative view is that missionaries were following clear mission strategies designed by their own mission society (Johnson, 1967; Terry, 2015). Prior to settlement, missionaries thoroughly explored the area to assess the best locations and their locational choices included deep economic considerations.[1] For example, Nunn (2010) lists as important local factors "access to a clean water supply, the ability to import supplies from Europe, and an abundance of fertile soil that could be used to grow crops." There is no quantitative study that informs us as to which of the narratives holds for the entire missionary enterprise.[2]

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,

[1] In present-day Togo, missionary Thauren (1931, p. 19-20) laid out the 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 [...]. 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 [...]."

[2] Existing studies focus on estimating the long-term economic effects of missions and study the placement of missions with a concern for the endogeneity of their estimates. Results are usually reported in one table and include few, and mostly geographical, controls. No attempt has been made to measure causal effects on missionary expansion.

Ghana is one of the most devout Christian countries, making it an ideal context to address our research question.[3] Creating a new dataset on the geographical, political, demographic, and economic characteristics of locations in pre-1932 Ghana, we investigate the local determinants of missionary expansion and apply various identification strategies to obtain causal effects. We find that missionaries went to healthier, safer, more accessible, and richer areas, privileging these better locations first. They also invested more in these missions (with administrative functions, European missionaries or schools). Our findings seem to contradict the secularization hypothesis according to which religiosity declines with income. However, descriptive evidence suggests that mission societies expanded in more developed areas because they crucially depended on African contributions and Africans saw Christianization as a way to improve their economic well-being.

Secondarily, we show that these factors might spuriously explain why locations with past missions, and better missions in particular, are more developed today. The effects of colonial missions on present-day measures of economic development 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 historical mission atlases for 203,574 cells of 0.1x0.1 degrees in 43 sub-Saharan African countries.

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 (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 religious diffusion. 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. (2018) finds that trade routes and ecological similarity to the 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.

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

Moreover, analyzes are cross-sectional in nature, except Cantoni (2012) who uses panel data on the dates of introduction of Protestantism for 74 territories. They also study conditional correlations, except Rubin (2014) who instruments for the printing press with a city's distance to Mainz.

Next, while there is a large non-economics literature on missionary expansion in Africa (Johnson, 1967; Park, 1994), and the role of Western missionary personalities in particular (Kretzmann, 1923; Bartels, 1965; Ballard, 2008), there have been very few systematic attempts to quantify the economic factors behind the diffusion of Christianity outside Europe.

Studying the spatio-temporal diffusion of religion is challenging. It 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.[4] Next, by obtaining data on numerous local characteristics in pre-1932 Ghana, we satisfy condition (ii). Lastly, we contribute to (iii).

Based on our findings, we revisit the question of the long-run impact of religion (see McCleary and Barro (2006a) and Iyer (2016) for surveys). Studies have focused on the effect of religion on economic development (Barro and McCleary, 2003; Guiso et al., 2006; Cantoni, 2015; Campante and Yanagizawa-Drott, 2015; Rubin, 2017; Andersen et al., 2017; Bryan et al., 2018), human capital (Becker and Woessmann, 2009; Dittmar, 2011; Chaney, 2016; Becker and Woessmann, 2018) and political and social attitudes (Guiso et al., 2003; Voigtländer and Voth, 2012; Cantoni et al., 2018).

A recent, but booming, strand of that literature explores the long-term effects of missions in the Global South. Web Appendix Table 1 gives details on 55 related studies. Most studies find strong effects, whether on economic development (Bai and Kung, 2015; Valencia Caicedo, 2019; Castelló-Climent et al., 2018; Michalopoulos et al., forthcoming), human capital (Nunn, 2014; Gallego and Woodberry, 2010; Wantchekon et al., 2015; Waldinger, 2017; Barro and McCleary, 2017), health (Cagé and Rueda, 2017; Menon and McQueeney, 2017; Calvi and Mantovanelli, 2018), social mobility (Wantchekon et al., 2015; Alesina et al., 2019), culture (Nunn, 2010; Fenske, 2015), or political participation (Woodberry, 2012; Cagé and Rueda, 2016).

[4]Other studies with panel data on missions – Valencia Caicedo (2019) (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 not annual.

To deal with endogeneity, many studies compare neighboring locations or add controls. In specific contexts, studies have been able to use innovative strategies to identify causal effects.[5] We present evidence on the process driving missionary expansion. This contributes to the understanding as to what the contaminating factors may be, and how truly valid identification strategies may be.

In addition, most studies obtain their mission location data from mission atlases. Atlases typically used for Africa are the 1900 *Atlas of Protestant Missions* (Beach, 1903) and the 1924 *Ethnographic Survey of Africa* (Roome, 1925), which includes Catholic missions (Figure 1(a) shows their locations).[6] If we use ecclesiastical census returns and other primary missionary sources instead, we uncover large discrepancies. Figure 1(b) shows that atlases omit most missions for most countries. Overall, 90% of Africa's missions are not reported. In Ghana, this share is 91-98% and atlases miss most hinterland missions (see Figures 2(a)-2(b)). 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. We use our detailed data for Ghana to show that atlases disproportionately capture the best missions, thus better locations.[7]

Our contribution is thus also methodological. Non-random omissions and their consequences for the analysis of path dependence are under-investigated. We draw attention to the risks of non-classical measurement error biases when using historical data and events for identification.[8] In our particular context, we emphasize the importance of: (i) reliable sources for the mission data; (ii) relevant controls that capture the various stages and factors behind missionary expansion; and (iii) identification strategies that bypass issues related to the measurement of controls and/or the comparison of missions of different periods, types or denominations.

1. Conceptual Framework: Determinants of Mission Location

We approach the question of mission locations through the perspective of mission societies, their aims and constraints. This ultimately feeds into supply. We also take into account demand. This

[5] Wantchekon et al. (2015) study four villages with missions, using control villages that they identified as "as likely to be selected." Cagé and Rueda (2016) compare Protestant missions with and without a printing press. Valencia Caicedo (2019) compares mission locations to locations that missions abandoned for exogenous reasons. Valencia Caicedo (2019), Waldinger (2017) and Barro and McCleary (2017) compare locations evangelized for exogenous reasons by different denominations. Waldinger (2017) exploits the initial directions of missionary expansion paths.

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

[7] Fahs (1925, p.271) already pointed out that atlases provide a 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 contribution of African missionaries to the diffusion of Christianity (Frankema, 2012; Meier zu Selhausen et al., 2018).

[8] Measurement error in survey data, in contrast, has received a lot of attention (e.g. Bollinger, 1996; Mahajan, 2006).

framework helps to guide the selection of variables of interest in our analysis.

Locational Choice. Mission societies operate like not-for-profit organizations. They obtain utility from converting locals in various locations. Utility may be thought of as the maximum amount a mission society is willing to spend for a particular conversion. For example, if one objective was to abolish slavery, more efforts will be made towards conversions in slave-exporting locations. Utility is maximized under a cost constraint. Costs for a given membership depend on: (i) the number of missionaries needed, their salaries and training costs. Training costs are allocated over the years of service, hence their life expectancy should matter; (ii) land, buildings, and equipment needed (religious artifacts and books); (iii) communication costs to home and the capital (access to the coast). Many of the set-up costs - e.g. a church building - are lumpy. Thus, high population density reduces the average cost of conversions. Local donations and support (e.g. a chief granting land and protection) also relax the cost constraint. Moreover, mission societies differ in their utility functions and budgets (i.e., donations from the motherland); they may also behave strategically. Next, mission societies may purposely make specific investments in specific locations, such as opening a school. Demand for Christianity is less obvious. It can come from (i) spiritual needs in a changing world; (ii) benefits of aligning with the new colonial regime; (iii) access to education and training; and (iv) social networks. These may differ across locations.

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

Expansion. The initial expansion is funded by donations from the motherland. But 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 locational factors, and the ranking of locations, may change over time.

2. New Data on Ghana and Africa

Web Appendix Section 1. provides more details on sources and data construction.

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 mission societies (classified as Presbyterian, Methodist, Catholic and other) and geocode their locations. Our main source are the ecclesiastical returns published in the *Blue Books of the Gold Coast*, 1844-1932 (see Web Appx. Fig. 1 for an example). Each society was required to submit annual reports on its activities to the colonial administration, thereby listing all of their stations. Churches also received annual grants from the government for their pastoral services, hence a strong incentive to report. Our source thus represents an *exhaustive census* of missions. The early origins of mission societies are then well documented by society-specific anniversary reports, and we have no difficulties reconstructing missions before 1844.

Using the same sources, we identify if a mission was a *main station* or an out-station. Main stations are the principal centers of a "circuit" - a society's administrative unit. Main stations are large and centrally located (Thauren, 1931); they are headed by an ordained, often European, missionary. Out-stations are located on average 20 km from a main station. Their congregations are smaller but still of significant size and taken together have more members than main stations (Web Appx. Table 4).[9] We also identify if a mission station had a *school*. We focus on "assisted schools", which followed the government school curriculum and certified quality standards (Williamson, 1952). As they received grants-in-aid, they were reported accurately. Figure 3 presents the respective evolutions of the total number of missions, main missions, and schools.

