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The Long-Term Effects of the Printing Press in Sub-Saharan Africa

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Abstract

This article delves into the relationship between newspaper readership and civic attitudes, and its effect on economic development. To this end, we investigate the long-term consequences of the introduction of the printing press in the 19th century. 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, within regions located close to missions, proximity to a printing press significantly increases newspaper readership today. We also document a strong association between proximity to a printing press and contemporary economic development. Our results are robust to a variety of identification strategies.

Keywords: historical persistence, printing press, Protestant missions, newspaper readership, political participation, economic development.
JEL No: D72, N37, N77, O33, Z12, Z13.

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1 Introduction

This article delves into the relationship between newspaper readership and civic attitudes, and its effect on economic development. To this end, we investigate the long-term consequences of the early introduction of the printing press in the 19th century 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). In addition, according to the principle of the *Sola Scriptura*, central to the Protestant doctrine, every Protestant should be able to read the Bible. Recent work has emphasized this incentive to increase literacy as an alternative explanation for the economic success of regions that first converted to Protestantism (Becker and Woessmann, 2009; Bai and Kung, 2011; McCleary and Pesina, 2012; Woodberry, 2012; Cantoni, 2013). These studies consider Protestant conversion as a whole. Instead of using such a binary approach, we exploit different types of missionary treatment. Missions invested in numerous activities. We focus on the introduction of the printing press and show that it still has consequences on newspaper readership nowadays. We discuss other long-term effects of the printing press; we document in particular a strong association between proximity to a printing press and contemporary economic development, and show that newspaper readership might explain this positive relationship. For this purpose, we built and geocoded an entirely new dataset of Protestant mission settlements. For each settlement, we document the exact geographic location, the educational, health-related and printing investments, as well as geographic and historical characteristics. Producing these data is our first contribution. Our second contribution is to identify the long-term effects of the printing press using an original empirical strategy relying on our reading of history.

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). Investing in printing necessitated 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 the printing technology enabled the local development of a culture of writing and information diffusion, beyond the single field of religious literature (Reports of the LMS, 1913). Publishing material for Africa was indeed central to the missionary ambitions since the

commencement of their work (Fahs and Davis, 1935); mission presses not only published Christian texts but were also the first to produce all sorts of written material and newspapers in indigenous languages (Maake, 2000). Local newspapers thus developed first around missionary printing presses, yielding a persistent geographic concentration of publishing activities and newspaper readership.

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. Moreover, we also find that a one-standard deviation increase in the proximity to a mission with a printing press increases contemporary economic development by around 10% of a standard deviation.

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), 150-kilometer (93 miles) and 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 first control for observable covariates. 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.[1] Despite our attempts to control for observable factors, our estimates might 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,

[1]In the online Appendix, we also use insights from Altonji et al. (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.

we instrument the proximity to the closest printing press. In the 19th Century, missionaries formed numerous societies that were not equally inclined to the same activities. 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.

Related literature Woodberry (2004, 2012) and Woodberry and Shah (2004) first document the role of Protestant missionaries on the consolidation of liberal democracy and emphasize the introduction of the printing press and newpapers as a potential mechanism. They identify the relationship between Protestantism and democracy using a cross-country identification strategy. On the contrary, we estimate the long-term effects of the printing press in sub-Saharan Africa using a variety of within-mission empirical strategies. Our econometric analysis moves beyond selection from missions's location and selection of missions into printing. Our empirical work relies on the building of a new geocoded dataset and on the use of several previously-unexploited historical archives. Moreover, we explore various channels that may explain persistence and document the effect of the printing press on economic development.

Our results also complement a growing literature documenting the persistence of development paths in developing countries (Acemoglu et al., 2001; Glaeser and Shleifer, 2002; Porta et al., 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, political participation and economic development, even within regions sharing the same institutional framework. As noticed by Feyrer and Sacerdote (2009), Huillery (2009) and Huillery (2011), historical events can explain heterogenous development dynamics. Recent micro-oriented studies therefore isolate specific channels through which a development dynamic was durably established (Nunn, 2008; Huillery, 2009; Dell, 2010; Cogneau and Moradi, 2011; Alesina et al., 2011; Michalopoulos and Papaioannou, 2011, 2013; Voigtländer and Voth, 2012). Of particular importance for sub-Saharan Africa are early investments. Wantchekon et al. (2012) highlight for example the durable impact of the first schools in Benin. 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 European cities where printing presses were established between 1450 and 1500 grow faster between 1500 and 1600 than similar cities which were not early adopters. While its focus is on urbanization and economic change in the 16th and 17th Century Europe, we identify the effect of the early arrival of the printing press on contemporary newspaper readership,

political participation and economic development in sub-Saharan Africa. Consistently with the hypothesis from historians of sub-Saharan Africa (Omu, 1978; Tudesq, 1995), we are the first to show empirically that proximity to the missionary press is associated with higher newspaper readership today. Moreover, we find that contemporary economic development is higher in regions close to the missionary press. Media and the quality of information have recently been shown to affect economic and democratic development (Casey, 2013; Cagé, 2014). We show that the development of the media might be a channel explaining the relationship between proximity to the printing press and contemporary economic development.

