THE LONG-TERM EFFECTS OF THE PRINTING PRESS IN SUB-SAHARAN AFRICA

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Abstract

This article examines the long-term consequences of the introduction of the printing press in the 19th century on newspaper readership and other civic attitudes in sub-Saharan Africa. In sub-Saharan Africa, Protestant missionaries were the first both to import the printing press technology and to allow the indigenous population to use it. We build a new geocoded dataset locating Protestant missions in 1903. This dataset includes, for each mission station, the geographic location and its characteristics, as well as the educational and health related investments undertaken by the mission. We show that proximity to a historical missionary settlement endowed with a printing press significantly increases newspaper readership today within regions located close to historical mission settlements. We also find a positive impact on political participation at the community level. Results are robust to a variety of identification strategies that attempt to address the potential endogenous selection of missions into printing and externalities on education and literacy.

Keywords: printing press, Protestant missions, historical persistence, newspaper readership, political participation.

JEL No: D72, N37, N77, O33, Z12, Z13

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"There can be no doubt that [the missionary newspapers] introduced the first generation of educated Africans to what had become an intrinsic part of enlightened society in Europe and other lands. Their example gave inspiration to African people who inherited the idea of the newspaper and came to employ it as the chief weapon by which they were to exercise their power of participation in the government of their land." (Omu, 1978)

1 Introduction

This article studies the long-term consequences of the early introduction of the printing press in the 19th century on newspaper readership and other civic attitudes in sub-Saharan Africa.

The long-term consequences of religious incentives for economic success have been widely studied in the social sciences, the most well-known theory being Max Weber's "Protestant Ethic" (Weber, 1930). According to the principle of the *Sola Scriptura* central to Protestant doctrine, every Protestant should be able to read the Bible. Recent work has emphasized this incentive to increase literacy as an explanation for the economic success of regions that first converted to Protestantism (Becker and Woessmann, 2009; Bai and Kung, 2011; Cantoni, 2012; McCleary and Pesina, 2012; Woodberry, 2012). These studies consider Protestant conversion as a whole. Instead of using such a binary approach, we exploit different types of missionary treatment. Mission stations brought numerous and diverse investments. We focus on the printing press, an important technological innovation (Dittmar, 2011), and show that its early arrival still has consequences on newspaper readership and other forms of civic attitudes nowadays. For this purpose, we built and geocoded an entirely new dataset of Protestant mission locations and of their investments in education, health and printing.

Protestant missionary activity played a central role in the development of a written tradition in sub-Saharan Africa. Because they needed to print Bibles and educational material, Protestant missionaries were among the first to bring the printing press to Africa. They made it accessible to the indigenous populations by both exposing them to the printing technology and granting them access to it (Woodberry, 2012). The printing technology was an investment with a large fixed cost. Protestant missionaries imported the press from Europe and it could not be easily exported to other regions due to transportation costs, and to the specific know-how required to use it. This early availability of printing technology in accessible environments enabled the local development of a culture of writing and information diffusion. Thanks to early access to the printing press, local newspapers developed first in certain African regions.

We show that this yielded a persistent geographic concentration of publishing activities and newspaper readership. Other forms of civic attitudes such as political participation were also eased by access to information technology.

Using contemporary individual-level data from the Afrobarometer, we find that proximity to the closest location of a mission with a printing press has a positive and statistically significant impact on the probability of reading the news. A one-standard deviation increase in the proximity to a mission with a printing press increases the probability of reading the news on a monthly basis from 3 to 14% of a standard deviation, depending on the specifications. In contrast, proximity to a mission without a printing press has no significant impact on newspaper readership.

Our econometric analysis attempts to move beyond two forms of selection. First, historical and geographical characteristics might have determined mission station location preventing us from comparing regions close and far from these settlements. Protestant missionaries did choose to locate in geographically favored areas (Johnson, 1967; Nunn, 2010). Second, Protestant stations invested in different activities such as printing, health and education. There may be endogenous selection of missions into printing.

To address selection from missions' location we restrict our sample of analysis to regions near historical mission settlements. These are regions for which there is a Protestant mission within alternatively a 200-kilometer (124 miles), a 150-kilometer (93 miles) and a 100-kilometer (62 miles) radius. Because regions near Protestant missions shared similar geographic, institutional and cultural environments, this restriction isolates the specific effect of the printing technology from other possible long-term determinants of newspaper readership embedded in specific mission locations.

To address selection of missions into printing, we use two different approaches. First, we control for observable covariates using both an OLS and a matching strategy. The set of observable covariates include geographic and historical characteristics as well as distance to historical mission stations that invested in health and educational facilities. We use insights from Altonji, Elder, and Taber (2005) and Oster (2013) to assess the bias due to unobservables using the sensitivity of the treatment to added controls. From this approach, it seems unlikely that the entire estimated effect of the distance to the printing press is driven by unobserved variables.

Despite our attempts to control for observable factors, our estimates might still be driven

by unobserved determinants of long-term development and proximity to a historical mission settlement endowed with a printing press. To deal with this problem, we propose an instrument for the proximity to the closest missionary printing press. In the 19th Century, missionaries formed numerous societies that were not equally inclined to the same activities. We exploit this variation to construct an instrument for the proximity to a historical location of the printing press. For each mission, we estimate the probability that it was endowed with a printing press using the share of missions from the mission's society equipped with a printing press in all the regions of the world *outside* sub-Saharan Africa. Our results are robust to the IV approach.

Finally, proximity to the printing press might have affected civic attitudes outcomes other than newspaper readership. We thus also analyze the impact of the distance to the printing press on different measures of political participation and try to measure the extent to which the impact of the distance to the printing press comes through the newspaper readership channel. We find a positive effect on political participation at the community level.

Our results complement a growing literature documenting the persistence of development paths in developing countries (Acemoglu, Johnson, and Robinson, 2001; Glaeser and Shleifer, 2002; Porta, de Silanes, and Shleifer, 2008). While this literature mainly compares regions with different institutional or colonial history, we highlight access to the printing press as a specific long-term determinant of newspaper readership and political participation even within regions sharing the same institutional framework. The role of such a technological transfer is of interest for development policies as it is easier to modify than institutions. As noticed by Feyrer and Sacerdote (2009), Huillery (2009) and Huillery (2011), it is important to explore precise historical channels to explain heterogeneous development dynamics. Recent micro-oriented studies isolate specific channels through which a development dynamic was durably established (Nunn, 2008; Huillery, 2009; Dell, 2010; Cogneau and Moradi, 2011; Alesina, Easterly, and Matuszeski, 2011; Michalopoulos and Papaioannou, 2011, 2013). Of particular importance for sub-Saharan Africa are early investments. Wantchekon, Klasnja, and Novta (2012) highlight for example the durable impact of the first schools in Benin on economic development. With the notable exception of Dittmar (2011), there has been no research on the long-term consequences of the printing press. Dittmar (2011) shows that between 1500 and 1600 European cities where printing presses were established in the 1400s grew 60% faster than cities that were otherwise similar. We identify the effect of the early arrival of the printing

press on contemporaneous outcomes. Moreover our work analyzes the role of the printing press in Africa when it had already been diffused to most of the globe. Finally, Dittmar (2011) examines the economic effects of the printing press, whereas we focus on newspaper readership and political participation that are other important consequences emphasized by historians of sub-Saharan Africa (Omu, 1978; Tudesq, 1995). This topic is of central importance for the development of democracy in sub-Saharan Africa.

The rest of the paper is organized as follows. Section 2 presents some historical background on missionary history in sub-Saharan Africa and the development of newspapers. Section 3 describes the data, in particular our new geocoded dataset of missions and discusses the determinants of missions' location and investments. In Section 4 we provide empirical evidence of the long-term impact of proximity to a printing press on newspaper readership and other civic attitudes today. We discuss extensively endogenous selection of missions into printing. Section 5 concludes.

2 Historical Background and Persistence

The introduction of the printing press Protestant missionaries pioneered in the development of a written tradition for sub-Saharan African languages. Wherever they went, Protestants quickly formalized indigenous languages, and printed Bibles and educational material in these languages.

Protestant missions facilitated the access to the printing press, acting as the intermediaries for its diffusion. For example, in South Africa, several mission societies acquired the printing press in Cape Colony between the 1820s and the 1870s. The Methodists acquired a printing press in Grahamstown in the 1830s. The Anglicans acquired presses for several stations in the eastern Cape in the 1860s and 1870s. In the later 19th and early 20th centuries, missionary societies outside the Cape Colony were also active in publishing, especially in Natal (Switzer, 1984).

Investing in printing technology was a better strategy than importing books, as transportation was long and native languages were mostly unknown in Europe. Due to technological constraints, printing presses could hardly be built in sub-Saharan Africa and had to be imported from Europe. Missionaries mainly imported hand press machines; nevertheless, importation

was far from easy.[1] Wooden printing presses were, for instance, highly inflammable materials. In 1819, Thomas Stingfellow and Robert Godlonton, both English settlers and qualified printers, set sail for South Africa with a large crate containing a second-hand wooden press. Their "inflammable" machine was however impounded in Table Bay by the Acting Governor, calling a halt to their printing project before it even started (Gordon-Brown, 1979). Similarly, the Wesleyan missionaries in Grahamstown (South Africa) decided to import an iron printing press at the end of the 1820s. But their project was almost as complicated. When Reverend Stephend Kay arrived with the machine in 1830, the missionaries realized that certain characters required for the Hosa language were missing from the typing range. The printing press therefore could not be used for almost three years, the time it took for the missing material to arrive to Grahamstone.

This anecdotal evidence illustrates the complexity of starting the printing activity in sub-Saharan Africa. The printing press was, furthermore, a costly object to transport because of its size and weight. It is difficult to have exact information on the size of the press. Some useful information is nevertheless given in Moran (1973) who details the sizes as found in catalogs. The platen of one of the smallest wooden presses found in the 1820s (the *Brooke*) was 30cm×3.8cm×45cm (1ft×1$\frac{1}{2}$in×1ft5in) while it was 91cm×30cm (3ft×11$\frac{1}{2}$in) for the largest one. Iron presses were larger. For example the size of the Columbian press introduced between 1812 and 1814 and which, according to Moran (1973),"looks much like others of the period", ranges from 53cm×40cm (21in×16in) to 106cm×68cm (42in×27in).