Missionaries in Ghana. We create a new data set of all 338 male European missionaries stationed in Ghana during 1751-1890 from a variety of sources (data not available post-1890).[10] For the mortality analysis in section 3., we reconstructed dates of service and death in Ghana. African missionary careers are less well-documented. From the Blue Books 1846-1890, we retrieved the localities where European missionaries were permanently based and which missions they served occasionally. 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 c. 1850 from Dickson (1969);

[9] We find that the number of out-stations per main station increased over time. We also find that distance to the main station remained relatively stable over time (Web Appx. Tables 2 and 3). Therefore, the density of out-stations increased within a circuit. Finally, the number and borders of circuits are endogenous and change with the expansion of Christian missions (Web Appx. Fig. 2 shows for selected years the location of main stations and out-stations).

[10] Women were also active in mission societies. We focus on men because they held formal positions, represent the vast majority of staff, and are consistently observable throughout.

(ii) *Political conditions:* Data on large pre-colonial cities before 1800 are from Chandler (1987) and headchief towns in 1901 are from Guggisberg (1908). From Dickson (1969), we derive the boundary of the Gold Coast Colony established by the British c. 1850; (iii) *Transportation:* We obtain from Dickson (1969) navigable rivers in 1850-1930 and trade routes ca. 1850. Railroads (1898-1932) and roads (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[11]; (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).[12] Mines are 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.[13]

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).[14]

Missions in Africa. We compile data for 203,574 grid cells of 0.1 x 0.1 degrees (11x11 km) for 43 sub-Saharan African countries. The Blue Books of the Gold Coast (Ghana) are exceptionally rich in detail. Blue Books of other British colonies do not list each station systematically over such a long period. Yearbooks of other colonies are completely silent. We thus use mission location data widely used in the literature. These stem from mission atlases. Fahs (1925, p. 271) writes that these atlases are based on "hundreds of documents" and "society field reports" and admits "problems of what to include in or to exclude (...). Various elements entered into the decision made in almost every case. No hard-and-fast rule was or could be applied." For example, they followed the principle of showing stations where Europeans resided. With this caveat in mind, we use Beach (1903), compiled by Cagé and Rueda (2016), which reports the locations of 672 Protestant missions in 1900, and added the year of foundation. We then use Roome (1925), digitized by Nunn (2010), which shows the locations of Catholic (361) and Protestant missions (851) in 1924.

[11]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.

[12]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).

[13]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).

[14]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).

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 the year of colonization 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 c. 1800 and log urban and rural population c. 1900 from HYDE (Klein Goldewijk et al., 2010), and log city population c. 1900 for towns above 10,000 from Jedwab and Moradi (2016) (who use colonial administrative sources);[15] (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 seven major export crops (cocoa, coffee, cotton, groundnut, palm oil, tea and tobacco). We then obtain cash crops' national export value c. 1900 and 1924. Mines in 1900 and 1924 come from Mamo et al. (2019); (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.[16] Finally, we obtain urban population (total population of cities above 10,000) from Jedwab and Moradi (2016), who rely on Africapolis (2012) and census data.

[15] 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 when replicating controls used in the literature.

[16] Since we use survey data, data is only available for 3,110-6,387 cells depending on the outcome.

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), lifting the share of Christians 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 was established in 1751 at the port of Elmina (Figure 4(a) shows the localities mentioned in this paragraph). By that time, European powers had established trading posts along 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 inland Ashanti Kingdom centered around its capital Kumasi. The ensuing peace treaty of 1875 transformed the Gold Coast into a formal British colony. In 1896, another war with the Ashanti forced the kingdom to become a British protectorate and protection was extended to the north in 1902. Railroad construction began in 1898, which helped the British to consolidate their control over Ghana and lowered transport costs for commodity exports. For our analysis, this motivates the choice of 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 and Methodist missionaries reached the Gold Coast in 1828 and 1835, respectively. By 1850, only 904 Ghanaians had converted and 21 missions existed (Isichei, 1995, p. 169; Miller, 2003, p. 23). Mass-evangelization did not take off until the 1870s, when 67 Protestant missions served about 6,000 Ghanaians. Catholic missions started their conversion efforts from 1880 onwards. 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). Missions viewed the provision of education as an effective way to attract new Christians. As such, they provided the bulk of formal schooling in colonial Ghana (Cogneau and Moradi, 2014). As indicated in Figure 3, early missions qualitatively differed 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)). Missionaries shunned away from creating inland stations before essential intelligence was gathered by missionaries actively traveling the country (Thauren, 1931, pp. 19-21; Engel, 1931, p. 14). The Ashanti Kingdom was hostile to Christian proselytizing. Thus, their territory acted as an institutional barrier. Missions expanded into the hinterland only 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. By 1932, missions covered large parts of Southern Ghana (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 standard cure and prophylaxis for malaria.[17] Figure 5(a) confirms the 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 about 80%. Simultaneously with quinine, missions increased their presence of European missionary staff (Figure 5(a)). However, despite quinine, the number of European missionaries remained always below 100 (Cardinall, 1932). With this small European representation, it is difficult to imagine how 340,000 and 1.2 million Ghanians were evangelized by 1932 and 1960 respectively. Indeed, employing African converts as missionaries and catechists was a cost-efficient strategy. 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 vernaculars (Schlatter, 1916; Graham, 1976; Agbeti, 1986, p. 57). By 1890, there were four African missionaries for every European. By 1918, Europeans constituted 2% and 8% of total Methodist and Presbyterian mission staff respectively (Parsons, 1963, p. 4; Sundkler and Steed, 2000, p. 717).[18]

Financing the Mission. An obvious constraint to missionary expansion was funding. Protestant mission societies initially depended on the financial support from Western congregations and philanthropists (Miller, 2003; Quartey, 2007). Cash-strapped mission committees relied on print propaganda, which sensationalized images of tropical missionary activities and "uncivilized" West African culture to elicit funding from metropolitan readers (Pietz, 1999; Maxwell, 2015). Those donations paid for the missionaries' training, the sea journey to Africa and initial set-up costs (Johnson, 1967). Metropolitan funding remained limited however. In order to expand, the

[17]Fischer (1991, p. 73-76) notes that a 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.

[18]Based on our data, the ratio of total mission stations to European missionaries increased substantially over time. These trends are consistent with patterns shown for the continent by Meier zu Selhausen (forthcoming).

missionary budget had to be raised from *within* Ghana. Moreover, the mission societies' declared ultimate goal was to develop self-financing African churches (Welbourn, 1971).

African congregations contributed to the costs in various ways (Schott, 1879, p. 18-19). First, the bulk of the construction and operation of missions was financed by the local community, often in conjunction with local chiefs (Johnson, 1967), who donated land, materials and labor to build the church and class room (Williamson, 1952; Summers, 2016). Second, congregations were responsible for providing housing and food to the missionaries (Smith, 1966, pp. 156-157; Debrunner, 1967, p. 249). Third, revenues were raised by donations from wealthier church members (Meyer, 1999, p. 17), and more generally through Sunday offerings. Furthermore, school fees constituted another substantial part of the mission budget (Frankema, 2012). For Africans, these sums were non-trivial, representing in 1926 about 20 days of unskilled wage labor.[19]

Missionary expansion also became associated with trade and the cash crop economy: cocoa, kola, palm oil/kernels and rubber (Debrunner, 1967, p. 54, 132 and 203). In particular, cocoa farming dramatically increased incomes from the 1890s onwards (Hill, 1963a; Austin, 2003). By 1911, Ghana had become the world's leading cocoa producer. Ghanaians invested their cocoa revenues in their children's education at mission schools (Foster, 1965; Meyer, 1999). 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, "Ghana Churches and the Christians became very dependent on cocoa for their economic support" (Sundkler and Steed, 2000, p. 216). More generally, various Protestant mission societies established trading companies that exported African cash crop produce and allocated portions of their profits to sustain missionary activities (Johnson, 1967; Gannon, 1983). Catholic missions, in contrast, were less constrained as they relied on the financial backing of the Vatican and its missionary associations across Europe (Schmidlin, 1933, pp. 560-564; Spitz, 1924; Debrunner, 1967).

4. Regression Framework for the Determinants of Missions

For both Ghana and Africa, we analyze the *determinants* of missionary expansion. Our main goal is to explore how missionary expansion was driven by economic considerations and forces.

Long-Difference Regressions for Ghana. For 2,091 cells and four periods 1751-1850, 1850-1875,

[19] Presbyterians introduced a church tax in 1876 which increased in 1880 and again in 1898 (Schott, 1879). In 1899, the ratio of monetary contributions from African congregations (church tax: 46%; subscriptions: 28%; Sunday offerings: 22%; school fees: 4%) to foreign donations was 2:3 (Basel Mission, 1900). In 1910, it was 2:1 (Schreiber, 1936, p. 258).

1875-1897, and 1897-1932, we first run repeated regressions of the form:

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

$M_{c,t}$ is a dummy equal to one if there is a mission in cell c in the last year of the period, $t = \{1850, 1875, 1897, 1932\}$. X_c is our vector of *time-invariant* locational factors. As we control for missions in the first year of the period t-s ($M_{c,t-s}$), the coefficients β_t capture the long-difference effects of the factors on missionary expansion in each period. We then investigate the intensive margin of missionary activities. As outcomes, we use the log number of missions (+1 to avoid dropping cells with none) and dummies equal to one if there is: (i) a main station, (ii) a mission school and (iii) and European missionary, conditional on a dummy for having a mission in the same year t.