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. We discuss extensively endogenous selection of missions into printing. Section 5 presents the long-term relationship between proximity to a printing press and economic development, and analyzes channels explaining this relationship. Section 6 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. Following the principle of the *Sola Scriptura*, every Protestant should be capable of reading and interpreting the Bible (Eisenstein, 1980; Woodberry and Shah, 2004; Woodberry, 2012). On this topic, Eisenstein (1980, p.158) writes: "*(...) Christian missionaries continued to set up printing presses in remote parts of the world to turn out Gospels and Psalters as had been done in Mainz four hundred years earlier*". On the contrary, for the Catholic religious practice, reading the Bible is not necessary. This difference between Protestants and Catholics appears on the title page illustration of *Actes and Monuments* (Foxe et al., 1830) showing *"devout Protestant with books on their laps and Catholic with prayer beads in their hands"* (Eisenstein, 1980, p.173).

Protestant missions facilitated the access to the printing press, acting as the intermediaries of 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.[2] 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 Xhosa 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

[2]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.

his first iron press around 1800, its price was £90. The price began to drop with competition; 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. In the 1840s, the Albion press – following the Columbian Press – varied in size from Amateur (15cm×12cm or $7\times5\frac{1}{2}$in) to Double Royal (100cm×58cm or 40in×23in). The price of the Double Royal was £75.[3] In 1830, the average annual income in the United Kingdom per adult was £30, while the average annual wage was £20. The average worker (blue-collar) annual wage was £15.[4] 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 indigenous population 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, ed, 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 indigenous population, most of the first indigenous newspapers were printed and sponsored by mission centers. Woodberry (2012) qualifies conversionary Protestants as being *"a crucial catalyst initiating the development and spread (. . .) of newspapers"*.

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.[5] The *Iwe Irohin*

[3]Not to refer to the prices of the cylinder machine which were used in the United States at the time. The simplest Koenig machine, the single cylinder, cost £900. A double machine cost £1,400 and the most advanced one £2,000.

[4]See e.g. Piketty and Zucman (2014).

[5]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

("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 in South Africa. Eight years later, in November 1884, the English/Xhosa weekly *Imvo Zabantsundu* ("The African Opinion") was published. It was the first black-owned 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 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*, was first published 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 1966 *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 continued 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. This 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 et al. (2005), it is harder for governments to control newspapers while

started in 1857, is regarded as the oldest newspaper in the Tswana language (Switzer, 1984).

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. In the online Appendix, we provide cross-country evidence of the persistence of newspaper supply.[6] Figure A.6 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 A.7 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. This suggestive evidence 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, newspaper readership is our variable of interest.

3 Data and Missionary Locations

3.1 Data

3.1.1 Historical data

Missionary activity We construct the mission-level data from the *Geography and Atlas of Christian Missions* (Dennis et al., eds, 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 online Appendix Figure A.2).

As opposed to other available geographic datasets of Protestant missions (Nunn, 2009a), ours contains detailed information for each mission settlement. In the *Geography and Atlas of Christian Missions*, each mission station is uniquely identified in a statistical appendix providing information on the mission's size (number of students,

[6] In the online Appendix, we present the few data sources on sub-Saharan African newspapers that are available and that we digitize and merge together.

of missionaries, etc) and a detailed record of its activities and investments. For example, we know whether each mission had a printing press, a school, a high school, a dispensary, or a hospital. The exhaustive list of variables and a reproduction of one page of the statistical index are provided in the online Appendix Figure A.1. We digitize this information for the entire world and geocode it for Africa. 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 1 shows the location of mission stations and their printing presses in 1903. This dataset is, to the extent of our knowledge, the most exhaustive recording of missionary investments in the world, and it is geocoded for Africa. We hope this dataset will be of use for future research.

Since very few Catholic missions are recorded in the *Geography and Atlas of Christian Missions*, we use data from Béthune (1889) to locate them. This source does not provide information on the investments conducted. This is not an empirical issue since Catholic missionaries had no role in bringing the printing press. Moreover, our specifications always controls for the distance to the closest Catholic mission.

Population density Historical population density comes from the HYDE 3.1 database (Klein Goldewijk et al., 2011). This database provides rasters of estimated historical population density on a 0.5 by 0.5 degree latitude longitude grid. The estimates are the results of a bio-geographic model that combines information on population density at the national and subnational levels with climatic and geographic data to infer a local estimate of the population density (Klein Goldewijk et al., 2010, 2011). For the national-level population density, data are from the Maddison Project Database, McEvedy and Jones (1978) and Livi-Bacci (2001). Sub-national level data come from censuses. The HYDE 3.1 database provides 56 rasters covering the period from 10000 BC to AD 2000. According to the documentation, the data is reliable for Africa starting from AD 1700. Figure A.3 in the online Appendix gives examples of the population density maps in 1700, 1800, 1900 and 2000. We extract all these estimates in a buffer of 10 km around each mission and around each town from the Afrobarometer.

Figure 2 shows the evolution of population density, as estimated in the HYDE 3.1 database, around missions depending on whether they had a printing press. Missions start to diverge in the late 19$^{\text{th}}$ Century. Population density is estimated to be systematically higher around missions with a printing press *after* missions started to settle (the average arrival date of missions in Africa is 1850). Such divergence between missions with and without the printing press supports our hypothesis of a positive impact of the missionary printing press for long-term development. However, because data from HYDE 3.1 is based on imperfect estimates of population density, we can only interpret

this figure as suggestive evidenc.