Printing presses were also costly. According to Moran (1973), at the beginning of the 19th century, wooden presses cost between £60 and £70. When Stanhope introduced his first iron press around 1800, its price was £90. The price began to drop when competitors entered the market; in 1808, however, it still ranged from £21 to £73. A few years later, at the end of the 1810s, the price of the Columbian press, another iron model, ranged from £100 and £125. In 1820 the price was still above £75. Finally in the 1840s, the Albion press – following the Columbian Press – varied in size from Amateur (15cm×12cm or 7×5$\frac{1}{2}$in) to Double Royal (100cm×58cm or 40in×23in). The price of the Double Royal was £75.[2] In 1830, the average annual income in the United Kingdom per adult was £30, while the average

[1] At the time of Protestant missions' settlement in sub-Saharan Africa, there existed three kinds of printing presses: the wooden press directly inherited from the old Gutenberg's printing press (Clair, 1976); the iron press, the most famous one being the Stanhope press which appeared around 1800; and the more technological steam press that uses a rolling cylinder in printing to overcome excessive manual strain.

[2] Not to refer to the prices of the cylinder machine. The simplest Koenig machine, the single cylinder, cost £900. A double machine cost £1,400 and the most advanced one £2,000.

annual wage was £20. The average worker (blue-collar) annual wage was £15.[3] According to Maddison's historical per capita GDP series, average incomes in Africa around 1820 were about five times smaller than in the United Kingdom. In other words, a printing press cost on average twenty-five years of a worker's wage.

Printing presses were costly and sizable and missionaries had to import them from Europe. Furthermore, specific knowledge was required to use them. When bringing a printing press to sub-Saharan Africa, the owner had to train apprentices and do much of the mechanical work himself: *"the editor, printer, publisher and proprietor were all combined in one person"* (Gordon-Brown, 1979). Printing presses were often operated by settlers who had experience on a printing office in England. Moreover, specific educational investments had to be made. Printing schools were established by Protestant missionaries for the native populations to acquire the specific knowledge required. In 1896, four printing schools were already active in South Africa (Cape Colony), Zanzibar and Malawi (Lake Nyasa) with close to 300 students (Church Missionary Society, 1896). As a consequence, printing presses were not available to the native population outside Protestant mission stations with a printing press.

The introduction of the first newspapers Because Protestant missionaries made printing presses available to the native population, most of the first indigenous newspapers were printed and sponsored by mission centers. The first newspaper intended for black readers, the *Umshumayeli Wendaba* ("Publishers of the News"), written in Xhosa, was published as an irregular quarterly in 1837 and printed at the Wesleyan Missionary Society in Cape Colony.[4] The *Iwe Irohin* ("The Newspaper") was founded in 1859 as a publication directed by Reverend Henry Townsend from the Anglican Church missionary society in Nigeria. *Isigidimi samaXhosa* ("The Xhosa Messenger"), the first African newspaper edited by Africans, was first released in January 1876 and printed at the Lovedale Mission Press. Eight years later, in November 1884, the English/Xhosa weekly *Imvo Zabantsundu* ("The African Opinion") was published. It was the first black-owned and controlled newspaper in South Africa. The *Imvo Zabantsundu* was edited by John Tengo Jabavu, former editor of the *Isigidimi*, and perhaps *"the most widely known mission-educated African in Southern Africa"* at the time (Switzer

[3] See e.g. Piketty and Zucman (2013).

[4] The London Missionary Society and Methodist missions also produced the earliest journals aimed at the Tswana Christian community from their stations at Kuruman and Thaba'Nchu. *Mokaeri Oa Becuana, Le Muleri Oa Mahuku* ("The Teacher of the Bechuana, the Announcer of the News"), which started in 1857, is regarded as the oldest newspaper in the Tswana language (Switzer, 1984).

and Switzer, 1979).

In regions where Protestant missions were less active, the first newspapers appeared only at the beginning of the 20th century and no indigenous newspapers were created before World War I. Before the war, the printing presses were mostly owned by the colonial powers. The first paper in Abidjan (Ivory Coast) to be owned and edited by an African, the *Eclaireur de la Cote d'Ivoire*, only appeared in 1935 (Mytton, 1983).

This lag of more than one century in the timing of creation of the first indigenous newspapers might explain the persistent effect of the proximity to a printing press on newspaper readership today. Newspapers take time to consolidate. In most sub-Saharan African countries, the newly-established government tried to take control of the press after independence. These nationalizations did not succeed in countries where newspapers were well established, stable and independent before colonization. In Nigeria, for instance, despite the *coup d'état*, the ensuing military regime and the development of a state-owned press, independent newspapers managed to survive. Similarly, even during Apartheid in South Africa, the black press and anti-Apartheid white-owned presses coninued to exist. *The Daily Dispatch*, the *SASO Newsletter* or *The World* regularly diffused their anti-Apartheid stances. This was not the case in former French colonies.

Reading habits exhibit strong persistence over time. A survey on newspapers made by the Lumina Foundation across Lagos, Enugu, Oyo, Edo, Kogi, Kaduna and the River States, highlights the persistence of reading habits in southern and middle-belt Nigeria. 59% of the respondents replied that they read newspapers as a family-inherited culture (Fraser, 2008).

The persistence of newspaper readership is of particular importance today despite growing questioning of the future of newspapers in the internet era. Sub-Saharan Africa is one of the few places in the world where the newspaper market is still growing. The newspaper market expands as literacy steadily increases whereas other media like television or internet require capital that most sub-Saharan Africans do not have. Moreover, as suggested by Bratton, Mattes, and Gymah-Boadi (2005) it is more difficult for governments to control newspapers while they can control radio or television by restricting supply and imposing a government monopoly.

Testing for the long-term impacts of the historical printing press on newspaper concentration ideally requires information on newspaper supply. Such information is not available at the local level in sub-Saharan Africa. The few datasets available only provide information

on the main national newspapers. Using the only available data, we provide cross-country evidence of the persistence of the supply of newspapers in the Online Appendix.[5] Figure B.1 shows the cross-country correlation between the number of newspapers that have existed and the average distance of the cities surveyed in the Afrobarometer to the closest historical mission settlement with a printing press. The figure displays a negative correlation between the average distance to the printing press and the total number of newspapers recorded. Figure B.2 shows the correlation between the date of publication of the first newspaper and the average distance of the cities surveyed in the Afrobarometer to the closest historical Protestant mission station with a printing press. We observe a positive correlation between the distance to the printing press and the publication date of the first newspaper: the closer a location is to a historically attested printing press, the sooner the first newspaper is recorded. Although this evidence is merely suggestive, it supports the notion of the early emergence of newspapers around mission stations and the persistence of the concentration pattern. In the remainder of the paper, the independent variable is newspaper readership, which is available at the individual level and geocoded at the city level in the Afrobarometer.

3 Data Description and Determinants of Missions' Location and Investments

3.1 Data

To study the long-term impact of the early introduction of the printing press on newspaper readership today, we built a new geocoded dataset of Protestant mission locations, investments and geographic and historical characteristics. This section summarizes the data sources used in this article, and the Online Appendix provides a complete list and description of all the variables employed.

Historical Data We construct the mission level data from the *Geography and Atlas of Christian Missions* (Dennis, Beach, and Fahs, 1903). We geocode the maps of sub-Saharan African regions from this atlas. The maps locate all the Protestant mission stations in 1903 (an example of these maps is provided in the Data Appendix Figure A.2).

[5] In the Online Appendix we present the few data sources on sub-Saharan Africa newspapers that are available and that we digitize and merge together. We also present a quick cross-country overview of the current state of the newspaper market in sub-Saharan Africa and of its evolution over time.

Each mission station is uniquely identified in a statistical index providing detailed information on the type of investments done in the station. Among others it identifies the mission's size (number of students, foreign missionaries and native workers) and its investment in school, health facilities and printing presses. The atlas also identifies the society to which each station is affiliated. The exhaustive list of variables and a reproduction of one page of the statistical index are provided in the Appendix (Figure A.1). We digitize this information for the entire world. Our sample of sub-Saharan African missions includes a total of 723 Protestant missions out of which 27 were equipped with a printing press in 1903. Figure I shows the location of mission stations and their printing presses in 1903.

Because in the *Geography and Atlas of Christian Missions* there are almost no Catholic missions, we use an alternative data source to control for the distance to Catholic missions (Béthune, 1889). Béthune (1889) locates Catholic mission in 1889 but does not provide any information on mission investments. We thus focus only on Protestant mission when estimating the impact of the distance to the printing press but control for the distance to Catholic missions. In the remainder of the paper, we use the terminology "mission" when refering to "Protestant mission".

The *Ethnographic Atlas* (Murdock, 1967) provides precolonial characteristics at the ethnic group-level such as initial population density. The slave trade data come from Nunn (2008). We geocode this data at the mission-level. Geocoded town-level data are from Nunn (2008).

[FIGURE I HERE]

Contemporaneous Data Data on newspaper readership are from the 2005 Afrobarometer surveys. There are 17 sub-Saharan countries in these surveys: 10 former English colonies (Ghana, Kenya, Lesotho, Malawi, Nigeria, South Africa, Tanzania, Uganda, Zambia and Zimbabwe), 4 French (Benin, Madagascar, Mali and Senegal), 2 German (Botswana and Namibia) and 1 Portuguese (Mozambique). Surveys are based on interviews conducted in the local languages from a random sample of either 1,200 or 2,400 individuals of voting age in each country. Overall, they cover approximately 21,000 individuals sampled to constitute representative groups at the national level.

The Afrobarometer provides individual-level subjective data on media consumption and civic attitudes. On average only 34% of the individuals surveyed read a newspaper at least once a month. The Afrobarometer also provides information on a set of individual controls:

education, age, sex and ethnicity, among others. This data is geocoded at the district level.[6] Table B.1 in the Online Appendix provides summary statistics for these variables.

Geographic Characteristics To control for geographic characteristics at the town and mission level, we use the *Global Agro-Ecological Zones* (GAEZ) data. The data are geocoded and provide information on annual precipitation levels, the average suitability for rainfed crops, the number of agriculture growing days per year and the accumulated temperature in the year.

3.2 Determinants of Missions' Location and Investments

Protestant missions were the first to make the printing press available to the indigenous population and to sponsor the first indigenous newspapers. Before turning to the empirical analysis, we analyze the determinants of mission location. We also compare missions that invested in the printing technology and missions that did not. On average, towns from the Afrobarometer are located 133.8 km away from the closest mission settlement and 70% of them are located 150 km away or closer to the closest mission settlement (Table I). As a baseline, we use the 150 km threshold to define towns close to a mission.