Panel Regressions for Ghana. For the same 2,091 cells and selected *time-varying* 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. The cell fixed effects allow us to study what causes changes in missions *within* cells over time. Standard errors are clustered at the cell level.

Africa. For 203,574 cells c in 43 sub-Saharan African countries 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.

Note that we do not necessarily capture causal effects with this analysis. Our goal is to identify factors that may have driven missionary expansion over time. We then develop identification strategies for selected factors within those long-difference and panel frameworks.

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. Long-Difference 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), consistent with a slow diffusion from the point of entry at the coast to the hinterland. Malaria ceased to be a significant barrier to missionary expansion in the late 19th century (columns 3-4).[20]

Political Conditions. African resistance to British colonialism obstructed missionary advancement. It was only after the British had defeated the Ashanti Kingdom in 1874 that missionaries expanded northwards beyond the borders of 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 19th century trade routes and ports (columns 1-2), later missions opened in proximity to railroads and roads, once they were in place (columns 3-4). The negative effects for navigable rivers in the early period (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 of 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 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 opened around mines (column 4).

Overall, results suggest that missionaries responded to economic opportunities when they arose. Furthermore, a handful of variables proxying for net benefits at the local level can account, to a large extent, for the geographic distribution of missions (R^2 as high as 0.61 in columns 2 and 4).

Intensive Margin. Missionary expansion generally followed a similar pattern at the intensive margin. Conditional on having a mission, we find more missions (Web Appx. Table 5), and higher probabilities of a European missionary (Web Appx. Table 7), a main station (Web Appx. Table 6) and a school (Web Appx. Table 8) in more accessible, populated and/or developed areas.[21]

Denomination-Level Analysis. The analysis so far ignored strategic interactions between and potential heterogeneities across mission societies. We run the same regression but transform the

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

[21] Because of lacking data for the post-1890 period, we only study whether there was a European missionary at any point in time between 1846 and 1890. As expected, we find stronger effects for stations where Europeans reside vs. which they visit. The coefficients of correlation between European, main and school missions vary between 0.4 and 0.6, thus indicating that these attributes are not overly concentrated in the same mission locations.

data into a pooled data set of four denominations (N = 2,091 x 4 = 8,364): Methodist, Presbyterian, Catholic and other. This allows us to add denomination fixed effects. We model strategic choices by including four dummies for whether, in the start year of each period, a cell was occupied by the same denomination, a competing denomination, or neighbored by a cell with the same denomination or a competing one (Web Appx. Table 9). Results generally hold.[22]

In addition, denominational differences confirm that economic considerations mattered for missionary expansion. Catholics had the financial support of the Vatican. We would thus expect Catholic missions to be relatively less associated with economic factors. We pool the data for the four denominations, add denomination fixed effects but also interact the cell characteristics with a dummy equal to one if the dependent variable captures Catholic expansion. Web Appendix Table 10 shows that Catholics are less likely to go to urban areas and possibly cash crop areas. They are more likely to go to areas historically associated with the slave trade, which is costly in that it does not bring direct economic benefits to the missions. Next, among Protestants, the expansion of Mainline Protestant missions (Presbyterians and Methodists) is taking place in more populated areas (Web Appx. Table 10). This is not surprising given that Mainline Protestants depended more on local contributions and valued entrepreneurship and education (Barro and McCleary, 2017).

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).[23]

Within-Ethnic Group Variation. We add 35 ethnic group fixed effects (from Murdock (1967)) to control for pre-colonial conditions (Michalopoulos and Papaioannou, 2014). Web Appx. Table 11 shows results hold when doing so. Because cells within ethnic homelands could still differ in unobservables, we use identification strategies for malaria, railroads, and cash crops.[24]

[22]Denominations were more likely to open a station in a cell if they already occupied the neighboring cell. Next, denominations avoided each other initially. As the market saturated, societies were more likely to enter areas with other denominations (col. 4). Since religious competition is not the focus of this paper, we leave this for future research.

[23]Most trade routes in 1850 were surveyed by colonial administrators. One exception is a route surveyed by a missionary in 1886. Also, trade routes differed from slave routes, so they do not capture the effects of the slave trade. Results hold if we drop the route surveyed by a missionary and control for proximity to slave routes (Web Appx. Table 12). Results also hold if we exclude variables measured after the periods' last year (not shown).

[24]While historical malaria from Depetris-Chauvin and Weil (2018) was by construction determined before

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

Missions expanded in higher-risk malaria areas after 1840 (column 1, Table 2). In column 2, malaria is also interacted with a dummy if year t is between 1810 and 1839. This separates the pre-treatment window into two subperiods of 30 years. Malaria had no differential effect in 1810-1840, thus implying parallel trends. The effect holds but is lower when adding ethnic group-year or district (as of 1931)-year fixed effects to compare neighboring cells over time (col. 3-4).

If malaria was an impediment, do we observe Europeans increasingly entering malarial areas post-quinine? For the years 1846-90, we know whether stations were permanently inhabitated or only monitored and visited by European personnel. We estimate 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, thereby comparing cells in the early versus later years. Column (5), Table 2, confirms a general increase in the number of missionaries in malarial regions, which was partly driven by Europeans (column (6)). Column (7) shows that quinine had a positive but smaller effect for the expansion of European permanent residences. Column (8) then shows that quinine had a strong effect on where African missionaries were based. These results suggest that the expansion into malarial areas was driven by African missionaries. This is in line with relying on African missionaries being more cost-efficient. The introduction of quinine was nevertheless important because it allowed enough European missionaries to live on the coast, from where they could routinely visit and supervise African staff in areas that were previously too lethal.[25]

Identification Strategies for Railroads. Once the British had consolidated their control 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

Christianization, there could be reverse causality between rail/crops and missions. There are also omission biases.

[25]For example, Spitz (1924, p. 372) explains that the "shortage of missionary priests makes a well-trained body of native catechists of paramount importance [...] After their training they work either at the central or secondary stations and are frequently visited by the [European] missionaries who superintend their work."

(see Web Appx. Figure 3): (i) A western line in 1898-1903, which British capitalists lobbied for, to connect two gold fields in the interior to the port of Sekondi (Figure 4(a) maps 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, aimed at connecting the coastal, colonial capital Accra to Kumasi. Other motivations were cited for its construction: the export of cash crops, the exploitation of goldfields, and tourism; and (iii) A central line in 1927, which was built parallel to the coast to connect fertile land as well as a diamond mine. Evangelization as a determining factor was never mentioned nor missionaries acting as lobbyists.

Five alternative routes were proposed for the first line but not 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.[26]

We run the same regression model as in Table 1, but we now use a 0-30 km dummy (instead of a 0-10 km dummy).[27] Panel A of Table 3, 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. Because we include the controls of Table 1 – dummies for whether there is a port, mine and 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

[26]Web Appx. Figure 3 maps their location. Cape Coast-Kumasi (1873): Proposed to link Cape Coast to Kumasi to send troops fight the Ashanti. 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.

[27]Web Appx. Table 14 motivates this choice. When including four dummies for whether the cell was within 0-10, 10-20, 20-30 and 30-40 km from a railroad built in 1897-1932, we find an effect until 30 km. The table also shows that railroads built after 1897 had no effect on missions in 1850, 1875 and 1897 (col. 2-4), thus confirming parallel trends.

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 4-5 show that the contemporaneous effect of railroads in t on missions in t is captured by lags of the rail dummy, suggesting that missions followed railroads. Rows 6-7 show that results hold when adding 34 ethnic group or 38 district fixed interacted with year effects, to compare connected and unconnected neighboring cells over time.

Commodity Booms. Export commodities were an important source of income during the colonial era (Austin, 2003). Ghana experienced various commodity export booms and busts as a result of new crop diffusion and changing world demand (Dickson, 1969, p. 143-178): palm oil (1860s-1910s), rubber (1890s-1910s), kola (1900s-1920s), gold (1900s-1930s) and cocoa (1900s-1930s).[28] We thus explore the relationship between cash crop cultivation, as a proxy for African incomes, and the expansion of missions. The fact that each boom happened at different times and affected different areas facilitates identification. We exclude gold in our baseline analysis because gold mines were owned by Europeans though part of that income trickled down to Africans.

In the absence of data on annual crop production at the cell level, we study the reduced-form effects of a Bartik-type instrumental variable predicting labor demand for each 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 these: (i) We know the national export value of crop s (palm, rubber, kola and cocoa) in year t for the 1846-1932 period; (ii) We know in which cells c crop s was produced at any one point in 1846-1932; (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 changing national export values.

Row 1 of Table 4 shows a strong positive effect (0.028***) of log predicted cash crop export value at the cell level. Results hold if we: (i) Use each crop's boom and bust one by one (palm oil, rubber, kola and cocoa; rows 2-5); and (ii) Substitute the production dummies with suitability dummies

[28] Export statistics for the period 1846-1932 (no data available before) confirm this (see Web Appx. Fig. 4).