Publication records We gather information on the number of publications printed at the mission press until 1923, twenty years after the publication of *Geography and Atlas of Christian Missions*. The *Bibliography of Christian Literature* (Rowling and Wilson, 1923) inventories all the books and reviews, religious or not, published by the missionaries. From this source, we identify 18 presses from our original sample that had a publication record in 1923. These printing presses were probably the most productive or the ones with the most stable production across time.

Historical controls 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).

3.1.2 Contemporary data

Newspaper readership Data on newspaper readership are from the 2005 Afrobarometer surveys. There are 17 sub-Saharan African 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.[7] Table A.3 in the online Appendix provides summary statistics for these variables.

Light density at night To proxy for contemporary economic development, we follow Michalopoulos and Papaioannou (2013) and use satellite images of light density at night. The data come from the Defense Meteorological Satellite Programs Operational

[7]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.

Linescan System of the National Geophysical Data Center. This system reports images of the earth at night captured from 8:30pm to 10:00pm local time. The satellite detects lights from human settlements, fires, gas flares, lightning, and the aurora. The measure ranges from 0 to 63 and is calculated for every 30-second area (approximately 1 square kilometer). The resulting annual composite images of lights are created by overlaying all images captured during a calendar year, dropping images where lights are shrouded by cloud or overpowered by the aurora or solar glare (near the poles), and removing ephemeral lights like fires and lightning (the map used is presented in the online Appendix Figure A.4). We construct average light density in 2012 for each mission and each Afrobarometer town. This measure is the average light density reported on the night light raster in a 10 km buffer around each location. Following Michalopoulos and Papaioannou (2013), we use the natural logarithm of average light density.

In the online Appendix, Figure B.1 plots our measure of average light density for Afrobarometer towns as a function of the distance to the printing press. The plot presents first suggestive evidence of the negative relationship between the two variables.

Geographic characteristics Finally, 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 A.2 in the online Appendix for more details). As a baseline, we use the 150 km threshold to define towns close to a mission.

Mission location A number of factors played a role in determining the location of mission settlements. Among them 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).

These known trends are for the most part confirmed in our data. In Table 1 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 (De Gruchy, 1999; Nunn, 2010).

According to Table 1 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 1.

Location of the printing press Did missions with a printing press locate in regions with specific geographical or historical characteristics correlated with determinants of newspaper readership? Table **??** compares the geographic and historical characteristics of missions with and without a printing press and perform a t-test on the equality of means. Missions with the printing press were not, on average, located in more geographically favored areas. 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, as well as initial population density.

On the contrary, missions with a printing press have more favorable historical characteristics: they are closer to historical cities and explorer routes. All our specifications control for these characteristics.

3.2.1 The printing press and other investments

Did missions with a printing press conduct different types of investments or have different characteristics? Table **??** 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.

4 Newspaper Readership and the Printing Press: Empirical Analysis

4.1 Specification and Identification Strategy

Let i index individuals, j index the village in which individuals live[8], 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 1

[8]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.

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 from 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.[9]

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[10], the historical exposure to the trans-Atlantic and Indian slave trades, the precolonial population density (in 1700), and the population density in 2005.

At the ethnicity-level (vector of ethnicity-level controls $\mathbf{Z_e'}$), we control for the malaria ecology of the land, average 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 the baseline set of controls.

4.2 OLS Estimation

4.2.1 Baseline Results

Table 3(a) presents OLS estimates of the impact of the proximity to a mission with a printing press on newspaper readership. In all the specifications we include the baseline controls. 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 1.4 percentage points. Controlling for the proximity to the closest mission increases slightly the point estimate to 1.5 percentage points; there is no effect of the proximity to a mission without a printing press (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

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

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

reading newspapers by 3.6% of a standard deviation (Column 2). In the following tables we include the proximity to a mission without a printing press in our baseline set of controls.

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. Therefore, we restrict our sample of analysis to regions near historical mission settlements. Such restrictions aim at correcting for possible selection in mission location. The rest of the analysis is conducted *within* regions near missions.

In Columns 3 to 5 of Table 3(a) 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 km (Column 3), 150 km (Column 4), and 100 km (Column 5) radius around the village. 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 in the proximity to a printing press. The point estimates vary between 1.3 and 1.5 percentage points. Considering individuals living in a village with at least one mission in a 150 km radius around the village (Column 4), we find that a one-standard deviation increase in the proximity to the closest printing press increases newspaper readership by 3.1% of a standard deviation. A variance decomposition of the results 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.

The online Appendix Table B.1 reports the estimated coefficients for all the covariates. All the coefficients are of the expected sign. Table B.2, reports the standardized coefficients (beta coefficient) for all the covariates. The impact of the distance to the printing press is of the same order of magnitude as the intensity of cash constraints, the distance to the capital and smaller than the urban area dummy. The effect of the respondent's level of education is around ten times higher. This difference is not surprising since distance to the printing press captures a historical effect that might have been attenuated over time. The effect of the interaction between proximity to the printing press and education is discussed in Section 5.

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).

4.3 Endogenous Selection of Missions into Printing

A crucial empirical challenge is the possibility of endogenous selection of missions into printing. Therefore, we augment regression (1) with an extensive set of covariates. We then develop an instrumental variable approach.