[TABLE I HERE]

Mission Location The decision of where to locate foreign mission stations is of central importance for our empirical analysis. A number of important factors played a role in determining these locations. Among the most important determinants are access to a clean water supply, the ability to import supplies from Europe, the abundance of a fertile soil that could be used to grow crops, and a high altitude with a temperate climate (Johnson, 1967). Moreover mission locations exhibited a form of path-dependence. The routes of initial missionary explorers determined which parts of Africa were the best-known to Europeans, as well as the locations of the earliest mission stations from which larger networks of stations were developed. The colonial railway network is another factor that affected mission locations, as well as the slave trade (Johnson, 1967; Nunn, 2010).

[6]Individual-level readership data allows us to control for other individual characteristics. There is no data on African newspaper circulation available at the district level. Moreover, as our identification strategy uses precise geographic variation, we need extensive district-level information and such information is not available for newspaper circulation.

These known trends are for the most part confirmed in our data. In Table II we perform a t-test on the equality of means for geographic and historical characteristics of towns located near (less than 150 km) and far (more than 150 km) from a historical mission settlement. As for the geographic characteristics, we find that missions locate in places with a lower prevalence of malaria and a more favorable climate (measured by the accumulated temperature and the annual precipitation level). They also locate in places more suitable for agriculture (measured by the suitability for rainfed crops and the number of agricultural growing days). Moreover, they locate closer to the coast. As for the historical determinants of mission location, slave exports are higher in places near missions. We also find that missions have a higher probability to be located near historical railway networks, and a lower probability to locate near an explorer's route.

An open question in the literature is the general effect of population density. Some missionaries intentionally built missions in more remote locations where the "word of God" otherwise would not have reached; whereas other missionaries recognized the benefits associated with dense populations and targeted these groups (Nunn, 2010). In his history of the London Missionary Society in Southern Africa, de Gruchy (1999) emphasizes this point:

> "On one hand, the evangelists found large towns attractive: their existence promised to make conversion easier that would have been the case with dispersed peoples [...] And yet, on the other hand, the Southern Tswana future-world, as both the LMS and Wesleyans envisaged it, consisted in scattered, loosely articulated communities of individuated farmsteads, each on its end lands; the preferred mode, that is, of the lower and middle."

According to Table II regions near historical mission settlements had on average a higher population density and more favorable geographic conditions. In our empirical analysis we only focus on regions near historical mission settlements. Moreover, our specifications always control for all the geographic and historical characteristics described in Table II.

[TABLE II HERE]

Printing Press Location Did missions with a printing press locate in regions with specific geographical or historical characteristics correlated with determinants of newspaper readership? In Table III we compare the geographic and historical characteristics of missions with

and without a printing press and perform a t-test on the equality of means. Interestingly, missions with the printing press were not, on average, located in more geographically favored areas than missions without. None of the geographical indicators are significantly different between the two groups, except for malaria ecology which is higher for missions that invested in the printing press.

Historical characteristics exhibit a different pattern. Slave export and railway contact have similar means between the two groups. On the contrary, missions with a printing press have more favorable historical characteristics: they are more likely to have higher initial population density, and to be close to historical cities and explorer routes. All our specifications control for these characteristics.

[TABLE III HERE]

3.2.1 Mission Characteristics and Investments

Did missions with a printing press conduct different types of investments or have different characteristics? Table IV presents descriptive statistics comparing investments and characteristics of missions with and without a printing press. Mission characteristics are similar between the two groups, except that missions with a printing press also have a much higher probability of being Bible Societies.

Missions with a printing press have on average more schools, both in level and per student than missions without, as well as more teachers per student. We use various empirical strategies to check that our results are not driven by these higher investments in education. Finally, missions with a printing press have more health facilities in level. However they do not invest more in health per capita. Our specifications always control for missions' characteristics and investments.

[TABLE IV HERE]

4 Newspaper Readership and the Printing Press: Empirical Analysis

This section explores the relation between proximity to the missionary printing press and newspaper readership and other civic attitudes nowadays.

4.1 Specification and Identification Strategy

Let i index individuals, j index the village in which individuals live[7], e index the ethnicity and c index the country. Standard errors are clustered at the village level.

Equation 1 describes our preferred identification equation:

$$\begin{aligned} \text{News}_{ijec} = \alpha\, &\text{Distance Printing Press}_j \\ &+\beta_1 \text{Distance Mission}_j + \boldsymbol{X_i'\beta_2} + \boldsymbol{Y_j'\beta_3} + \boldsymbol{Z_e'\beta_4} + \delta_c + u_{ijec} \end{aligned} \tag{1}$$

"Distance Printing Press$_j$" is the logarithm of the distance from village j to the closest mission with a printing press. Distances are measured in kilometers. The parameter α is our parameter of interest. It captures the impact of the proximity to a printing press on newpaper readership today.

"Distance Mission$_j$" is the logarithm of the distance from village j to the closest mission. The distances are computed using the geocoded information described in Figure I and Section 3.1.

We control for a large set of covariates that might determine individual behaviors today and historical mission settlement. The choice of the control set is inspired by Nunn (2008) and Michalopoulos and Papaioannou (2011).

The vector of individual controls $\mathbf{X_i'}$ includes the age of the surveyed individuals, their age squared, their sex, their level of education, their religion (two binary variables indicating whether the individual is Protestant or Catholic), their television and radio consumption, and two indices ranging from 0 to 4 indicating the intensity of cash and water constraints. These two indices are proxies for living standards and geographical constraints.[8]

The vector of village-level controls $\mathbf{Y_j'}$ includes a wide range of historical and geographical factors that may have played a role in determining both mission center locations and long-term economic development. At the village level, we control for the distance to the capital city, whether the village is located in an urban area, current and historical distance to the coast[9] and the historical exposure to the trans-Atlantic and Indian slave trades.

At the ethnicity-level (vector of ethnicity-level controls $\mathbf{Z_e'}$), we control for the precolonial population density, the population density in 2005, the malaria ecology of the land, average

[7] In the Afrobarometer, individuals are assembled by the smallest unit among villages, cities or districts. We defined this unit using the latitude and longitude provided in the Afrobarometer. We call "village" this unit in the remainder of the paper.

[8] This set of individual level controls is similar to the one used in Nunn and Wantchekon (2011).

[9] Historical distance to the coast is the distance to the coast of the respondent's ethnicity.

elevation and the share of land within 10 km of water.

The three vectors of individual-, village- and ethnicity-level controls ($\mathbf{X_i'}$, $\mathbf{Y_j'}$ and $\mathbf{Z_e'}$) plus the country fixed effects constitute our baseline set of controls that we use in all specifications.

4.2 OLS Estimation

4.2.1 Baseline Results

Table V presents OLS estimates of the impact of the proximity to a mission with a printing press on newspaper readership. In all the specifications we control for the baseline controls described above. Column 1 shows that a 1% increase in the proximity to the closest mission with a printing press is associated with an increase in the probability of reading a newspaper by nearly 1.5 percentage points. Controlling for the proximity to the closest mission increases slightly the point estimate to 1.6 percentage points (column 2). This negative coefficient is statistically significant and economically meaningful. A one-standard deviation increase in the logarithm of the proximity to the printing press increases the probability of reading newspapers by 3.6% of a standard deviation (column 2).

Interestingly, there is no effect of the proximity to a mission without a printing press. This supports our hypothesis that the proximity to a printing press matters *per se* as a long-term determinant of newspaper readership today. In other words, technology seems to matter more than religion. In the following tables we include the proximity to a mission without a printing press in our baseline set of controls but do not report the coefficient in order to save space.[10]

Reducing the Sample to Individuals Close to a Protestant Mission As shown in Section 2, regions near historical mission settlements have on average a higher population density and better geographic conditions than regions further. Moreover, all the mission stations invested in activities, especially education, that are probably correlated with long-term development. Thus, this section restricts the sample to regions near historical mission settlements. Such restrictions aim at correcting for possible selection in mission location. The rest of the analysis will be conducted *within* regions near historical mission settlements.

In columns 3 to 5 of Table V we present the results of the estimation of equation (1) when the sample is restricted to individuals near a Protestant mission. Near is sequentially defined as being in a village with at least a Protestant mission in a 200 kilometer (120 miles)

[10]Results with all the covariates are available upon demand.

radius around the village (Column 3), a 150 kilometer (93 miles) radius (Column 4) and a 100-kilometer (62 miles) radius (Column 5). These restrictions represent, respectively, 80%, 70% and 60% of the sample.

For all the different specifications, we find a negative and statistically significant impact of an increase of the proximity to a printing press. The point estimates vary between 1.4 and 1.6 percentage points. Considering individuals living in a village with at least one mission in a 100-kilometer radius around the village (column 5), we find that a one-standard deviation increase in the proximity to the closest printing press increases newspaper readership by 3.2% of a standard deviation. A variance decomposition of the results from column 4 shows that the proximity to the printing press and the other covariates together explain 21.3% of the total variation in newspaper readership. Of these 21.3%, 0.4 to 2.9% is explained by the distance to the printing press.

As the sample is restricted to regions close to historical mission settlements, the effect found can be lower than the real ones if the printing press has a spillover effect across regions. If the effect of the printing press vanishes in regions outside the threshold but is present in regions considered, then our estimates might indeed be downward biased because of spatial externalities (Miguel and Kremer, 2004; Michalopoulos and Papaioannou, 2011).

[TABLE V HERE]

4.3 Endogenous Selection of Missions into Printing

A crucial empirical challenge is the possibility of endogenous selection of missions into printing. To deal with such potential endogenous selection, we first augment regression (1) with an extensive set of covariates using both an OLS and a matching strategy. Moreover, using recent insights from Oster (2013), we find that it is unlikely that the entire estimated effect of the distance to the printing press is driven by unobserved variables.

4.3.1 Selection on Observables

OLS Strategy We first control for selection on observables in an OLS framework. We augment our baseline set of controls with additional potential determinants of the location of the mission stations and of the missions with a printing press among mission stations. These determinants include a binary variable equal to one if any part of the railway network was built on land historically inhabited by the ethnic group and zero otherwise; a binary variable

equal to one if a European explorer traveled through land historically occupied by the ethnic group; and the distance to the closest precolonial city (cities in 1400).