(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 crop incomes. Rows 11-12 show that results hold when adding ethnic group or 1931 district fixed effects interacted with year fixed effects. In row 13 we test whether booms and busts had an asymmetric effect. We use first-differences and interact the log change in cash crop value with a dummy if it is negative.[29] Cash crop booms led to the establishment of missions. Once there was a bust, missions did not disappear, possibly due to sunk costs.[30]

Intensive Margin and Denominations. Applying the same cross-sectional identification strategies for railroads, we do not find any effects on the number of missions or the opening of main stations and schools once we control for whether the cell had a mission (see Web Appx. Table 15). The panel analysis, however, produces strong positive effects on these dimensions for both railroads and cash crops (same table). Using the same cross-sectional and panel strategies, Web Appendix Table 16 then confirms that railroads and cash crops have stronger effects on Mainline Protestant missions than on Catholic missions or Other Protestant Missions.

5.3. Dynamics of Missionary Expansion

This section highlights the dynamics of missionary expansion by documenting the changing locational characteristics in the stock of missions over time. We construct a measure that summarizes how "attractive" a location was to missionaries. More precisely, 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*. We distinguish between four groups of cells in 1840-1932:[31] (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"). Figure 6(a) plots a quadratic fit of the average score for those four groups.

The pattern suggests 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

[29] We transform the fixed effects model into a first-difference model, keeping the year fixed effects, while the cell fixed effects are removed by the first-difference transformation.

[30] Results hold if we (Web Appendix Table 19): (i) Add gold; (ii) Control for distance to the Presbyterian mission of Aburi (and the Presbyterian sphere of influence), which encouraged Ghanaians to grow cocoa (Hill, 1963a); (iii) Use other measures of suitability; and (iv) Use alternative deflator series to construct cash crop value at constant prices.

[31] We use 1840 because it is the first year with 10 missions.

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 of all the four groups decrease over time. Scores of the "becomes 1" group decrease, because less and less attractive mission locations are added over time. Scores of the "remains 0" group decrease, because switchers are among the best locations of the cells with no missions.[32]

The results are not mechanically driven by the choice of the year 1932 to determine the regression coefficients. Results hold if we (not shown, but available upon request): (i) Use the period 1751-1840 to estimate the importance of each factor and study the predicted scores in 1840-1932; and (ii) Use the urbanization rate in 1931 as the predicted variable instead of the mission dummy in 1932.

5.4. Results for Africa

We replicate the analysis for Africa as far as data availability allows. In Table 6, 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 (col. 1), or Roome (1925), supposedly representing the year 1924 (col. 2), on characteristics proxying for geography, political conditions, transportation, population, and economic activities, as well as country fixed effects. From the year of foundation reported for 83% of Protestant missions in Beach (1903), we construct a quasi-panel.[33] We then examine in columns 3-5 how the effects vary across three periods defined around four turning points: 1792 (first year with a mission), 1850 (approximate date when anti-slavery efforts intensified), 1881 (start of Scramble for Africa), and 1900 (last year of data).

We find that: (i) Missionaries chose locations with healthier environments (malaria – especially in earlier periods – and tsetse);[34] (ii) Missionaries avoided large pre-colonial cities and ethnic homelands that were colonized later (especially before 1850), two potential measures of African resistance. They also avoided Muslim centers before 1850, our measure of religious resistance. They favored centralized ethnic areas in Beach (1903) (especially in later periods) 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

[32]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 R^2 values imply that the best-ness of a location is predicted by the year it gained or lost a mission.

[33]Such data does not exist for Roome (1925) or other atlases for Africa.

[34]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).

throughout the period; 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.

Overall, missionaries chose healthier, safer, more accessible, populated, and developed areas. However, the adjusted R^2 are relatively low, at 0.03-0.04 in columns 1-2 vs. 0.35-0.61 for Ghana (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 missions.[35] This creates classical measurement error. When combining the cells into 3x3 cells, the adjusted R^2 increases to 0.15 (not shown). Second, our set of controls is incomplete. For Ghana, we compiled a rich data set, but such data do not exist for the whole of Africa.[36] When using the all-Africa variables for the Ghana sample only, the R^2 remains low, at 0.12-0.21 (not shown). However, if we use 3x3 cells for Ghanaian observations, we get 0.39-0.46 (not shown).

Pre-Determined Variables and Within-Ethnic Group Variation. Some countries have seen major expansions of missions as early as the 1790s (Sierra Leone, South Africa), so the controls are not necessarily pre-determined for these. Web Appendix Table 17 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). Another strategy is to include 1,158 country-ethnic group fixed effects. Most significant effects remain so and a few effects become insignificant (Web Appx. Table 17).[37]

Causal Effects. With respect to malaria, we do not know when quinine became the regular treatment for each country. Regarding railroads, Web Appendix Table 20 shows that the results of Table 6 hold if we use a 0-30 km rail dummy and apply the same cross-sectional identification strategies as for Ghana (spatial fixed effects, military and mining lines, placebo lines, instrumentation with Euclidean minimum spanning tree between the major cities).[38] We

[35]For 109 missions reported in both Beach and Roome and digitized by Cagé and Rueda (2016) and Nunn (2010) respectively, we found an average distance of 2 cells between their georeferenced locations (Web Appx. Fig. 6).

[36]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 contemporary ethnographer suggests that all mission stations are clustered along explorer routes and the coast (see Web Appendix Figure 5).

[37]Results hold if we drop controls defined ex-post or cluster standard errors at the ethnic group level (not shown).

[38]Most lines were built late, hence the larger (longer-term) effects for 1924. These effects hold if we (Web Appx. Table 20): (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 6, 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

cannot do a panel analysis for railroads because the foundation year of mission is only available before 1900 and very few railroad lines were built before then. 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. Finally, we cannot do a panel analysis for cash crops because we do not have annual data on the production of each crop for each country over such a long period.[39]

Denomination-Level Data. Web Appx. Table 18 shows that results hold if we repeat the analysis but transform the data set into a pooled data set of missionary expansion for two denominations (Protestants and Catholics) in 1924 (N = 203,574 x 2 = 407,148) or five Protestant denominations (Methodists, Presbyterians, Anglicans, Lutherans, Other) in 1900 (N = 203,574 x 5 = 1,017,870). This allows us to add denomination fixed effects. Using the same model, we then study locational differences between Catholics and Protestants in 1924 or Mainline Protestants (first four groups above) and Other Protestants in 1900 by interacting the locational characteristics with a dummy if the dependent variable captures Catholic / Non-Mainline Protestant expansion. The table shows that Catholics were differentially going to poorer areas (negative effects for railroads, cities, cash crops and mines), and likewise for Other Protestants (negative effects for cities and mines). When using the same cross-sectional strategies as before for railroads, we also find stronger effects for Mainline Protestants than for Catholics or Other Protestants (Web Appx. Table 21).

6. Christianity, Modernization, and Economic Development in Africa

Our results have several implications for the relationship between religion and development. While in Section 3. we discussed why mission societies sought to expand in more developed areas, i.e. why Christian supply increased, we now discuss why Africans in these locations may have been more receptive to evangelization efforts, i.e. why Christian demand was high.

According to the *secularization hypothesis*, religiosity decreases with education, urbanization, and

effect on the Roome (1925) missions in 1924 but the effect is ten times smaller than the effect for the lines built).

[39]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.

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. Since the late 19th century, incomes grew significantly as Ghana transformed into a cash-crop economy, stimulated by the increased demand from global markets (Hill, 1963b; Austin, 2007). Per capita incomes doubled between 1870 and 1913, and tripled by 1950. Entrepreneurial 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). Various interpretations can reconcile our results with the secularization hypothesis.

First, our results do not exclude the possibility that it were the poorest individuals in the richest places who converted to Christianity. 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 were often ex-slaves and social outcasts (Hastings, 1994; Maxwell, 2016). By the mid-19th century, however, 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 (Debrunner, 1967). Moreover, missionary expansion required financially capable members to contribute to church activities (see Section 3.).

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). However, we showed that the complementarity between Christianity and education weakened over time, as missions were increasingly opened without providing schooling, suggesting that Christianity spread without meeting 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 disrupted the monopoly of, and spread at the expense of, African traditional religions. By switching religious beliefs, people may have remained as religious as before, consistent with the religion-market model (see McCleary and Barro (2006a) for a survey).

Fourth, African traditional religions reinforced the power of chiefs, making them the custodian of the well-being of the community. Christianity offered in its ideology of individualism and its alliance with colonial rule a legitimization to escape the chiefs' authority (Ekechi, 1971; Der, 1974; Peel, 2000; Maxwell, 2016). Our results corroborate this interpretation. Christianity spread after the defeat of the Ashanti Kingdom in 1874, after which it became clear that colonial rule would define the long-term political status quo. Over time, Christianity became institutionalized and churches consolidated their grip on society by relying on African missionaries.[40]

Finally, there are spiritual needs in a world where established systems of meaning were 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).[41] 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).

Thus, Christianization was driven by economics and went along with modernization in Africa.

7. Implications for Long-Run Economic Development

We used an exhaustive census of missions and a comprehensive spatio-temporal database to shed light on the dynamics of missionary expansion. We documented that economic forces led to an early Christianization of more developed, accessible, and populated places. In particular, we showed how - with quinine and Africanization - malaria became less of an impediment and how transport infrastructure and income from export commodities attracted Christian missions. Over time, diffusion led churches to expand to less developed areas. What are the implications of those

[40] 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."