4.3.1 Selection on Observables

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 an 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 be 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 3(b) 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 1.8 to 2.3. 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]

[11] In the online Appendix Table C.4 we report the coefficients for all the different distances. Only distance to the printing press matters for newspaper readership nowadays

4.3.2 IV Estimation

Despite our attempts to control for observable factors, our estimates might 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.[12]

In the early period of missionary expansion, missionaries faced numerous difficulties despite the support of an increasing number of church ministers (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 18th 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

[12]Bai and Kung (2011), in their study of protestantism and economic prosperity in China, similarly compare the effects different Protestant denominations had on economic outcome, different denominations emphasizing Calvinist principles differently. We improve this empirical strategy in two important ways. First, while Bai and Kung (2011) work at the denomination level, we work at the society level (see more on this below). Second and most importantly, we are able to measure the exact investments made by each society.

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 B. Simpson, had not invested in a single printing press ten years later, even though it had already settled 52 missions around the globe (Dennis et al., eds, 1903).

IV strategy There are 5,535 missions in the entire world outside sub-Saharan Africa (6,258 including sub-Saharan Africa) reported in the *Geography and Atlas of Christian Missions*. Only 2.3% of these missions had a printing press.[13] These missions were affiliated with 262 different societies among which 69 are present in both sub-Saharan Africa and the rest of the world. Moreover, the arrival date of missions with a printing press to Africa and to the rest of the world is almost identical (1877 for both samples).

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*. In sub-Saharan Africa, we know 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). Among the 69 originating societies recorded, 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 online Appendix Table B.5 we find a statistically significant and positive correlation of "Society PP" with the probability that a mission has a printing press.

Let "Village $\text{Printing}_j(k)$" 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 $\text{Printing}_j(k)$" is defined in equation (2):

$$\text{Village Printing}_j(k) = \sum_{x \leq k} \text{Society PP}_{m(x)} \tag{2}$$

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

Figure 3 represents the construction of the instrumental variable. Take the example of two different villages j_1 and j_2 and two different distances given by the radii 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 village j_2. By construction, the larger the radius, the higher the potential value of Village Printing$_j(k)$.

"Village Printing$_j(k)$" is used as an instrument for "Distance Printing Press". The exclusion restriction is that the share of missions from a society having invested in a printing press outside sub-Saharan Africa ("Society PP$_m$") is not correlated with long-term determinants of newspaper readership in sub-Saharan Africa. For instance, societies that invested the 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 exclusion restriction in Table 4 and online Appendix Tables B.3. Table 4 compares the average investments of missionary societies outside sub-Saharan Africa depending on whether they invested in the printing press. 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. Similarly, Table B.3 in the online Appendix reports OLS estimates of the mission-level regression of "Society PP" on mission characteristics, investments, geographic and historical characteristics. None of the coefficients are statistically significant. Societies that invested the more in printing outside sub-Saharan Africa did not systematically conduct other type of investments in sub-Saharan Africa, nor did they settle in more geographically favored regions.

Results Table 5 presents the results using a 50 km radius for the construction of "Village Printing (k)".[14] Table 5 Panel A gives the results of the first stage of the estimation. All the coefficients are negative and statistically significant. 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 less than 150 km away from a historical mission settlement (Column 2).

Table 5 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 press decreases individual newspaper readership nowadays by 10%

[14] In the online Appendix Tables B.6 and B.7, we show that the results are robust to the use of other radii.

of a standard deviation for regions located less than 150 km away from a historical mission settlement (Column 2). Results for regions located less than 200 km or 100 km away from a historical mission settlement are of similar magnitude.

The magnitude of the IV coefficients is larger than the OLS's. 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.

Taken together, all the results from Section 4 are consistent with the idea that the introduction of the printing press has a long-lasting effect on newspaper readership.

4.3.3 Robustness Checks

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

In the online Appendix Section C.1, we check that the results of Table 3(b) are robust to 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). Our results robust to using matching (Table C.3).

Moreover, in the online Appendix Section C.2, we use insights from Altonji et al. (2005) and Oster (2013) to assess the bias from unobservables using the sensitivity of the treatment to added controls under the proportional selection assumption. The resultsmake it unlikely that the entire estimated effect of the distance to the printing press is driven by unobserved variables.

Some of the contemporary controls, especially education, may be *bad controls* in the sense of Angrist and Pischke (2009). This issue would arise if any of the contemporary controls were also outcomes. Online Appendix Table C.6 presents the results of the estimation of equation (1) with the additional observables added in Table 3(b) but without 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 in the controls set. The results are not significantly different from those presented in Table 3(b).

Because missions that invested in the printing press might be larger, we also 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 vari-

able.[15] The results are given in the online Appendix Table C.7. Distance to the largest missions has no effect on newspaper readership nowadays.

Online Appendix Table C.9 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.

We also 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 the closest mission be also considered as a treatment. Table C.8 shows that our results are robust to this two-way clustering strategy. Our results are also robust to a Probit rather than an OLS specification (online Appendix Table C.5).

Finally, online Appendix Table C.10 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.

5 Discussion

Is newspaper readership today really measuring regional persistence in newspaper reading habits? Or are our results driven by an increase in education in regions close to the printing press, even *within* regions close to missions? This section first explores the possible channels explaining the effect of the printing press on newspaper readership. It then investigates the relationship between proximity to a printing press and political participation. Finally, it documents the long-term consequences of the printing press on economic development and studies the channels explaining this relationship.