We also control for the distance to the closest missionary investments that may have been correlated with long-term development: different types of schools (high school, boarding school, college, etc) and health facilities. Similarly, we add geographic and investment characteristics of the closest mission: the annual precipitation level, the suitability for rain-fed crops, the number of agricultural growing days and the accumulated temperature, the number of native workers, students, teachers and physicians, the total population of the mission and the arrival date of the mission. Finally, we add the logarithm of the distance to the closest Catholic mission in 1889.

Table VI shows the results of the estimation of equation (1) when all these additional controls are added. Our results are robust to the inclusion of these controls and they are more statistically significant. Moreover the magnitude of the effect is larger. The point estimates vary from 2 to 2.4. A one-standard deviation increase in the proximity to the closest printing press increases newspaper readership by 5.2% of a standard deviation when considering the 100 km threshold (column 3).[11] These results are robust to a Probit specification (Appendix Table B.3).

Some of the contemporaneous controls, especially education, may be *bad controls* in the sense of Angrist and Pishke (2009). This issue would arise if any of the contemporaneous controls were also outcomes. As a robustness check, dealing with this potential issue, Table B.4 in the Online Appendix presents the results of the regression presented in Table VI when we drop some contemporaneous controls from the baseline set of controls. The variables dropped are education, religion, cash constraints, water constraints, population density in 2005, distance to the capital watching the news on television and listening to the news on the radio. The results are not sensitively different from those presented in Table VI.

[TABLE VI HERE]

Matching Strategy As a robustness check, we also control for selection on observables using a matching strategy. As opposed to the OLS estimator that imposes linearity in the parameters, the matching estimator allows for non-linear effects of observables (Acemoglu, 2005).

[11] In the Online Appendix Table B.2 we report the coefficients for all the different distances.

Using a Logit model, we regress the binary variable indicating whether missions are endowed with a printing press on all the observable characteristics available at the mission level (these observables correspond to the variables reported in Tables III and IV). From this regression we compute the propensity score, which is the estimated probability of having a printing press. We then match each mission with a printing press to the mission with the closest propensity score using a one-to-one matching. The missions matched are extremely similar to the missions with a printing press but had not imported it in 1903. We call the sample of missions similar to those with a printing press but without a printing press $\overline{PP}$. The sample of missions with a printing press is called PP. Tables B.5 and B.6 in the Appendix show respectively the results of the regression from which we compute the propensity score and the balance check comparing samples PP and $\overline{PP}$. There are no significant differences between the two samples.

Each city from the Afrobarometer is then associated to the closest mission in the sample $\left\{\overline{PP} \cup PP\right\}$. We define a binary variable "Treat" equal to one if a city is associated to a mission that did import the printing press and to zero otherwise. The way we construct the treatment area is described in more detail in the Appendix A.5.

Equation (2) describes the identification equation:

$$\begin{aligned} \text{News}_{ijec} = \delta_1 &\text{Distance Mission}_j + \delta_2 \text{Treat}_j \\ &+ \delta_3 \text{Treat}_j \times \text{Distance Mission}_j \\ &+ \boldsymbol{X_i'\beta_2} + \boldsymbol{Y_j'\beta_3} + \boldsymbol{Z_e'\beta_4} + \delta_c + u_{ijec} \end{aligned} \tag{2}$$

"Distance Mission" is the distance from town j to the closest mission station in the sample $\left\{\overline{PP} \cup PP\right\}$. "Treat * Distance Mission" is the crossed effect of "Treat" and "Distance Mission". The controls are the same as in Table VI.

Table VII gives the results of the estimation of equation (2). The effect of proximity to the closest mission from $\left\{\overline{PP} \cup PP\right\}$ is also more robust if the closest mission did invest in a printing press. Interestingly, the magnitude of the effect is comparable to the one in the previous section.

[TABLE VII HERE]

Using Selection on Observables to Assess the Bias from Unobservables Insights from Altonji, Elder, and Taber (2005) and Oster (2013) attempt at assessing the bias from

unobservables using the sensitivity of the treatment to added controls. In this section, we use this approach to compare the magnitude of the treatment effect with the potential selection bias.[12]

Suppose there is a set of unobservable explanatory variables W'. Since these variables are unobserved, they are not included in regression (1). The *proportional selection assumption* (PSA) states that $\delta C_{WX} = \frac{C_{W'X}}{V_{W'}}$. X is the treatment variable (here distance to the printing press), W is the set of observed covariates, $C_{W'X}$ is the covariance of W' and X and $V_{W'}$ is the variance of W'. δ is a measure of the relationship between C_{WX} and $C_{W'X}$. The PSA assumption is key in the approach as it states that the relationship between the observed covariates W and the treatment X is informative about the relationship between the unobserved covariates W' and X, from which the bias is coming.

Consider the following three regressions:

$$\text{News} = \gamma X + W + W' + \varepsilon_{\max} \tag{M-max}$$

$$\text{News} = \xi X + M + \varepsilon_1 \tag{M-1}$$

$$\text{News} = \Lambda X + W + \varepsilon_2 \tag{M-2}$$

Let $R_{\max}$ be the R-squared of the full model regression (M-max). R_2 is the R-squared of the regression (M-2) including all the observed covariates. R_1 is the R-squared of regression (M-1) including only a restricted set of covariates M. M is a set of observed controls that do not have a related unobserved component and are orthogonal to W and W'(Oster, 2013).

According to Oster (2013), under the PSA and when δ is close to one, $B(\delta) = \delta \frac{(\xi - \Lambda)(R_{\max} - R_2)}{R_2 - R_1}$ is (i) equal to the unobserved bias if $\delta = 1$; (ii) a close upper bound on the bias if $\delta < 1$; (iii) and a close lower bound on the bias if $\delta > 1$.[13]

We can the bias due to unobserved variables from the movements in the treatment effect due to the added controls using the ratio $B(\delta)$. However, to compute the ratio it would be necessary to know the true value of $R_{\max}$. Because there is probably some randomness in the movements of the outcome, it is unlikely that $R_{\max}$ is equal to one. Oster (2013) uses the R-squared from different randomized experiments as a measure of $R_{\max}$. We cannot use the same approach because we analyze historical events. In the literature of the long-term

[12]The results using the original Altonji, Elder, and Taber (2005) approach used for instance by Nunn and Wantchekon (2011) are available upon demand.

[13]If W is selected randomly from $\{W, W'\}$, then $\delta = 1$. If W is the most important set of controls from $\{W, W'\}$ then $\delta < 1$.

consequences of historical events, in particular of Protestantism (Becker and Woessmann, 2009) and the diffusion of the printing press (Dittmar, 2011) the R-squared rarely exceed 0.65 and are usually close to 0.5. In our regressions, the R-squared never exceed 0.5. Thus, in our computations we choose 0.6 and 0.7, two conservative values of $R_{\max}$.

Figure II1 (respectively II2) plots the ratio of the treatment as given in Table VI over the bias $B(\delta)$ for different values of δ with $R_{\max} = 0.6$ (respectively $R_{\max} = 0.7$). In each graph, two different restricted sets of controls M are chosen. The first set only includes country fixed effects; the second one includes country fixed effects, age, age squared, gender, distance to the closest mission, and distance to the capital city. All the regressions restrict the sample to cities located in 150-km radius of a mission. In all the specifications, for all the values of δ and the two values of $R_{\max}$, the ratio of the treatment over the bias $B(\delta)$ is higher than one. These results make it unlikely that the entire estimated effect of the distance to the printing press is driven by unobserved variables.

[FIGURE II HERE]

4.3.2 IV Estimation

Despite our attempts to control for observable factors, our estimates might still be driven by unobserved factors correlated both with long-term development and proximity to historical location of a mission with a printing press. We thus develop an instrumental variable approach. This approach is based on our historical readings of the different preferences of missionary societies for the printing press.

In the early period of missionary expansion, missionaries faced numerous difficulties despite the fact that an increasing number of church ministers were supporting the will of "sending missionaries to the heathen" (Ellis, 1844). Travels were often costly and required careful planning. Moreover, independent missionaries could face the hostility of colonial powers, especially fearing anti-slavery positions. In the late 18th Century, they also endured the hostitility of the clergymen who disagreed with the conversion methods used by the evangelists.

As a result of the raising popularity of the missionary work and the struggles missionaries faced, different associations of missionaries and evangelists started to emerge in the late eighteenth century. The first societies were mostly launched under the impulsion of the evangelists, for instance the Baptist Missionary Society (BMS) founded in 1792 by William Carey. Many of them had no denominational affiliation and emerged as the association of churchmen

convinced of the importance of the missionary work. In 1795, several meetings between different churchmen (among which John Love, John Townsend, John Eyre and George Townsend) established the founding principles of the London Missionary Society (LMS). These principles reflect the will to overcome denominational barriers and join efforts for the purpose of missionary work. This will is clear in the founding letter of the LMS signed in 1795:

> "We [...] declare our earnest desire to [...] unite together, purposing to use our best endeavors that we may bring forward the formation of an extensive and regularly organized society, to consist of evangelical ministers and lay brethren of all denominations, the object of which society shall be, to concert and pursue the most effectual measures for accomplishing this important and glorious design." (Ellis (1844), p. 19).

In the early 19th Century, numerous and diverse societies had been created. The Church Missionary Society (CMS), for instance, was founded in 1800 by the Church of England in response to the raising popularity of the missionary work (Stock, 1899). The aim of these organizations was to coordinate efforts and funds of the missionary work. Their priorities differed and depended on the preferences and means of the societies' command. The CMS, for instance, "in the absence of missionaries,[...] fell back upon the printing press as an agent of evangelization" from the start of its activity (Stock (1899), p. 75). Similarly, *The Duff*, the first vessel sent abroad by the LMS to Tahiti, carried "a valuable collection of articles of clothing, books, printing apparatus, and useful tools" (Ellis (1844), p. 40). On the contrary, the Christian Missionary Alliance, founded in 1887 by the wealthy Reverend Albert Benjamin Simpson had not invested in a single printing press ten years later, even though they had already settled 52 missions around the globe (Dennis, Beach, and Fahs, 1903).

Missionary societies were therefore not equally inclined to the same activities. We exploit this variation to construct an instrument for the proximity to a historical location of a mission with a printing press.[14]

IV Strategy Let "Society PP_m" be the share of missions from mission m's society equipped with (at least) a printing press in all the regions of the world *outside sub-Saharan Africa*. This

[14] We could have aggregated the different missionary "societies" by "denominations". However doing so we would have lost interesting information. As stressed above, the preferences of the different mission stations were indeed specific to small "societies" rather than determined by the largest "denominations" missions referred too. Moreover as it appears in Table B.7 in the Online Appendix many societies had no (or sometimes multiple) denominational affiliation.

information comes from the *Geography Atlas of Christian Missions* (Dennis, Beach, and Fahs, 1903) we digitized.