[41] 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."

findings for the study of long-run development? A large literature uses the historical presence of missions as a source of local variation in religion and human capital to study their long-term effects. We note that most studies retrieve mission location data from a source different from ours: Historical atlases (see Web Appx. Table 1). We first scrutinize this standard source.

7.1. Endogenous Measurement Error and Omitted Variable Bias

There are problems with atlases that have not been raised. In the literature, two atlases feature particularly prominently: Beach (1903) and Roome (1925). We examine them in detail.

First, atlases significantly underreport missions. For Ghana, atlases show far fewer missions than census returns: 26 vs. 304 (i.e., 91% are missing) in 1900 (Beach, 1903) and 23 vs. 1,213 (98%) in 1924 (Roome, 1925) (see Fig. 2(a)-2(b)). For Africa, we counted the number of missions from historical sources. The extent of misreporting is of a similar scale: Beach (1903) and Roome (1925) omitted 93% and 98% of missions (see Fig. 1(b)).[42] Omissions may be random. If so, the resulting attenuation bias will lead to conservative estimates of the contemporary effect of missions.

Second, as Fahs (1925) hinted at, atlases overwhelmingly plot residence stations of European missionaries. However, evangelization in Africa was not a European enterprise. Moreover, the localities that Europeans preferred may have been highly selected, i.e. they were healthier, more urban and more developed. Europeans also tended to reside at mission stations that were founded early in the evangelization process. Because of this, it is important to adjust the timing and nature of control variables. Omitted variable biases may be consequential.

Selection. Using our census data for Ghana we uncover which missions found their way into atlases. Examining the geographic distribution of missions (see Fig. 2(a) and 2(b)) reveals two stylized facts pointing to non-random selection. First, the atlases miss most hinterland missions. Second, Roome (1925) does not capture the exponential growth of missions between 1900 and 1924. We study this further by plotting 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. Figure 6(b) shows that correlations are high for earlier years (about 0.8 for Beach (1903) and 0.4 for Roome (1925)).[43] Atlases are misleading in that

[42]The extent of omissions is relatively similar 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).

[43]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).

they pretend to show missions in 1900 and 1924, but they represent the early missions ca. 1850.

Atlas missions also differ qualitatively. In Table 5 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 confirm that atlases capture early missions (col. 2 and 7) and/or main stations and schools (col. 3 and 8) and/or the residence of Europeans (col. 4 and 9; N = 2,069 due to missionaries's identity being missing for some missions). Some characteristics are then correlated with each other (col. 5 and 10). Overall, atlases endogenously select better missions and may thus lead to upward-biased contemporary effects. Now, do atlases at least reliably select the best missions? The answer is no. If we define main / school / European missions (based on residence) as "best" missions, atlases still miss 68-83% (N = 48 ; 105) of them.

Omitted Variable Bias. Omitted variable bias becomes a concern for identification. Missionaries' locational choices were time and context dependent. Because mission expansion was a dynamic process, careful thought needs to be put into the type and timing of control variables. 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, which differ in characteristics, and thus locational strategies.

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

How do endogenous measurement error and omitted variables affect the estimations of contemporary effects? Using our data we conduct a validation study for Ghana. We compare the estimated effect of mission locations retrieved from atlases vs. ecclesiastical censuses. We also study how the set of control variables affects the estimations and potential biases.

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 ($D_{c,g,today}$):

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

Given the lack of data on incomes at the local level, we use log average night light intensity in 2000-01 as development indicator.[44] $M_{c,g}$ represents the actual reflection of missions derived from census returns. We first examine how ρ varies if we include: (i) No controls $X_{c,g}$; (ii) The controls

[44]Nightlights have become a standard measure in the stream of literature that studies development at the local level (Henderson et al., 2012; Michalopoulos and Papaioannou, 2013).

commonly used in studies of Africa ("standard controls")[45]; and (iii) Our full set of determinants from Table 1 ("our controls"). We then examine how the coefficient ρ varies if we use instead of $M_{c,g}$ the construct $\widetilde{M_{c,g}}$ derived from mission atlases and measured with error.

Table 7 presents the results. Using the mission dummy $M_{c,g}$ (row 1), we find large unconditional effects of 3.39-4.01 (columns 1 and 4). Alternatively, one standard deviation in the mission dummy is associated with a 0.39-0.46 increase in the standard deviation in log night lights. Adding the standard controls reduces the estimated effect by 20-30%, to 2.74-2.84 (columns 2 and 5). Finally, our controls further reduce the effect by 80-90%, to 0.41-0.68 (columns 3 and 6). This means that an early colonial mission increases night lights by 41-68%, or only 0.05-0.08 if expressed in terms of standard deviations. This long-term effect is positive, but relatively small.

When using $\widetilde{M_{c,g}}$ (row 2), we typically obtain *larger* point estimates. Comparing the unconditional effects, atlas missions produce effects that are 25% (Beach (1903), column 1) and 40% (Roome (1925), column 4) larger. Note that exogenous measurement error would cause *smaller* estimates. In fact, using the methodology of Bound et al. (2001), we calculated that the coefficient should have been attenuated by 6% for Beach (1903) and 22% for Roome (1925). The difference implies endogenous measurement error. Adding the standard controls contributes to bridging the gap in the estimated effects between $\widetilde{M_{c,g}}$ and $M_{c,g}$ (columns 2 and 5).[46] Our controls further bridge the gap for Roome (1925) (column 6), but not for Beach (1903) (column 3).[47]

Overall, our controls lower the effects of both $M_{c,g}$ (row 1) and $\widetilde{M_{c,g}}$ (row 2). Our controls thus appear to reduce both omitted variable bias *and* endogenous measurement error. The effects remain significant in columns (3) and (6) of row 1. Our controls are also incomplete and imperfectly measured so the effect might be even lower with better controls.

[45] 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).

[46] With exogenous measurement error, adding controls should lead to an even stronger attenuation bias (Bound et al., 2001). When adding the standard controls, the calculated 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.

[47] 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).

Next, we explore whether contemporary effects vary with the foundation year of the mission. While the reference to the year 1900 and 1924 in the atlases is incorrect, it may be the case that missions founded earlier have a larger causal effect on subsequent development outcomes than the missions that followed later. For example, if missions promoted growth at the local level, cells with an early presence of missions would be able to accumulate growth effects over a longer period of time. Alternatively, early missions may have received relatively more investments, i.e. they could have been main / school / European missions, which caused development at the local level. 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) confirms that unconditional effects are higher for earlier years. However, once we add the controls from Table 1, the effects are much lower and not downward-sloping. Thus, the stronger effects for earlier missions could be because better locations received missions first.

Finally, one may wonder whether our effects are modest because ecclesiastical censuses include *all* missions, even those with few congregants. Web Appx. Table 4 reveals that out-stations were large, comprising between 69 and 180 congregants on average depending on the denomination (vs. 263-383 for main stations). We now compare the long-term effects of supposedly larger and supposedly smaller missions. Table 8 shows, for 1900 and 1924, the unconditional effects and the conditional effects of the true mission dummy when adding dummies for whether the missions in our data set were created in the two pre-1875 periods or were main stations, had a school or had European missionaries living on site or frequently visiting. Without controls (col. 1 and 5) and with the literature's standard controls (col. 2 and 6), there are direct effects of some of these measures on night lights, suggesting that "better" missions had stronger effects. However, with our controls (col. 3 and 7), many of these become statistically insignificant, which suggests that our controls capture endogenous mission quality. Only missions established early have significantly higher effects, either because their effects accumulated over a longer period of time *or* were selected in ways that we cannot observe. We also verify that the non-effects for main / European / school missions are not due the inclusion of the early foundation dummies (col. 4 and 8).

Other Outcomes. Web Appendix Table 22 shows, for the years 1900 and 1924, the effects of $M_{c,g}$ and $\widetilde{M_{c,g}}$ on other measures of local development in Ghana: (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 $\widetilde{M_{c,g}}$. Adding our controls significantly reduces the gap in the estimated effects when using $M_{c,g}$ and $\widetilde{M_{c,g}}$, consistent with endogenous measurement error and omitted variable bias.

The literature identified Christianity and education as important mechanisms by which colonial missions continue to affect present-day development. Are the effects on those proposed channels reduced as well? In Table 9, we examine for the years 1900 (columns 1-3) and 1924 (columns 4-6) the estimated effects when using $M_{c,g}$ (Panel A) and $\widetilde{M_{c,g}}$ (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 rapidly spread in Africa during 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) that must have spread in areas without historical missions. Rows 3-4 show the effects on present-day adult literacy (mean = 34.7%) and the share of adults having completed secondary education (mean = 7.5%). If measurement error were exogenous, the unconditional effects would be lower when using $\widetilde{M_{c,g}}$. On the contrary, they are not significantly different for Christianity and literacy and they 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 again sharply reduce the effects, consistent with omitted variable bias.