5.1 Printing Press and Newspaper Readership: Channels of Transmission

Education As one of the missionaries' objectives was to maximize conversion through reading the Bible, they taught literacy to the native population (Woodberry, 2004).[16] A number of recent studies emphasize the positive consequences on human capital of con-

[15] The size of the mission is the total number of students, missionaries and indigenous teachers and workers. Within these 30 largest mission, only two have a printing press.

[16] The role of missionary activity on literacy was significantly reduced later in the Century (around the 1940s) when imaging technology developed (McCleary and Pesina, 2012).

version through reading the Bible (Becker and Woessmann, 2009; Bai and Kung, 2011; McCleary and Pesina, 2012; Woodberry, 2012). In the sub-Saharan African context, Nunn (2009b) finds that Protestant missions increased educational attainment (see also Nunn and Wantchekon, 2011). Human capital accumulation, fostered by missionary activity, might thus be driving our results. We show in this section that it is not the case.

Two aspects of our econometric analysis account for the effect of education on newspaper readership, independently of proximity to the printing press. First, education is included in our baseline set of controls. Second, we control for 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. These controls capture the historical regional determinants of education. Moreover, as a falsification test, we estimate the impact of the proximity to a printing press on education. Table 6 shows no statistically significant effect of the distance to a printing press on education.

This result does not imply that missionaries had no long-term impact on education and human capital accumulation. Consistently with the existing literature (Wantchekon et al., 2012), we find a positive and statistically significant impact of the proximity to a mission with a high-school on education (Table 6). For regions located less than 150 km away from a mission, 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. Moreover, distance to the printing press can only affect newspaper readership if people are educated enough to read the news. In Table 7(a), we interact the distance to the printing press with a binary variable equal to one if the education level of the individual is above the median (equivalent to having completed elementary schooling). As expected, proximity to a printing press only affects newspaper readership when education is high enough.

Publication records Is newspaper readership today really capturing the regional historical development of the newspaper and printing industry? To answer this question, we use a proxy for the regional development of the publishing industry; we gather information on the number of publications printed at the mission press until 1923. In the publication record data, we find that 18 missions with a printing press (out of the 27 missions equipped with a printing press in 1903) had a publication record in 1923. The missions where these printing presses were located did not exhibit any particular type of geographical or historical characteristics nor did they specialise in any kind of specific investments (online Appendix Tables A.4 and A.5). We therefore interpret the presence of such records as a proxy for the activity of the printing presses: printing

presses with a publication record in 1923 were probably the most active. Table 7(b) shows the result of regression (1) when we add distance to the closest mission with a publication record ("Distance PP with Publication") as a control. The coefficient associated with "Distance PP with Publication" is negative and statistically significant. Moreover, once we control for the distance to a mission with a printing press and a publication record, the coefficient associated with the distance to a printing press is no longer statistically significant. This suggests that the impact of the distance to a printing press on newspaper readership may be explained by the development of publishing activities.

The results of Table 7(b) have to be taken carefully since they rely heavily on the only archival source we found to track the middle-run evolution of the publishing activities of missions with a printing press. However, they are in line with our assumption that the long-term impact of the printing press on newspaper readership may be due to the early development of the newspaper industry around missions with a printing press.

5.2 Political Participation

The literature on the determinants of political participation in sub-Saharan 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 – through proximity to a printing press – might be another important determinant of political participation. Information may indeed affect political outcomes (DellaVigna and Kaplan, 2007; Enikolopov et al., 2011) and participation at elections (Strömberg, 2004; Oberholzer-Gee and Waldfogel, 2009; Gentzkow et al., 2012; Cagé, 2014).[17]

We estimate the impact of the distance to a printing press on three different measures of political participation registration for elections; voting in past elections; and a proxy for political participation at the local level ("Actions as Citizen"). We also estimate its impact on a measure of satisfaction with the democratic system ("Satisfaction") as well as on a proxy for the quality of political discussion at the local level ("Listen").[18]

Proximity to the printing press might have affected political participation through newspaper readership. However, the historical dynamics associated with the arrival of the printing press might also affect directly political participation. For instance, the introduction of the printing press may have increased nationalism through the strength-

[17] With the notable exception of Reinikka and Svensson (2005), 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.

[18] Each variable is described in details in the online Appendix, Section A.4. The description provides the question used in the Afrobarometer to construct the variable.

ening of a common language (Anderson, 1991).[19] Moreover, newspaper readership may have increased political participation, but the latter may also exhibit a persistent pattern.

Results We aim at determining whether there is a relationship between distance to a printing press and political participation.

Table 8 presents the results of the OLS regression of the different measures of political participation on distance to the printing press and the baseline and additional controls. Distance to the printing press only has a negative and statistically significant effect on political participation (or local political activism) as measured by "Actions". A one-standard deviation increase in distance to the printing press decreases "Actions" by 5.2% of a standard deviation (Column 6). The result remains stable when adding measures of contemporary media consumption (Column 7). This result is in line with the hypothesis stating that the historical dynamics associated with the printing press might have had a direct persistent effect on political participation.

In the next sub-section, we finally investigate the long-term consequences of the introduction of the printing press on economic development.

5.3 Contemporary Economic Development

According to Dittmar (2011), between 1500 and 1600, European cities where printing presses were established in the 1400s grew 60% faster than otherwise similar cities. We investigate here the link between distance to the printing press and economic development in sub-Saharan Africa. Figure 2 is consistent with the interpretation of distance to the printing press having generated a regional dynamic fostering economic development. From the beginning of the 20$^{\text{th}}$ Century, population density as estimated with HYDE 3.1 data is higher and grows faster around missions that brought the printing press than around missions that did not import it. Moreover, there is no evidence of any pre-existing gap in population density between regions close to missions with and without a printing press. However, because the population density from HYDE 3.1 is based on imperfect estimates of population density, we can only interpret this figure as suggestive evidence.