There are 5,535 missions in the entire world outside sub-Saharan Africa (6,258 including sub-Saharan Africa) reported in the Atlas in 1903. Only 2.3% of these missions had a printing press.[15] These missions were affiliated with 262 different societies.

In sub-Saharan Africa, we have information on the originating society for 679 out of our 723 missions (44 missions were either affiliated to a society existing only in sub-Saharan Africa or not affiliated to a society). These missions are affiliated with 69 different societies. Among these 69 societies, 16.8% had a printing press in at least one of their missions. Our instrumenting assumption is that the larger this share, the more likely it was for a mission associated with this society to invest in a printing press in sub-Saharan Africa. In the Appendix Table B.8 we find a statistically significant and positive correlation of "Society PP" on the probability that a mission has a printing press.

[TABLE VIII HERE]

Let "Village Printing$_j(k)$" be the sum of Society PP$_m$ for all the missions historically located less than k km away from village j. For each village j, we call $m_j(x)$ any mission station historically located x km away from j. The variable "Village Printing$_j(k)$" is defined in equation 3:

$$\text{Village Printing}_j(k) = \sum_{x \leq k} \text{Society PP}_{m(x)} \tag{3}$$

In Figure III we draw a diagram of the instrumental variable's construction. We took the example of two different villages – villages j_1 and j_2 – and of two different distances given by the radius k_0 and k_1. If we consider the smaller radius – k_0 – then village j_1 has a higher probability – as estimated by Village Printing$_{j_1}(k_0)$ – to be closer to a mission with a printing press than villages j_2 whose surrounding missions are from societies without printing presses outside of sub-Saharan Africa. By construction, the larger the radius we consider, the higher the potential value of Village Printing$_j(k)$.[16]

[FIGURE III HERE]

[15] This is slightly lower than in sub-Saharan Africa where the percentage of the missions with a printing press was 3.7%.

[16] In the illustration, Village Printing$_{j_2}(k_0) = 0 <$ Village Printing$_{j_2}(k_1) = 0.02$.

"Village Printing$_j(k)$" is used as an instrument for the proximity to the closest historical location of a mission with a printing press ("Distance Printing Press"). The exclusion restriction is that the share of missions from a society having invested in a printing press ("Society PP$_m$") outside sub-Saharan Africa is not correlated with long-term determinants of newspaper readership in sub-Saharan Africa. For instance, the societies that invested most in printing presses should not be the richest, nor have invested more, nor be located in places with the best geographic characteristics.

We provide evidence supporting the validity of the exclusion restriction in Tables VIII and IX. In Table VIII we compare the average investments performed by missionary societies in the entire world outside sub-Saharan Africa depending on whether they invested in the printing press before 1903. There is no significant difference other than the arrival date. In 1903, societies that had invested in the printing press had settled, on average, earlier than those that did not. In Table IX we report OLS estimates of the mission-level regression of "Society PP" on mission characteristics, investments, geographic and historical characteristics. None of the coefficients we obtain are statistically significant supporting our exclusion restriction. The societies outside sub-Saharan Africa investing the most into printing did not systematically conduct other type of investments in sub-Saharan Africa, nor did they settle in particularly geographically favored regions.

Results We present here the results for a radius of 50 km for the construction of "Village Printing (k)" but results are robust to the use of other radii, from 50 to 100km radius.[17] Table X Panel A gives the results of the first stage of the estimation. All the coefficients are negative and statistically significant. Moreover they are robust to restricting the sample to locations close to historical locations of mission stations. A one-standard deviation increase in "Village Printing$_j(50)$" decreases the distance to the closest printing press by 5.7% of a standard deviation for regions located at less than 150 km from a historical mission settlement (Column 2). Results for regions located at less than 200 km or 100 km from an historical mission settlement are of similar magnitude.

Table X Panel B presents the results of the second stage of the estimation. The positive impact of the proximity to a printing press on newspaper readership is robust to the instrumentation strategy. If anything, the results tend to be larger than those obtained in the previous sections. A one-standard deviation increase in the distance to the closest printing

[17] These results are available from the authors upon demand.

press decreases individual newspaper readership nowadays by 13% for regions located at less than 150 km from a historical mission settlement (Column 2). Results for regions located at less than 200 km or 100 km from an historical mission settlement are of similar magnitude. Therefore, the results of the persistent effect of proximity to historical location to the printing press on newspaper readership is robust to the IV approach.

The magnitude of the IV estimations from Table X are larger than the point estimates of the OLS estimations. A possible explanation is that the OLS estimates might be suffering from attenuation bias due to measurement error in mission locations. This measurement error might come from the "manual" construction of the dataset or errors in placement from the historical maps. It might make it more difficult to gauge the effect of the proximity to a mission with a printing press in the OLS estimation. The instrumentation would then be correcting for the attenuation bias, hence increasing the point estimates.

[TABLE IX HERE]

[TABLE X HERE]

Taken together, all the results from Section 4 are consistent with the idea that the introduction of the printing press had a long-lasting effect on newspaper readership. In the next section we perform a couple of robustness checks confirming this finding.

4.4 Discussion

4.4.1 Additional Robustness Checks

We perform several falsification tests and robustness checks. This section briefly describes them; the detailed results for these additional tests are in the Online Appendix.

Because missions that invested in the printing press might be larger, we first check that our effect is not driven by the mission size. As a falsification test, we estimate equation (1) with the distance to the 30 largest missions as the main explanatory variables[18]. The results are given in the Online Appendix Table B.9. Distance to the largest missions has no effect on newspaper readership nowadays.

Second, we estimate equation (1) using two-way clustering at the closest mission and the village levels. Clustering the standard errors at the mission level might be relevant should

[18]Within these 30 largest mission, only two have a printing-press

the closest mission be also considered as a treatment. Our main explanatory variable is the continuous treatment "Distance Printing Press" which varies at the village level. However, as some villages share the same closest mission, one may argue that the identity of the closest mission is a treatment *per se*. In this case it would make sense to cluster the standard errors at both the mission and the village levels. Table B.10 shows that our results are robust to this two-way clustering strategy.

Table B.11 in the Online Appendix shows the results of the estimation of equation (1) for a sample restricted to former British colonies. Our results are robust to this restriction and the magnitude of the effect remains unchanged. Our results thus cannot be entirely attributed to the colonizer's legal origins.

Finally, Table B.12 in the Online Appendix presents the results of the estimation of equation (1) when the dependent variable $News_{ijc}$ is a binary variable equal to one if individual i in village j and country c, listens to the news on the radio (Columns 1 to 3) or watches the news on television (Columns 4 to 6) at least once a month. We find no statistically significant effect of the printing press on listening to the news on the radio or watching them on television.

4.4.2 The Long-Term Impact of the Printing Press on Education and Human Capital

An obvious concern when studying the long-term impact of the printing press brought by missionaries is how it might have affected education and literacy. As most missionaries' objective was to maximize conversion through reading the Bible, they taught literacy to the native population (Woodberry, 2004).[19] A number of recent studies emphasize the positive consequences on human capital of conversion through reading the Bible (Becker and Woessmann, 2009; Bai and Kung, 2011; McCleary and Pesina, 2012; Woodberry, 2012). In the sub-Saharan context, Nunn (2009) finds that Protestant missions increased educational attainment (see also Nunn and Wantchekon (2011)). Moreover, in his fascinating study of the long-term consequences of the printing press, Dittmar (2011) explains the effect of the printing press on growth through its spillovers on human capital accumulation and technological change.

It is thus a concern that investments, in particular in education, made by missions with a printing press could be driving our results.

[19] However, the role of missionary activity on literacy may have been significantly reduced later in the century (around the 1940s) when imaging technology developed (McCleary and Pesina, 2012).

Two points from the previous analysis aim at compensating for this potential pitfall. First, the level of education of individuals surveyed in the Afrobarometer is included in our basic set of controls. Therefore, when estimating the impact of the printing press on newspaper readership nowadays, we are controlling for education. Second, we control for the missionary investments in education. These controls are the number of teachers and the number of students in the nearest mission and the distance to the nearest mission with a school or a high school.

An additional falsification test estimates the impact of the proximity to a printing press on education, controlling for the same set of observables as in Table VI. The results are reported in Table XI. We find no statistically significant effect of the distance to a printing press on education (first line). This result does not imply that missionaries had no effect on education and the accumulation of human capital. As was expected from the existing literature (Wantchekon, Klasnja, and Novta, 2012), we find a positive and statistically significant impact of the proximity to a mission with a high-school on education (Table XI line 3). This effect is economically meaningful. For regions located less than 150 km away from a historical mission settlement, a one-standard deviation increase in the distance to the closest mission with a high school increases education today by 6.9% of a standard deviation.

Hence we find a long-term positive impact of high school on education nowadays. We have then isolated a specific effect of proximity to a historical mission settlement with a printing press on newspaper readership. Given the actual controversy in the literature on the effect of human capital on democracy (see e.g. Glaeser, Ponzetto, and Shleifer (2007) and Acemoglu, Johnson, Robinson, and Yared (2008)), the next section aims at isolating the long-term effect of the printing press on civic attitudes, through the newspaper readership channel.

[TABLE XI HERE]

4.4.3 The Printing Press, Newspaper Readership and Political Participation

There is a growing literature in political economy on how information can affect political outcomes (DellaVigna and Kaplan, 2007; Enikolopov, Petrova, and Zhuravskaya, 2011), and more specifically, on how media access affects political participation (Strömberg, 2004; Oberholzer-Gee and Waldfogel, 2006; Gentzkow, Shapiro, and Sinkinson, 2012; Cagé, 2013). By exploring historical determinants of newspapers' development, the present work contributes to this literature. This section aims at determining whether proximity to the printing press also had a

long-term effect on civic attitudes.[20]

The literature on the determinants of political participation in Africa has mainly focused on the role of ethnicity (Gibson and Long, 2012; Ichino and Nathan, 2013a) and clientelism (Ichino and Nathan, 2013b). We contend that media access might be another important determinant of political participation in sub-Saharan Africa. Access to information can affect civic attitudes and in particular attitudes toward political participation.