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

We do not have census data on missions for the 43 African countries. We thus rely on atlas missions and study how contemporary effects vary when we add standard controls or our controls from Table 6 and country fixed effects (N = 203,574). Row 3 of Table 7 shows the results. The unconditional effects imply that a mission increases night lights by 2.1-2.2. 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%, to 1.83-1.90 (col. 2 and 5), whereas adding our controls reduces them by 40-45%, to 1.24-1.28 (col. 3 and 6). Having a mission increases night lights by 124-128%, which seems large. 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 for Africa.[48] Likewise, if we use our controls and

[48]For example, we use the pre-colonial explorer routes digitized by Nunn and Wantchekon (2011). This is an

add two dummies for whether the mission was founded in 1792-1849 or 1850-1881, the effect of the mission dummy defined in 1900 is further reduced by one third (0.87***, not shown), whereas the early foundation dummies are positive and significant. However, we cannot tell whether this is due to a first-mover advantage *or* endogenous selection in ways that we cannot observe.

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 22) as well as the Christian share, literacy rates and secondary school completion (analogous to Ghana) to proxy for mechanisms (see Panel C of Table 9), we find that contemporary effects are also reduced or statistically insignificant for the Africa sample when adding our controls, consistent with endogenous measurement error and omitted variable bias.[49]

7.4. Discussion of Colonial Missions and Long-Run Persistence

We have shown that the contemporary effects of missions in colonial Africa appear relatively small. We do not doubt that there were potential 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 persistence. First, the post-World War II period saw the secularization and major expansion of public education. This weakened the position of Christian churches as the gatekeepers of education. Second, Pentecostalism has been on the rise in Africa, competing intensively with (former mission) Mainline churches (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. Persistence is therefore not transferred to new denominations. In addition, Pentecostalism places less emphasis on education than Mainline Protestantism (Barro and McCleary, 2017). Third, even if we find

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 5).

[49]Some studies use survey data to examine whether members from ethnic groups historically more exposed to missions have better outcomes today. Ethnic homelands in Africa vary in shape (mean: 260 cells; min: 1; max: 3,505), so it is unclear how to control for group-level differences determining missions. Some studies control for historical missions in the locations where individuals live, capturing the effect of missions through their ancestors. It endogenously selects migrants and does not address endogenous group-level differences in historical exposure.

positive correlations for the mechanisms, the link between those mechanisms and macroeconomic development is weak at the country level (Barro and McCleary, 2003). Strikingly, 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. Certainly, most African countries have not experienced comparable economic transformations that resulted from the Reformation in 16th century Europe (e.g., Weber, 1905).

8. Conclusion

Extensive literature has emerged that uses the establishment of historical missions as a natural experiment to study the effects of human capital, religion and culture on economic outcomes today. This literature belongs to a 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. We show that missionary expansion was driven by various economic factors in Africa. The diffusion of religion, education and culture thus depends on spatial patterns of economic development, even at low income levels. Secondarily, the use of endogenously located missions as a historical shock, and their endogenous measurement, could lead to an overly optimistic account of the importance of missions for contemporary development.

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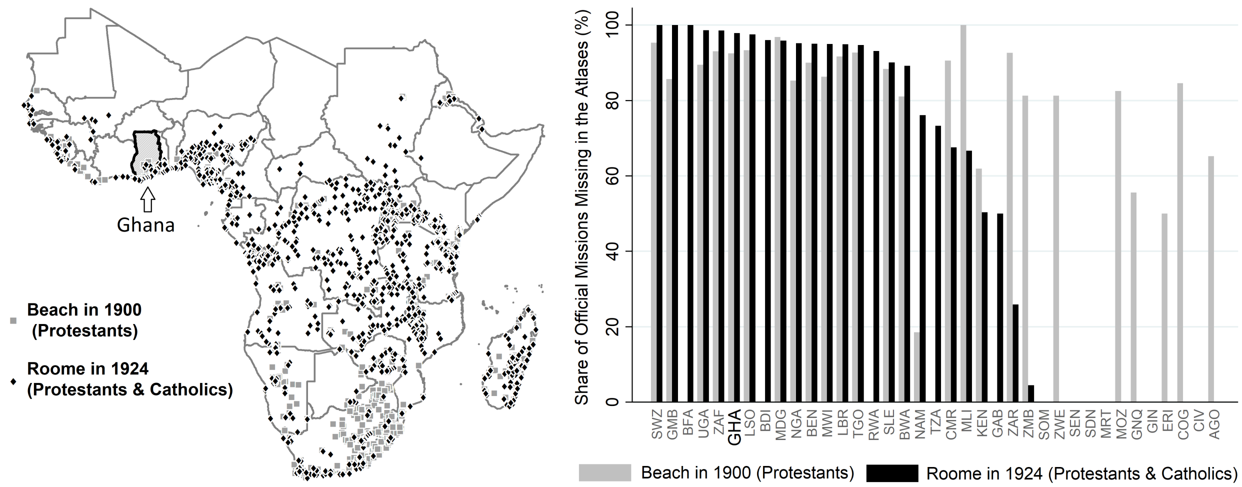
Figure 1: Missions in Sub-Saharan Africa: Mission Atlases vs. Census Sources

(a) Missions Reported in Mission Atlases

(b) Share of Omitted Missions in Mission Atlases

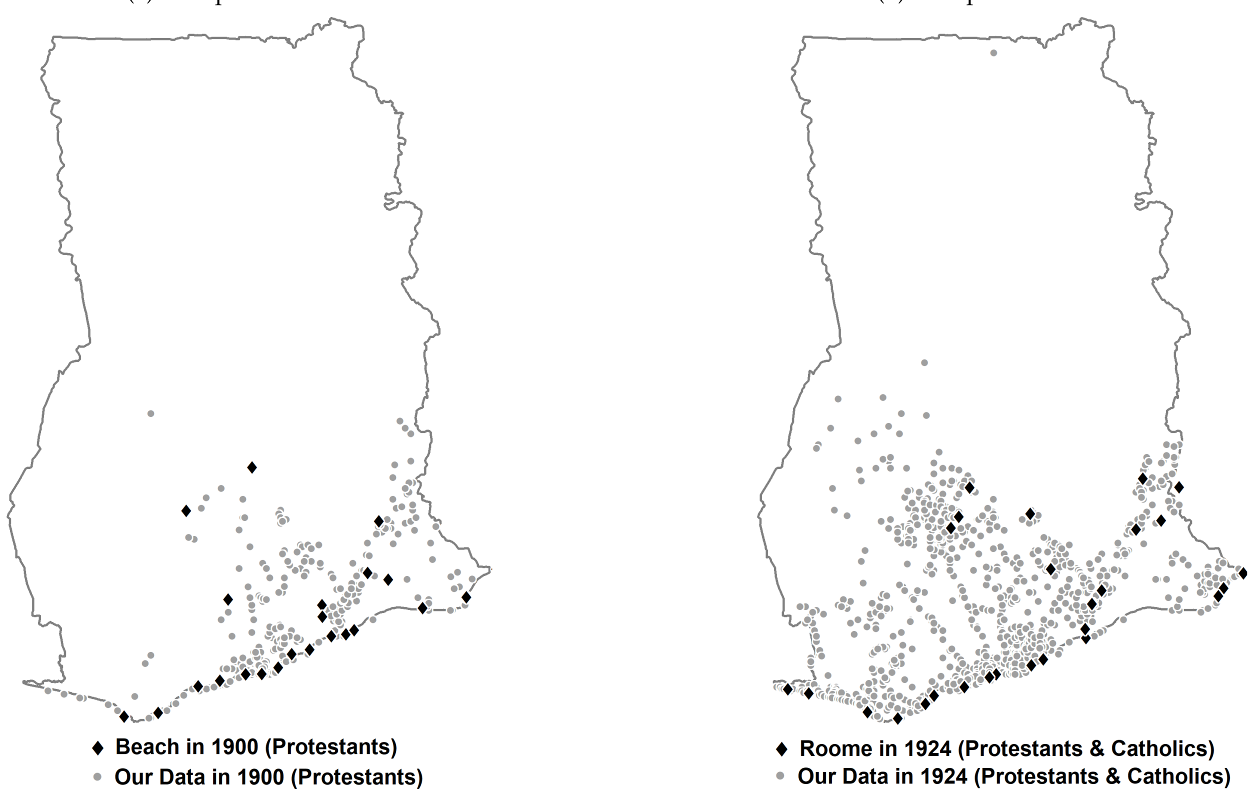


Notes: Subfigure 1(a) shows for 43 sub-Saharan African countries the Protestant missions in 1900 from Beach (1903) (N = 677) and the Protestant and Catholic missions in 1924 from Roome (1925) (N = 1,212). Subfigure 1(b) shows when the data is available the share of missions in census sources that are 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. Census Sources

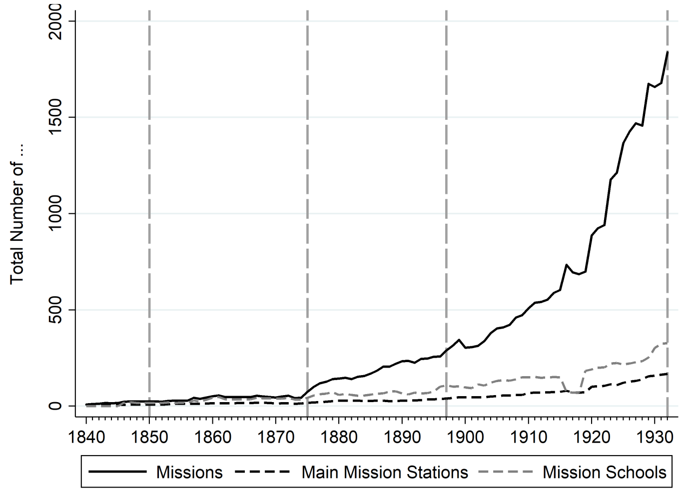
(a) Comparison in 1900

(b) Comparison in 1924



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

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

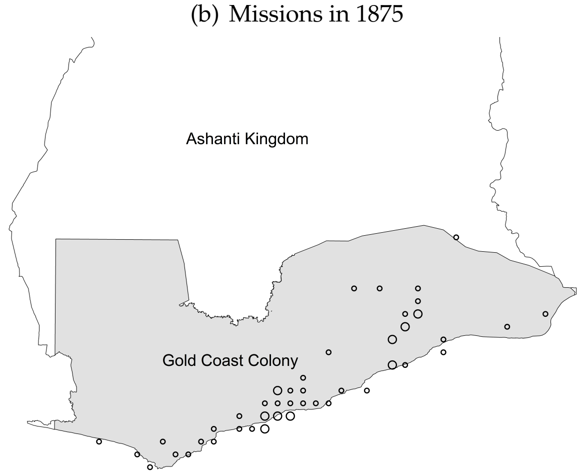


Notes: The figure shows for Ghana the evolution of the total number of missions / main mission stations / mission schools, annually from 1840 to 1932. Ghana consists of 2,091 cells. See Web Appendix for data sources.