Table 9 shows the estimated coefficients from the regression of city-level light density

[19] *"If we consider the character of these newer nationalisms which, between 1820 and 1920, changed the face of the Old World, two striking features mark them off from their ancestors. First, in almost all of them "national print-languages" were of central ideological and political importance."* (p.67) Similarly, Eisenstein (1980) argues that *"it is not accident that nationalism and mass literacy have developed together. The two processes have been linked ever since Europeans ceased to speak the same language when citing their Scriptures or saying their prayers"* (p.165).

on "Distance Printing Press". A one-standard deviation increase in distance to the printing press significantly decreases light density by 10.7% of a standard deviation (Column 1). This estimate is robust to instrumenting distance to the printing press using the IV strategy described in Section 4.3.2 (online Appendix Tables B.9, B.10, and B.11).

How to explain such a long-term effect of the printing press on economic development among regions close to missions? Building on Habermas (1989), Dittmar (2011) argues that proximity to the printing press has enabled the development of a culture of information exchange and of an urban, bourgeois public sphere. We argue that the development of the newspaper industry may be another channel explaining the positive relationship between proximity to a printing press and contemporary economic development. In particular, newspaper readers can be more informed citizens more likely to cross party lines – Casey (2013) shows that it is indeed the case for Sierra Leone. In that case, through an increase in newspaper readership, proximity to a printing press may have increased political accountability which in turn leads to a more equitable allocation of public spending and higher economic development.

Column 2 of Table 9 examines whether the development of the media industry can explain the long-term effect of the printing press on economic development. As in Section 5.1, we add "Distance PP with Publication" as a control to capture the historical distance to the centers of development of the publishing industry. The effect of "Distance PP with Publication" is negative, statistically significant and of the same order of magnitude as the effect of distance to the printing press found in Column 1. The effect of distance to the printing press is no longer statistically nor economically significant when adding "Distance PP with Publication" as a control. Our results are therefore in line with the hypothesis stating that the development of the newspaper industry may be another channel explaining the positive relationship between proximity to a historical location of the printing press and contemporary economic development.[20]

6 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 has long-term effects on newspaper readership. Moreover, we

[20]In the online Appendix, Section B.2 uses an alternative method to explore the hypothesis stating that the development of the newspaper industry may be another channel explaining the positive relationship between proximity to a historical location of the printing press and contemporary economic development. The approach is very imperfect, therefore the results are to be interpreted carefully.

document a long-term impact on contemporary economic development. We show that the early development of the newspaper industry and reading habits can explain part of these long-term effects of the printing press on economic development in sub-Saharan Africa. Our results suggest that a better understanding of African media development will be key for the future of African democracy and economic change.

References

Acemoglu, Daron, "Constitutions, Politics, and Economics: A Review Essay on Persson and Tabellini's the Economic Effects of Constitutions," *Journal of Economic Literature*, 2005, *43* (4), pp. 1025–1048.

_ , Simon Johnson, and James A Robinson, "The Colonial Origins of Comparative Development: An Empirical Investigation," *The American Economic Review*, 2001, *91* (5), pp. 1369–1401.

Alesina, Alberto, William Easterly, and Janina Matuszeski, "Artificial States," *Journal of the European Economic Association*, 2011, *9* (2), 246–277.

Altonji, Joseph G, Todd E Elder, and Christopher R Taber, "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools," *Journal of Political Economy*, February 2005, *113* (1), 151–184.

Anderson, Benedict, *Imagined Communities: Reflections on the Origin and Spread of Nationalism*, Verso Books, 1991.

Angrist, J D and J S Pischke, *Mostly harmless econometrics: an empiricist's companion*, Princeton University Press, 2009.

Bai, Ying and James Kai sing Kung, "Diffusing Useful Knowledge While Spreading God's Message: Protestantism and Economic Prosperity in China, 1841-1920," *Mimeo, The Hong-Kong University of Science and Technology*, 2011.

Becker, Sascha O and Ludger Woessmann, "Was Weber Wrong? A Human Capital Theory of Protestant Economic History," *Quarterly Journal of Economics*, 2009, *124* (2), 531–596.

Béthune, Léon, *Les Missions Catholiques d'Afrique*, Desclee, 1889.

Bratton, Michael, Robert Mattes, and E Gymah-Boadi, *Public Opinion, Democracy, and Market Reform in Africa*, Cambridge University Press, 2005.

Cagé, Julia, "Media Competition and the Provision of Information," Mimeo, Harvard 2014.

Cantoni, Davide, "The Economic Effects of the Protestant Reformation: Testing the Weber Hypothesis in the German Lands," Discussion Papers in Economics 14811, University of Munich, Department of Economics March 2013.

Casey, Katherine, "Crossing Party Lines: The Effects of Information on Redistributive Politics," Working Paper 2013.

Church Missionary Society, ed., *The Church Missionary Atlas*, Student Volunteer movement for foreign missions, 1896.

Clair, Colin, *A History of European Printing*, Academic Press, 1976.