First, because it provides information on different political events such as elections, access to information might mechanically increase the pool of people informed of the events to which they can participate, increasing the likelihood of participation. We estimate the impact of newspaper readership on three different measures of political participation. Each variable is described in a subsequent footnote. The description provides the question used in the Afrobarometer to construct the variable. The variables are also summarized in Table A.1 in the Appendix. The outcome variables used are: registration for elections[21]; voting in past elections[22]; and a proxy for political participation at the local level ("Actions as Citizen"[23]).

Second, access to information can increase the accountability of political instances, thus increasing the incentives for citizens to participate in the democratic process. If this were to be the case, access to information should increase satisfaction with the democratic system. However, as pointed out by Djankov, McLiesh, Nenova, and Shleifer (2003) and Cagé (2013), access to information can be associated with monitoring only if the media's quality is compatible with the costs and difficulties of the monitoring function. In regions where media are either captured or of very poor quality, they are less likely to monitor politicians efficiently. Therefore, newspaper readership is less likely to affect political participation through monitoring in sub-Saharan Africa. We use the 'Satisfaction" variable of the Afrobarometer

[20]There has been very little quantitative work in economics on mass media focusing on Africa although Africa is an exemplary place to study newspaper activity, a notable exception being the work by Reinikka and Svensson (2005).

[21]Understanding that some [Ghanaians/Kenyans/etc.] were not able to register as voters for the [20xx] elections, which statement is true for you? You were registered to vote, You did not want to register, You could not find a place to register, You were prevented from registering, You were too young to register, Did not register for some other reason, Don't Know/Can't remember.

[22]With regard to the most recent, [20xx] national elections, which statement is true for you? You voted in the elections, You decided not to vote, You could not find the polling station, You were prevented from voting, You did not have time to vote, Did not vote for some other reason, You were not registered, Don't Know/Can't remember.

[23]Here is a list of actions that people sometimes take as citizens. For each of these, please tell me whether you, personally, have done any of these things during the past year. If not, would you do this if you had the chance: attend a community meeting; go together with others to raise an issue; attend a demonstration or protest march.

to infer satisfaction with democracy.[24] This outcome is likely to increase if there is efficient monitoring in politics.

Finally, information institutions provide a space for citizens to discuss political matters: access to information might improve the environment of political discussion.[25] We evaluate the impact of the proximity to a printing press on a proxy for the quality of political discussion at the local level: "Listen".[26]

Proximity to the printing press might have affected political participation through newspaper readership. The arrival of the printing press could also have had other impacts that might in turn have affected political participation. For instance, as suggested by Anderson (1991), the introduction of the printing press can have increased nationalism through the strengthening of a common language. Moreover, newspaper readership may have increased political participation, but the latter may also exhibit a persistent pattern. In such case, political participation today might not be fully captured by contemporaneous newspaper readership. In this section, we analyze the impact of the distance to the printing press on the different measures of civic attitudes described above and measure the extent to which the impact of the distance to the printing press comes through the newspaper readership channel.

Results Table XII presents the results of the OLS estimation of the impact of the proximity to a mission with a printing press on our different measures of political participation. As before, we focus on regions close to a mission. For the sake of space we present in the text only the results for the 200 km threshold, but the tables using the 100km and the 150km threshold are available in the Online Appendix and give similar results (Tables B.13 and B.14). Similarly, results for the probit specification are available in the Online Appendix (Tables B.15, B.16 and B.17). The estimations include our entire set of controls (baseline and additional controls described above). We also include as a control newspaper readership to measure the extent to which the impact of proximity to a printing press affects political participation through the newspaper readership channel.

Columns 1, 3, 5, 7 and 9 of Table XII show that among the five selected outcomes, distance to the historical location of the printing press only affects political participation

[24] Binary variable indicating that an individual both thinks that his country is a democracy and is "fairly" or "very satisfied" with "the way democracy works".

[25] Habermas (1989) suggested the important role of the development of the public sphere of discussion for the emergence of democracy.

[26] Binary variable indicating whether respondent disagreed with the statement: "As far as politics is concerned, friends and neighbors do not listen to you?"

at the community level ("Actions") and the quality of political discussion ("Listen"). An increase of one-standard deviation in the distance to the printing press decreases "Actions" and "Listen" by respectively 5.8% and 4.3% of a standard deviation. A variance decomposition of the results from columns 5 and 7 shows that the proximity to the printing press along with the other covariates together explain 7.3% and 3% of the total variation in, respectively, "Actions" and "Listen". Of these 7.3% and 3%, distance to the historical location of the printing press explains, respectively, 0.8 to 1% and 0.6 to 3% of the total variation. The R2s in Table XII are lower than those obtained in Table VI. A possible explanation is that distance to the printing press only has an indirect effect on civic attitudes through the development of information institutions such as newspaper readership.

In Columns 2, 4, 6, 8 and 10 we introduce media consumption (newspaper, TV and radio) as controls to determine whether the impact of the distance to the printing press comes through the newspaper readership channel. Introducing these controls does not change the estimated coefficients for the impact of the distance to the printing press on "Actions" (Column 6). The impact of the printing press on political participation at the community level thus does not occur entirely through the newspaper readership channel. However, the effect of distance to the printing press on "Listen" is no longer significant, implying that distance to the printing press only affects the quality of the political discussion environment through newspaper readership.

This section provides evidence supporting our hypothesis of the long-lasting consequences on political participation at the community level of the printing press in sub-Saharan Africa. No effect is found on other forms of civic attitudes such as registration to elections or voting in general elections probably because they have often been the target of public policies. Such policies might have counterbalanced the positive dynamic established by the early arrival of the printing press. The interaction between public policies and long-term determinants of culture is a new and fascinating issue that was recently raised by Voigtlander and Voth (2012).

[TABLE XII HERE]

5 Conclusion

In this paper, we study the impact of the early introduction of the printing press by Protestant missionaries in the 19th century. The evidence we obtain from a variety of identification strategies is consistent with our hypothesis that the early introduction of the printing press had some long-term effect on newspaper readership. Moreover its effect goes beyond literacy and education. Through its impact on newspaper readership, we find that proximity to the printing press also increases civic attitudes at the local level. This is of particular interest in the sub-Saharan African context where there is still much to do to fight against corruption and to improve democratic institutions.

Our results raise numerous questions that will be the object of further research. In particular, there is still much to do in order to disentangle the different channels through which media access can affect civic participation at the local level: is it a purely informational effect or is it due to an increase in sensibility to social and political issues? Future research will also aim at evaluating the role of information institutions on other dimensions of development such as health or business creation. Information institutions can be vectors of social and economic policies, and their role on economic and political development has to be studied more thoroughly, especially in sub-Saharan Africa.

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TABLE I
SUMMARY STATISTICS OF THE DISTANCE FROM THE AFROBAROMETER TOWN TO THE CLOSEST MISSION AND TO THE CLOSEST PRINTING PRESS.

	Mean	sd	Median	Min	Max
Distance to Mission, 100km	1.338	1.733	0.710	0.007	12.897
Distance to Printing Press, 100km	4.456	3.014	3.705	0.016	16.891
Mission $<$ 150 km	0.718	0.450	1.000	0.000	1.000
Mission $<$ 150 km and Printing $<$ 150 km	0.109	0.312	0.000	0.000	1.000
Observations	21330				

Notes: The table gives summary statistics for the distance of Afrobarometer towns to Protestant missions. The variables in the first two rows respectively describe the distance to the closest mission and the closest mission with a printing press in hundreds of kilometers. The last two rows describe two binary variables equal to one if the city is located in a 150 km radius of respectively any mission or a mission with a printing press.

TABLE II
DETERMINANTS OF THE LOCATION OF MISSIONS

	No Mission	Mission	Diff/se
Geographic Characteristics			
Accumulated Temperature / 1000	10.989	13.470	-2.481**
			(0.76)
Annual Precipitation level / 1000	1.229	1.287	-0.058
			(0.11)
Suitability for Rainfed Crops	5.615	5.043	0.573***
			(0.10)
Number of Growing Days / 100	1.810	4.182	-2.371*
			(1.17)
Distance Capital, 100km	4.452	3.144	1.308***
			(0.15)
Distance Coast, 100km	5.770	3.399	2.371***
			(0.16)
Malaria	17.132	9.733	7.399***
			(0.49)
Historical Characteristics			
Slave Exports, per capita	0.084	0.122	-0.038**
			(0.01)
Railway Contact	0.295	0.480	-0.185***
			(0.02)
Explorer Contact	0.579	0.380	0.199***
			(0.02)
Initial Population Density	15.887	32.487	-16.600***
			(1.82)
Distance 1400 City, 100 km	3.392	5.104	-1.712***
			(0.15)
Distance 1800 City, 100 km	4.353	7.323	-2.970***
			(0.30)
Observations	1980		

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table compares geographical and historical characteristics of places with and without missions. Column 1 presents the results for places without missions. Column 2 presents the results for places with a mission. In Column 3 we perform a t-test on the equality of means (standard errors in parenthesis). Variables are described in the Online Appendix.

TABLE III
DETERMINANTS OF THE LOCATION OF MISSIONS WITH A PRINTING PRESS

	No printing	Printing	Diff/se
Geographic Characteristics			
Accumulated Temp /1000	12.808	13.184	-0.376
			(3.025)
Annual Precipitation/ 1000	1.246	1.384	-0.138
			(0.441)
Suitability for Rainfed Crops	4.992	4.750	0.242
			(0.356)
Number of Growing Days / 100	3.952	2.192	1.761
			(4.842)
Distance to Capital, 100 km	2.702	2.655	0.047
			(0.374)
Distance to the Coast, 100 km	2.310	2.747	-0.437
			(0.534)
Malaria Ecology	5.187	10.295	-5.108***
			(1.509)
Historical Characteristics			
Slave Exports, per capita	0.074	0.042	0.031
			(0.107)
Railway Contact	0.237	0.107	0.129
			(0.081)
Explorer Contact	0.143	0.286	-0.143*
			(0.069)
Initial Population Density	77.575	198.466	-120.891***
			(30.221)
Distance to 1400 City, 100 km	8.872	6.969	1.903*
			(0.932)
Distance to 1800 City, 100 km	15.587	10.704	4.883**
			(1.890)
Observations	679		

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table compares geographic and historical characteristics of places where missions with and without a printing press locate. Column 1 presents the results for missions without a printing press. Column 2 presents the results for missions with a printing press. In Column 3 we perform a t-test on the equality of means (standard errors in parenthesis). Variables are described in the Online Appendix.