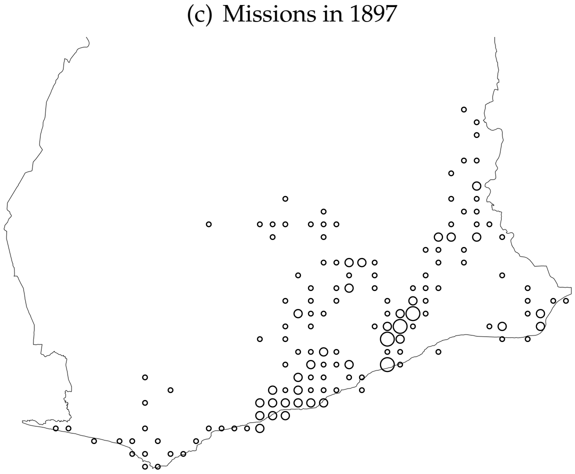
Figure 4: Location of Missions in Ghana for Selected Years

(a) Missions in 1850

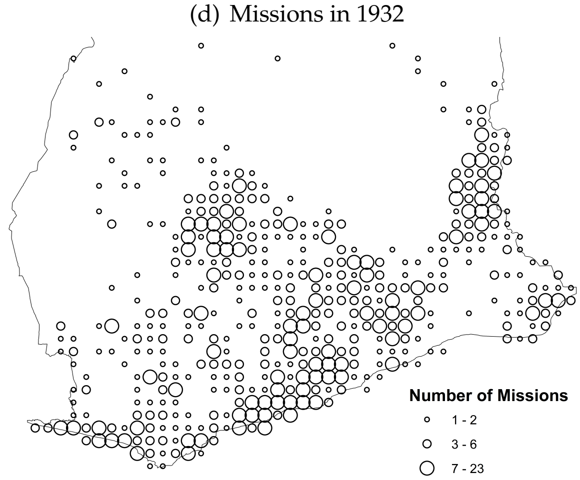
(b) Missions in 1875



(c) Missions in 1897



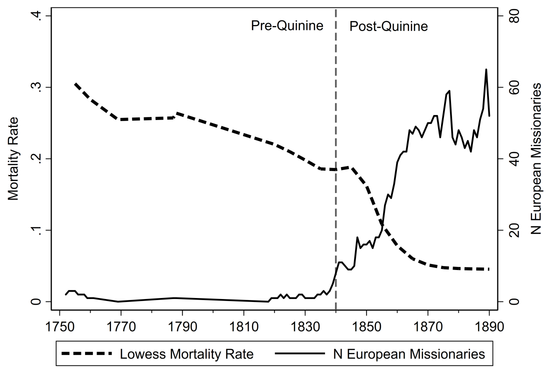
(d) Missions in 1932



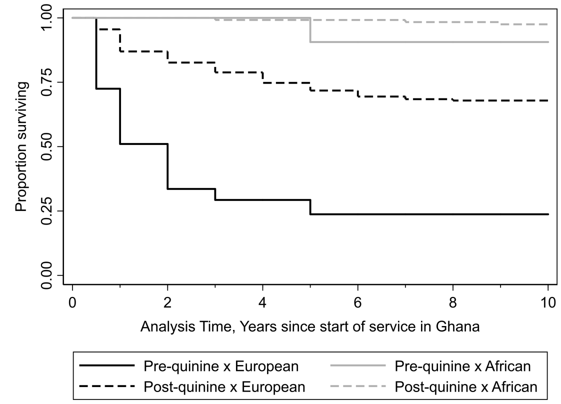
Notes: The subfigures show the location of all missions (Protestant and Catholic) in Ghana for selected turning points in the history of Ghana: 1850, 1875, 1897 and 1932. See Web Data Appendix for data sources.

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

(a) Mortality and Number of European Missionaries



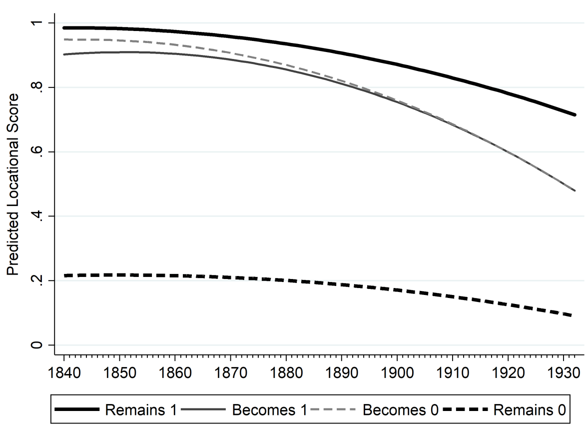
(b) Kaplan-Meier Survival Analysis of Missionaries



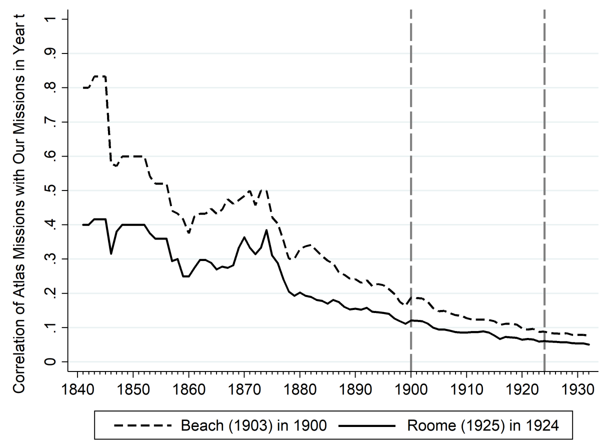
Notes: Subfigure 5(a) shows mortality rates and the number of European male missionaries in 1751-1890. The post-quinine era is defined as post-1840. Subfigure 5(b) shows survival probabilities of European and African missionaries pre- and post-quinine (data for 1751-1890 period). See Web Appendix for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

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

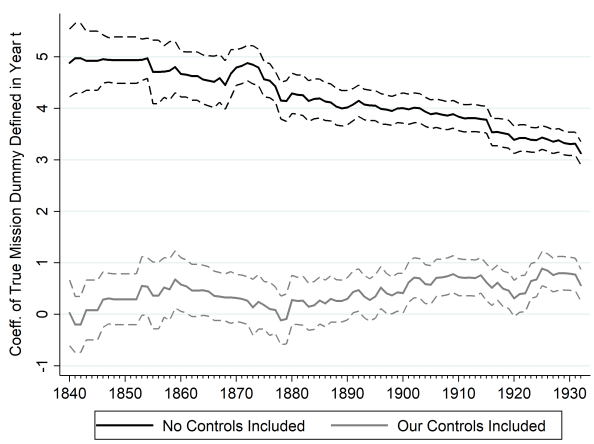
(a) Locational Factors and Likelihood of Having Missions



(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]
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 Port in the Cell 1850	0.166	0.212**	0.129	-0.159**
	[0.107]	[0.101]	[0.079]	[0.075]
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	Euro. Any	Euro. Resid.	Afri.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
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					0.008***	0.002***	0.001**	0.007***
					[0.001]	[0.001]	[0.000]	[0.001]
Cell Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
34 Ethnic Group FE x 115 Year FE	N	N	Y	N	N	N	N	N
38 District 1931 FE x 115 Year FE	N	N	N	Y	N	N	N	N

Notes: Columns (1)-(4): For 2,091 cells c and 115 years t (1783-1897) (N = 240,465), 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 t is between 1810 (incl.) and 1840 (excl.). Columns (5)-(8): For 2,091 cells c and 40 years t (1846-1890) (N = 93,253), we regress a dummy if there is a missionary / European missionary ("Resid." indicates that a European missionary lives there permanently instead of only frequently visiting) / 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 9: 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 Euclid. distance to the nodes, hence N = 2,088). *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 (cell FE and year FE included). 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 (cell FE and year FE included). 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 BEACH (1900) AND ROOME (1924) MISSIONS