Cogneau, Denis and Alexander Moradi, "Borders that Divide: Education and Religion in Ghana and Togo since Colonial Times," Working Paper Series 2911, Department of Economics, University of Sussex November 2011.

De Gruchy, J W, *The London Missionary Society in Southern Africa: Historical Essays in Celebration of the Bicentenary of the LMS in Southern Africa, 1799-1999*, David Philip Publishers, 1999.

Dell, Melissa, "The Persistent Effects of Peru's Mining Mita," *Econometrica*, 2010, *78* (6), 1863–1903.

DellaVigna, Stefano and Ethan Kaplan, "The Fox News Effect: Media Bias and Voting," *The Quarterly Journal of Economics*, 2007, *122* (3), 1187–1234.

Dennis, James S, Harlan P Beach, and Charles H Fahs, eds, *World Statistics of Christian Missions*, Student Volunteer movement for foreign missions, 1903.

Dittmar, Jeremiah E, "Information Technology and Economic Change: The Impact of The Printing Press," *The Quarterly Journal of Economics*, 2011, *126* (3), 1133–1172.

Eisenstein, E L, *The Printing Press as an Agent of Change* number vol.˜1. In 'Volumes 1 and 2 in One.', Cambridge University Press, 1980.

Ellis, William, *History of the London Missionary Society*, John Snow, 1844.

Enikolopov, Ruben, Maria Petrova, and Ekaterina Zhuravskaya, "Media and Political Persuasion: Evidence from Russia," *American Economic Review*, 2011.

Fahs, C H and H E Davis, *Conspectus of Cooperative Missionary Enterprise*, International Missionary Council, 1935.

Feyrer, James and Bruce Sacerdote, "Colonialism and Modern Income: Islands as Natural Experiments," *The Review of Economics and Statistics*, May 2009, *91* (2), 245–262.

Foxe, J., J. Malham, and T. Pratt, *Fox's Book of Martyrs; Or, The Acts and Monuments of the Christian Church*, J. J.Woodward, 1830.

Fraser, Robert, *Book History through Postcolonial Eyes: Rewriting the Script*, Routledge, 2008.

Gentzkow, Matthew, Jesse M Shapiro, and Michael Sinkinson, "Competition and Ideological Diversity: Historical Evidence from US Newspapers," Working Paper 18234, National Bureau of Economic Research July 2012.

Gibson, Clark and James D Long, "Ethnicity, Performance, and Elections in Africa: an Experimental Approach to Voting Behavior," Mimeo, Harvard University 2012.

Glaeser, Edward L and Andrei Shleifer, "Legal Origins," *The Quarterly Journal of Economics*, November 2002, *117* (4), 1193–1229.

Goldewijk, K. Klein, A. Beusen, and Peter Janssen, "Long-Term Dynamic Model of Global Population and Built-up area in a Spatially Explicit Way: HYDE 3.1," *The Holocene*, 2010, *20*, 565–573.

Goldewijk, Kees Klein, Arthur Beusen, Gerard van Drecht, and Martine de Vos, "The HYDE 3.1 Spatial Explicit Data of Human Induced Global Land Use Change over the Past 12000 Years," *Global Ecology and Biogeography*, 2011, *20*, 73–86.

Gordon-Brown, A, *The settlers' press: seventy years of printing in Grahamstown covering the publication of books, pamphlets, directories, almanacs, newspapers, with historical notes and anecdotes and contemporary illustrations*, A. A. Balkema, 1979.

Habermas, Jurgen, *The Structural Transformation of the Public Sphere: An Inquiry into a Bourgeois Society*, The MIT Press, 1989.

Huillery, Elise, "History Matters: The Long-Term Impact of Colonial Public Investments in French West Africa," *American Economic Journal: Applied Economics*, April 2009, *1* (2), 176–215.

_ , "The Impact of European Settlement within French West Africa: Did Pre-colonial Prosperous Areas Fall Behind?," *Journal of African Economies*, March 2011, *20* (2), 263–311.

Ichino, Nahomi and Noah L Nathan, "Crossing the Line: Local Ethnic Geography and Voting in Ghana," *Forthcoming, American Political Science Review*, 2013.

_ **and** _ , "Do Primaries Improve Electoral Performance? Clientelism and Intra-Party Conflict in Ghana," *American Journal of Political Science*, 2013, *57* (2), 428–441.

Johnson, Hildegard B, "The Location of Christian Missions in Africa.," *Geographical Review*, 1967, *57* (2), 168–202.

Livi-Bacci, M., *A Concise History of World Population*, Wiley, 2001.

Maake, Nhlanhla, *Politics of Publishing in South Africa*, University of Natal Press,

McCleary, Rachel and Jesus Pesina, "Protestantism and Human Capital in Guatemala," Mimeo, Harvard University 2012.

McEvedy, C. and R. Jones, *Atlas of World Population History*, Penguin, 1978.

Michalopoulos, Stelios and Elias Papaioannou, "The Long-Run Effects of the Scramble for Africa," Working Paper 17620, National Bureau of Economic Research November 2011.

_ **and** _ , "Pre-colonial Ethnic Institutions and Contemporary African Development," *Econometrica*, 2013, *81* (1), 113–152.

Miguel, Edward and Michael Kremer, "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities," *Econometrica*, 2004, *72* (1), 159–217.

Moran, J, *Printing Presses: History and Development from the Fifteenth Century to Modern Times*, University of California Press, 1973.