TABLE IV
CHARACTERISTICS AND INVESTMENTS OF MISSIONS WITH AND W/O A PRINTING PRESS

	No Printing	Printing	Diff/se
Mission Characteristics			
Arrival Date	1878	1872	7
			(4)
Bible Society	0.05	0.36	-0.30***
			(0.05)
Number of Native Workers	3.42	1.79	1.64
			(3.20)
Total Population	328	413	-86
			(120)
Investment in Education			
Schools	0.26	1.64	-1.38***
			(0.17)
Number of Students	321	397	-76
			(119)
Schools per Student (%)	0.32	1.35	-1.03**
			(0.37)
Teachers per Student (%)	10.09	18.86	-8.77*
			(4.38)
Investments in Health			
Health Facilities	0.19	1.46	-1.28***
			(0.14)
Physicians per Capita (%)	0.35	0.95	-0.61
			(0.58)
Health Facilities per Capita (%)	1.52	2.30	-0.78
			(1.27)
Observations	679		

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table compares the characteristics and investments of missions with and without a printing press. Column 1 presents the results for missions without a printing press. Column 2 presents the results for missions with a printing press. In Column 3 we perform a t-test on the equality of means (standard errors in parenthesis). Variables are described in the Online Appendix.

TABLE V
DISTANCE TO A PRINTING PRESS AND NEWSPAPER READERSHIP, BASELINE OLS ESTIMATION

	(1)	(2)	(3)	(4)	(5)
	All	All	200km	150km	100 km
	b/se	b/se	b/se	b/se	b/se
Distance Printing Press	-0.015**	-0.016**	-0.014**	-0.015**	-0.013*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Distance Mission		0.002	0.004	-0.000	0.001
		(0.005)	(0.006)	(0.006)	(0.007)
Observations	15086	15086	12405	10970	9383
Baseline Controls	Yes	Yes	Yes	Yes	Yes
Clusters	1809	1809	1456	1315	1136
R2	0.360	0.360	0.356	0.353	0.357
F-Statistic	216.4	211.6	194.3	183.8	166.9

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village-, and ethnicity-level controls described in the text. All specifications include country fixed effects. In columns 1 and 2 we present results for the entire sample. In columns 3 to 5 the sample is sequentially restricted to individuals living 200 km (column 3), 150 km (column 4) and 100 km (column 5) away from a historical mission settlement.

TABLE VI
PRINTING PRESS AND NEWSPAPER READERSHIP, CONTROLLING FOR OBSERVABLES, OLS ESTIMATION

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Distance Printing Press	-0.018**	-0.024***	-0.022**
	(0.009)	(0.009)	(0.009)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.359	0.356	0.361
F-Statistic	141.8	134.8	124.5

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in more details in the text. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 3) and 100 km (Column 3) away from a historical mission settlement.

TABLE VII
PRINTING PRESS AND NEWSPAPER READERSHIP, CONTROLLING FOR OBSERVABLES, MATCHING ESTIMATION

	(1)	(2)	(3)
	200 km	150 km	100 km
	b/se	b/se	b/se
Treat * Distance Mission	-0.020*	-0.021*	-0.015
	(0.011)	(0.011)	(0.013)
Printing Treatment	0.119*	0.114*	0.078
	(0.061)	(0.061)	(0.066)
Distance Mission	0.001	-0.005	-0.010
	(0.010)	(0.011)	(0.011)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.359	0.356	0.361
F-Statistic	137.3	130.7	120.9

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports OLS estimates. The unit of observation is an individual. The dependent variable is newspaper readership. Standard errors are clustered by village. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in the text. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 2) and 100 km (Column 3) away from a historical mission settlement.

TABLE VIII
INVESTMENTS OF SOCIETIES WITH AND WITHOUT THE PRINTING PRESS

	No Printing	Printing	Diff/se
Mission Characteristics			
Arrival Date	1867	1842	25**
			(8)
Bible Society	0.10	0.09	0.01
			(0.06)
Number of Native Workers	1.38	1.42	-0.04
			(1.43)
Total Population	220	172	48
			(61)
Investment in Education			
Schools (any kind) in mission	0.37	0.51	-0.14
			(0.11)
Number of Students	215	166	49
			(61)
Schools per Student (%)	0.54	0.66	-0.12
			(0.24)
Teachers per Student (%)	9.87	11.07	-1.19
			(3.42)
Other Investments			
Health Facilities	0.26	0.46	-0.20
			(0.16)
Physicians per Capita (%)	0.56	0.19	0.37
			(0.59)
Health Facilities per Capita (%)	2.22	0.91	1.30
			(1.49)
Observations	69		

Notes: The table compares average investments performed by societies in the entire world depending on whether they invested in the printing press somewhere in the world before 1903. Societies compared are those also present in sub-Saharan Africa.

TABLE IX
MISSIONS CHARACTERISTICS IN SUB-SAHARAN AFRICA AND "SOCIETY PP", OLS ESTIMATION

	(1) Society PP	
	b	se
Geographic Characteristics		
Accumulated Temp /1000	-0.000	(0.000)
Annual Precipitation/ 1000	-0.013	(0.034)
Suitability for Rainfed Crops	-0.004	(0.006)
Number of Growing Days / 100	0.001	(0.003)
Distance to Capital, 100 km	-0.007	(0.006)
Distance to the Coast, 100 km	-0.005	(0.004)
Malaria Ecology	0.005	(0.004)
Historical Characteristics		
Slave Exports, per capita	-0.017	(0.022)
Railway Contact	-0.034	(0.032)
Explorer Contact	0.003	(0.023)
Initial Population Density	-0.000	(0.000)
Distance to 1400 City, 100 km	-0.007	(0.007)
Distance to 1800 City, 100 km	0.001	(0.001)
Mission Characteristics		
Arrival Date	0.001	(0.001)
Bible Society	-0.076	(0.074)
Number of Native Workers	0.000	(0.002)
Total Population	-0.000	(0.002)
Investment in Education		
Schools	0.031	(0.029)
Number of Students	0.000	(0.002)
Schools per Student (%)	0.010	(0.011)
Teachers per Student (%)	-0.000	(0.000)
Investments in Health		
Health Facilities	0.007	(0.011)
Physicians per Capita (%)	-0.000	(0.004)
Health Facilities per Capita (%)	-0.004	(0.003)
Observations	371	
Country FE	Yes	
Clusters (Society)	48	
R2	0.204	

Notes: * p<0.10, ** p<0.05, *** p<0.01. This table reports OLS estimates of mission-level regression of the share of missions from the mission's society equipped with printing presses in all the regions of the world outside sub-Saharan Africa on mission characteristics, investments, geographical and historical characteristics. The unit of observation is a mission. Standard errors are clustered by society.

TABLE X
IMPACT OF THE PROXIMITY TO A PRINTING PRESS, IV ESTIMATION

	(1) 200km	(2) 150km	(3) 100km
Panel A: Dependent Variable is Distance Printing Press			
Village Printing (50)	-0.570***	-0.572**	-0.458**
	(0.169)	(0.176)	(0.184)
Panel B: Dependent Variable is News Readership			
Distance Printing Press	-0.066**	-0.058*	-0.057*
	(0.030)	(0.031)	(0.033)
Observations	11925	10583	9059
Baseline Controls	Yes	Yes	Yes
Clusters	1401	1267	1093
R2 First Stage	0.636	0.628	0.622
F First Stage	60.825	65.827	56.469

Notes: * p<0.10, ** p<0.05, *** p<0.01. The unit of observation is an individual. Standard errors in parentheses are clustered by village. The table reports the first and second stage of the IV estimation of the impact of the distance to a printing press on newspaper readership. The distance to a printing press is instrumented by Village Printing$_j$(50). The construction of the variables "Village Printing$_j$(50)" and "Denomination PP$_m$" is described in more details in the text. The controls are the individual-, village-, ethnicity- and mission-level controls described in the text.

TABLE XI
PROXIMITY TO A PRINTING PRESS AND EDUCATION, CONTROLLING FOR OBSERVABLES

	Education		
	(1)	(2)	(3)
	200km	150 km	100 km
	b/se	b/se	b/se
Distance Printing Press	-0.023	-0.034	-0.036
	(0.029)	(0.028)	(0.029)
Distance Any Schools	-0.038	-0.024	-0.021
	(0.050)	(0.049)	(0.050)
Distance High/Boarding School	-0.071	-0.089*	-0.090*
	(0.051)	(0.048)	(0.050)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.379	0.396	0.389
F-Statistic	131.5	122.9	105.1

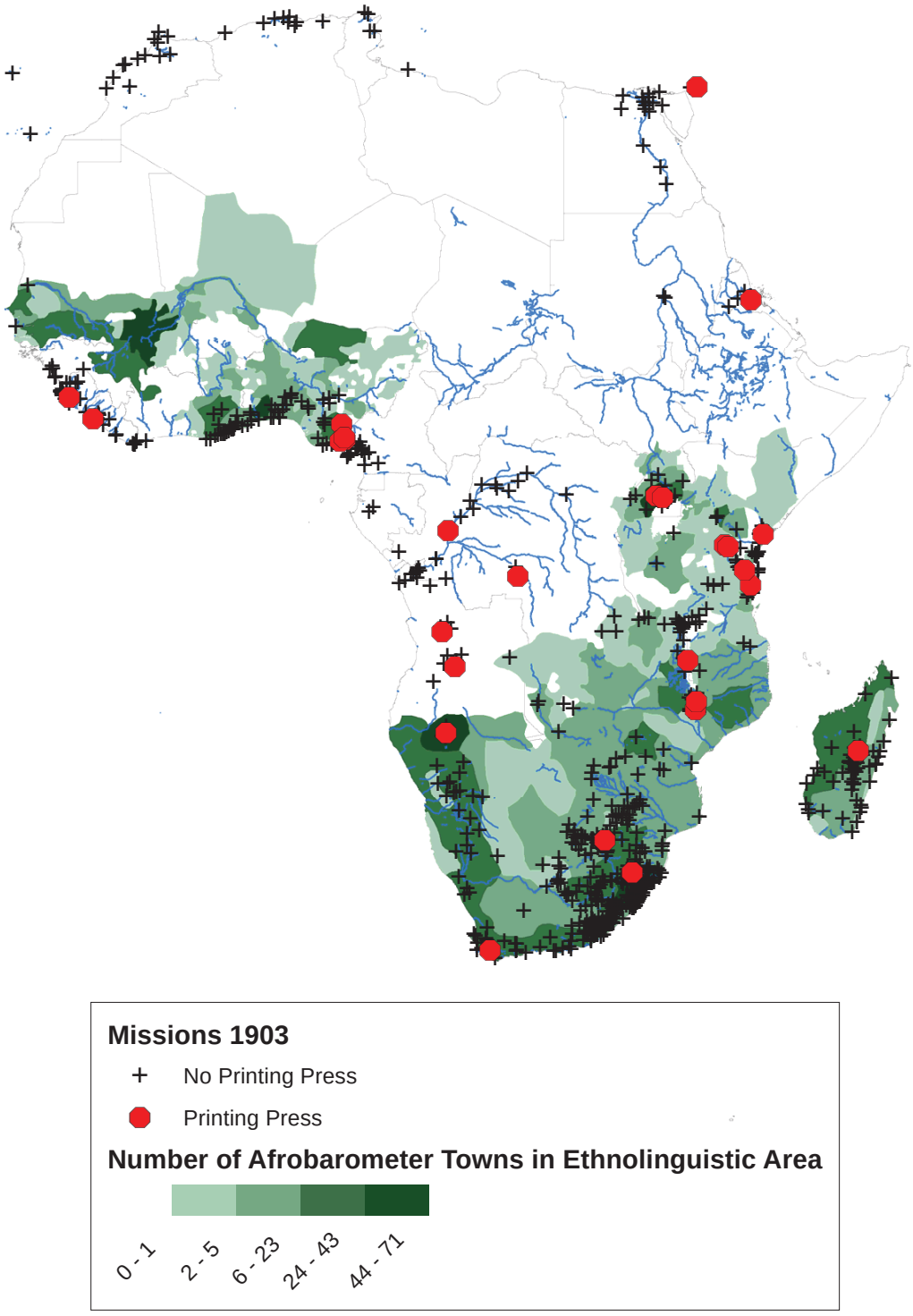
Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports OLS estimates. The unit of observation is an individual. Standard errors in parentheses are clustered by village. The controls are the individual-, village-, ethnicity- and mission-level controls described in the text. The dependent variable is the level of education nowadays. In Columns 1 to 3 the sample is sequentially restricted to individuals living 200 km (Column 1), 150 km (Column 2) and 100 km (Column 3) away from a historical mission settlement.