Dep. Var.:	Dummy if Any Atlas Mission in Cell c in...									
	Beach in 1900					Roome in 1924				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mission in Year t	0.16***	0.04**	0.01	0.00	0.00	0.06***	0.01*	-0.02***	0.01	-0.02***
	[0.03]	[0.02]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Created 1751-1850		0.53***	0.11	0.37***	0.04		0.46***	0.33***	0.31**	0.23*
		[0.11]	[0.12]	[0.14]	[0.13]		[0.11]	[0.10]	[0.14]	[0.12]
Created 1851-1875		0.21***	-0.04	0.13	-0.08		0.22***	0.13**	0.18**	0.12*
		[0.08]	[0.05]	[0.08]	[0.05]		[0.07]	[0.06]	[0.07]	[0.07]
Main Station Year t			0.60***		0.60***			0.16***		0.17***
			[0.10]		[0.10]			[0.05]		[0.05]
School Year t			0.03		0.02			0.09***		0.09***
			[0.06]		[0.06]			[0.03]		[0.03]
Euro Resid 1846-90				0.21**	0.10				0.17*	0.10
				[0.10]	[0.07]				[0.09]	[0.08]
Euro Visit 1846-90				0.06	0.05				-0.04	-0.09**
				[0.05]	[0.04]				[0.03]	[0.03]
R-squared	0.15	0.37	0.62	0.41	0.64	0.05	0.28	0.38	0.35	0.45
Observations	2,091	2,091	2,091	2,069	2,069	2,091	2,091	2,091	2,069	2,069

Notes: For 2,091 cells c, we regress a dummy if there is an atlas mission in cell c in Beach (1900) or Roome (1924) on the mission characteristics in the same cell the same year (1900 or 1924, unless otherwise indicated) in our census data. Col. (4)-(5) and (9)-(10): Identity of the missionary missing for 22 obs. Robust SE's: * $p<0.10$, ** $p<0.05$, *** $p<0.01$. See Web Appendix for data sources.

Table 6: CORRELATES OF MISSIONARY EXPANSION, LONG-DIFFERENCES, AFRICA

Dependent Variable:	Dummy if Mission in the Cell in:				
	Beach in 1900	Roome in 1924	Col. (3)-(5) Beach in ... 1850	1881	1900
	(1)	(2)	(3)	(4)	(5)
Dummy if Any Mission in ... 1850 / 1881				0.980***	0.987***
				[0.003]	[0.002]
Historical Malaria Index	-0.025***	-0.048***	-0.004*	-0.015***	-0.006
	[0.006]	[0.011]	[0.002]	[0.003]	[0.005]
Tsetse Index	-0.003**	-0.008***	-0.000	-0.002*	-0.002*
	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]
Log Distance to Coast	-0.003***	-0.003***	-0.001***	-0.001***	-0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Large Pre-Colonial City 1400	-0.031***	0.05	-0.008**	-0.013***	-0.010***
	[0.008]	[0.042]	[0.003]	[0.004]	[0.003]
Dummy if Large Pre-Colonial City 1800	0.015	0.068	0.006	0.022	-0.015***
	[0.026]	[0.044]	[0.017]	[0.022]	[0.004]
Dummy if Largest or 2nd Largest City 1901	0.058***	0.173***	0.026***	0.021	0.030**
	[0.020]	[0.029]	[0.009]	[0.013]	[0.015]
Year of Colonization	0	-0.000***	-0.000***	-0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Centralized State (Murdock)	0.002***	-0.001**	0.000	0.001***	0.001***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]
Log Distance to Muslim Center	-0.001	0.002***	0.000***	-0.000	-0.001*
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Slave Port in the Cell 1800-1900	0.046**	0.131***	0.012	0.024	0.007
	[0.022]	[0.031]	[0.012]	[0.016]	[0.012]
Dummy if Navigable River 10 Km	0.003***	0.012***	-0.000	-0.000	0.004***
	[0.001]	[0.002]	[0.000]	[0.000]	[0.001]
Dummy if Lake 10 Km	0.001	0.011***	0.000	0.001	0.001
	[0.002]	[0.003]	[0.001]	[0.001]	[0.001]
Dummy if Explorer Route 10 Km	0.001	0.002**	0.000	0.000	0.000
	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]
Dummy if Railroad 1900 / 1924 10 Km	0.014***	0.023***	0.004**	0.001	0.005**
	[0.004]	[0.002]	[0.002]	[0.002]	[0.002]
Log Population Density 1800	0	0	-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***	0.002	0.003**	0.003	0.004*
	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]
Log Urban Population 1900	0.002***	0.006***	0.000***	0.001***	0.001***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]
Log Rural Population 1900	0.001***	0.000***	0.000***	0.000***	0.000**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Slavery (Murdock)	0.001**	0.003***	0.000	0.000	0.001*
	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]
Log Norm. Slave Exports 15th-19th Cent.	0.001	0.006***	-0.000	0.001	0.001
	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]
Log Pred. Cash Crop Export Val. 1900 / 1924	0.001***	0.000**	0.000**	0.000**	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Dummy if Mine 1900 / 1924 50 Km	-0.001	0.004*	0.003*	-0.001	-0.002
	[0.002]	[0.002]	[0.001]	[0.002]	[0.001]
Dummy if Polygamy (Murdock)	-0.001***	0.001**	-0.000	-0.001***	-0.001*
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]
Fixed Effects	Country	Country	Country	Country	Country
Adj. R-squared	0.03	0.04	0.02	0.25	0.52

Notes: For 203,574 cells in 43 sub-Saharan African countries, we regress a dummy if there is an atlas mission in Beach in 1900 (col. (1)) or in Roome in 1924 (col. (2)) on characteristics proxying for geography, political conditions, transportation, population and economic activities. 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, a dummy if we know the year of the anthropological study used by Murdock (1959) to create his data, and a dummy if that year precedes 1900 / 1924. Col.(3)-(5): For Beach and period [t-1;t], we regress a dummy if there is a mission in t on the characteristics and a dummy if there is a mission in t-1 (using the year of foundation). Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appx. for data sources.

Table 7: Long-Term Economic Effects of Missions for Mission Map Years, Ghana and Africa

	Dependent Variable: Log Night Light Intensity in the Cell c. 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 (see text for details). "Ours": All controls of Table 1 for Ghana and all controls of Table 6 for Africa. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 8: Long-Term Economics Effects of Missions Depending on Their Type, Ghana

Dep. Var.:	Dummy Log Night Light Intensity in the Cell c. 2000:							
Dummies Defined in:	Year 1900 (Same as Beach)				Year 1924 (Same as Roome)			
Controls Included:	None (1)	Standard (2)	Ours (3)	Ours (4)	None (5)	Standard (6)	Ours (7)	Ours (8)
Mission in Year t	3.24***	2.34***	0.26	0.28	2.76***	2.31***	0.67***	0.66***
	[0.24]	[0.25]	[0.22]	[0.22]	[0.15]	[0.16]	[0.18]	[0.18]
Created 1751-1850	1.35***	0.6	0.67*		1.09***	0.64*	0.64**	
	[0.45]	[0.42]	[0.36]		[0.40]	[0.38]	[0.32]	
Created 1851-1875	1.36***	0.78*	0.59*		1.25***	0.88**	0.63**	
	[0.49]	[0.43]	[0.34]		[0.42]	[0.37]	[0.31]	
Main Station Year t	-0.06	0.04	-0.03	0.16	0.5	0.26	-0.25	-0.08
	[0.39]	[0.37]	[0.30]	[0.27]	[0.43]	[0.40]	[0.30]	[0.29]
School Year t	-0.19	0.08	-0.01	0.05	0.87**	0.6	-0.22	0.12
	[0.32]	[0.31]	[0.29]	[0.29]	[0.40]	[0.38]	[0.33]	[0.29]
Euro Resid 1846-90	0.85*	0.65	-0.19	0.06	0.84***	0.70**	0.14	0.14
	[0.51]	[0.47]	[0.34]	[0.32]	[0.29]	[0.30]	[0.24]	[0.24]
Euro Visit 1846-90	0.37	0.24	-0.19	-0.07	0.48	0.56*	0.16	0.19
	[0.49]	[0.44]	[0.32]	[0.31]	[0.30]	[0.31]	[0.25]	[0.25]
R-squared	0.25	0.35	0.61	0.61	0.40	0.45	0.62	0.62
Observations	2,069	2,069	2,069	2,069	2,069	2,069	2,069	2,069

Notes: For 2,069 cells in Ghana (identity of the missionary missing for 2,091 - 2,069 = 22 obs.), we regress our main measure of local economic development, log mean night light intensity in the cell c. 2000, on the true mission dummy and mission characteristics in the cell, all defined in the same year (1900 / 1924) unless otherwise indicated. "Euro Resid 1846-90": Mission stations where European missionaries permanently resided at one point in 1846-1890 (data not available for other years). "Euro Visit 1846-90": Mission stations where European missionaries did not permanently reside but frequently visited at one point in 1846-1890. "Standard": Controls identified as regularly used in the literature (see text for details). "Ours": All controls of Table 1 for Ghana and all controls of Table 6 for Africa. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.

Table 9: 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 6 for Africa. Robust SE's: * p<0.10, ** p<0.05, *** p<0.01. See Web Appendix for data sources.