TABLE XII

PRINTING PRESS AND POLITICAL PARTICIPATION, 200KM THRESHOLD

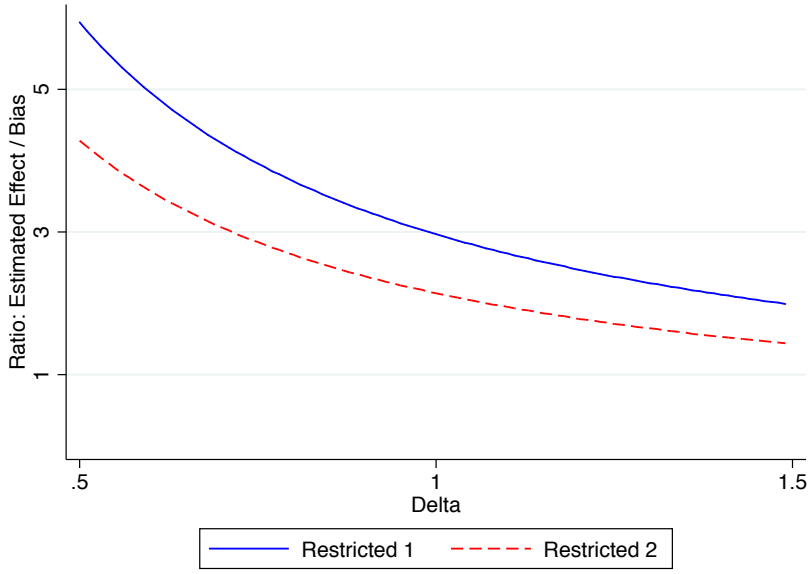
	(1) Register b/se	(2) Register b/se	(3) Turnout b/se	(4) Turnout b/se	(5) Action b/se	(6) Action b/se	(7) Listen b/se	(8) Listen b/se	(9) Satisfaction b/se	(10) Satisfaction b/se
Distance Printing Press	0.003	0.003	0.004	0.004	-0.026***	-0.026***	-0.020*	-0.018	-0.013	-0.013
	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)	(0.011)	(0.011)	(0.009)	(0.009)
Read News		-0.003		-0.002		0.045***		0.056***		-0.010
		(0.009)		(0.009)		(0.011)		(0.014)		(0.012)
Listen News		0.024**		0.023**		0.043***		0.008		0.044***
		(0.011)		(0.012)		(0.014)		(0.019)		(0.017)
Watch News		-0.001		0.005		0.002		0.005		-0.012
		(0.009)		(0.010)		(0.012)		(0.015)		(0.013)
Observations	12254	12254	12297	12297	12297	12297	8806	8806	10077	10077
Baseline Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1453	1453	1454	1454	1454	1454	1388	1388	1430	1430
R2	0.227	0.227	0.205	0.205	0.153	0.156	0.0723	0.0745	0.194	0.195
F-Statistic	50.87	48.52	53.84	51.29	49.56	48.99	11.89	11.67	44.67	42.85

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports OLS estimates. The unit of observation is an individual. The dependent variables are different measures of civic attitudes depending on the columns. Standard errors in parentheses are clustered by village. The baseline controls are the individual-, village- and ethnicity-level controls described in the text and the distance to the closest mission without a printing press. All specifications include country fixed effects. The additional controls are the determinants of the location of mission stations, geographic characteristics, mission characteristics and investments and the distance to the closest mission settlements with different kinds of investments described in more details in the text. The sample is restricted to individuals living 200 km away from a historical mission settlement.

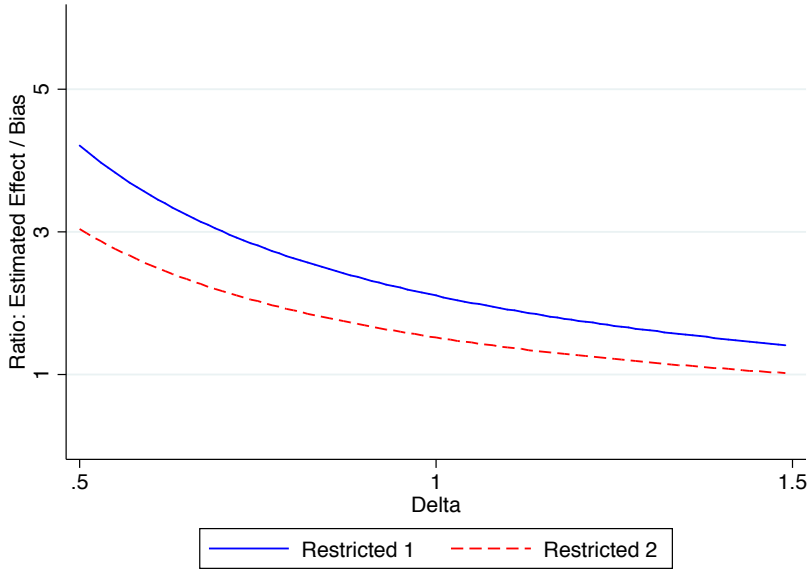


Notes: This map is a digitized and geocoded version of plates 14 to 18 of Dennis, Beach, and Fahs (1903). The geocoding was conducted by the authors.

FIGURE I
MISSION STATIONS WITH AND WITHOUT A PRINTING PRESS IN 1903



(1) $R_{\max} = 0.6$

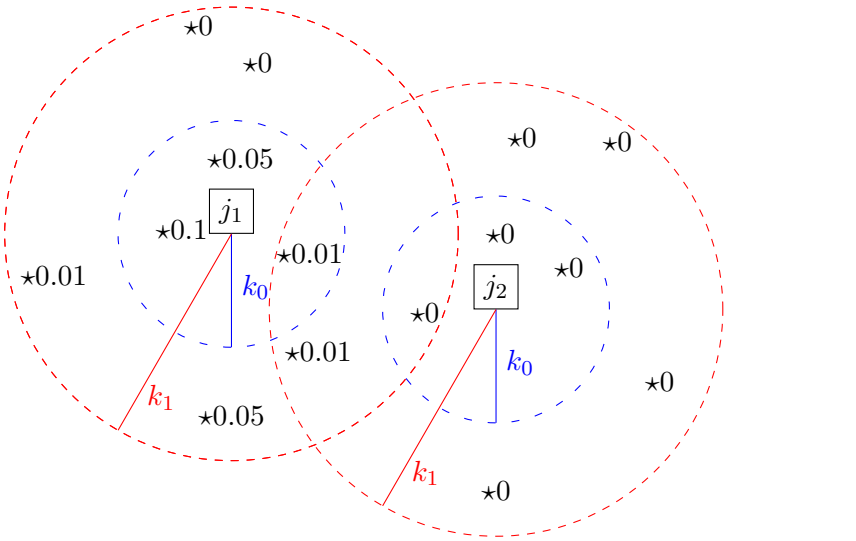


(2) $R_{\max} = 0.7$

Notes: Each graph plots the ratio of the treatment over the bias $B(\delta)$ using two different sets of restricted controls M. The first set ("Resricted 1") only includes country fixed effects. The second set ("Restricted 2") includes country fixed effects, age, age squared, gender, distance to the closest mission, and distance to the capital city. Figure II1 (respectively II2) uses the value $R_{\max} = 0.6$ (respectively $R_{\max} = 0.7$) to compute $B(\delta)$.

FIGURE II

MAGNITUDE OF THE TREATMENT RELATIVE TO THE BIAS FOR DIFFERENT VALUES OF δ



$\star$	Mission
j	Village
k	Radius
$\star\, x$	A share x of missions from this society have a printing press outside sub Saharan Africa

Notes: Figure III provides an illustrative example of how we construct the "Village Printing$_j(k)$" variable. In the Figure, we consider the case of two different villages – j_1 and j_2 – and of two different distances given by the radius k_0 and k_1.
Village Printing$_{j_1}(k_0) = 0.16 = 0.1 + 0.05 + 0.01$.
Village Printing$_{j_1}(k_1) = 0.23 = 0.05 + 0.1 + 0.01 + 0.01 + 0.01 + 0.05$.
Village Printing$_{j_2}(k_0) = 0$.
Village Printing$_{j_2}(k_1) = 0.02 = 0.01 + 0.01$.

FIGURE III
INSTRUMENTING THE DISTANCE TO THE PRINTING PRESS USING MISSIONS' SOCIETY: A GRAPHICAL ILLUSTRATION