Murdock, George Peter, *Ethnographic Atlas: a Summary*, Pittsburg University Press, 1967.

Mytton, Graham, *Mass Communication in Africa*, Edward Arnold, 1983.

Nunn, Nathan, "The Long Term Effects of Africa's Slave Trade," *Quarterly Journal of Economics*, 2008, *123* (1), 139–176.

_ , "Christians in Colonial Africa," Mimeo, Harvard University 2009.

_ , "The Importance of History for Economic Development," *Annual Review of Economics*, September 2009, *1* (1), 65–92.

_ , "Religious Conversion in Colonial Africa," *American Economic Review Papers and Proceedings*, May 2010, *100* (2), 147–152.

_ **and Leonard Wantchekon**, "The Slave Trade and the Origins of Mistrust in Africa," *American Economic Review*, December 2011, *101* (7), 3221–3252.

Oberholzer-Gee, Felix and Joel Waldfogel, "Media Markets and Localism: Does Local News en Espanol Boost Hispanic Voter Turnout?," *American Economic Review*, December 2009, *99* (5), 2120–2128.

Omu, Fred I A, *Press and Politics in Nigeria, 1880-1937* Ibadan History Series, Longman, 1978.

Oster, Emily, "Unobservable Selection and Coefficient Stability: Theory and Validation," Technical Report w19054, NBER Working Paper 2013.

Piketty, Thomas and Gabriel Zucman, "Capital is Back: Wealth-Income Ratios in Rich Countries, 1700-2010," *Quarterly Journal of Economics*, 2014, *129* (3).

Porta, Rafael La, Florencio Lopez de Silanes, and Andrei Shleifer, "The Economic Consequences of Legal Origins," *Journal of Economic Literature*, 2008, *46* (2), 285–332.

Reinikka, Ritva and Jakob Svensson, "Fighting Corruption to Improve Schooling: Evidence from a Newspaper Campaign in Uganda," *Journal of the European Economic Association*, 2005, *3*, pp. 259–267.

Rowling, Canon F. and C.E. Wilson, *Bibliography of Christian Literature*, London Conference of Missionary Societies of Great Britain and Ireland, 1923.

Stock, Eugene, *History of the Church Missionary Society*, Church Missionary Society, 1899.

Strömberg, David, "Radio's Impact on Public Spending," *The Quarterly Journal of Economics*, February 2004, *119* (1), 189–221.

Switzer, L and D Switzer, *The Black Press in South Africa and Lesotho: a Descriptive Bibliographic Guide to African, Coloured, and Indian Newspapers, Newsletters, and Magazines, 1836-1976* Bibliographies and guides in African studies, Hall, 1979.

Switzer, Les, "The African Christian Community and its Press in Victorian South Africa.," *Cahiers d'tudes africaines*, 1984, *24* (96), 455–476.

Tudesq, André-Jean., *Feuilles d'Afrique: Etude de la presse de l'Afrique subsaharienne* Publications de la Maison des sciences de l'homme d'Aquitaine, Editions de la maison des sciences de l'homme d'Aquitanie, 1995.

Voigtländer, Nico and Hans-Joachim Voth, "Persecution Perpetuated: The Medieval Origins of Anti-Semitic Violence in Nazi Germany," *The Quarterly Journal of Economics*, 2012, *127* (3), 1339–1392.

Wantchekon, Leonard, Marko Klasnja, and Natalija Novta, "Education and Human Capital Externalities: Evidence from Colonial Benin," Mimeo, Princeton University 2012.

Weber, Max, *The Protestant Ethic and the Spirit of Capitalism*, London and Boston: Unwin Hyman, 1930.

Woodberry, Robert D, "The Shadow of Empire: Christian Missions, Colonial Policy, and Democracy in Postcolonial Societies." PhD dissertation, University of North Carolina at Chapel Hill 2004.

_ , "The Missionary Roots of Liberal Democracy," *American Political Science Review*, 2012, *106* (02), 244–274.

_ **and Timothy Shah**, "Christianity and democracy: The pioneering Protestants," *Journal of Democracy*, 2004, *15* (2), 47–60.

Table 1: Determinants of the Location of Missions

	No Mission	Mission	Diff
Accumulated Temperature / 1000	10.921	13.476	-2.555***
			(0.761)
Annual Precipitation level / 1000	1.227	1.287	-0.060
			(0.110)
Suitability for Rainfed Crops	5.606	5.046	0.560***
			(0.099)
Number of Growing Days / 100	1.803	4.182	-2.379**
			(1.174)
Distance Capital, 100km	4.451	3.142	1.309***
			(0.145)
Distance Coast, 100km	5.768	3.402	2.366***
			(0.160)
Malaria	17.025	9.723	7.302***
			(0.488)
Slave Exports, per capita	0.083	0.116	-0.032**
			(0.012)
Railway Contact	0.288	0.470	-0.182***
			(0.025)
Explorer Contact	0.582	0.357	0.224***
			(0.025)
Initial Population Density	12.753	20.700	-7.948**
			(2.591)
Distance 1400 City, 100 km	3.394	5.106	-1.712***
			(0.145)
Distance 1800 City, 100 km	4.367	7.320	-2.953***
			(0.297)
Observations	533	1446	1979

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 2: Location, Characteristics and Investments of Missions With and Without a Printing Press

	No Printing	Printing	Diff
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)
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	11.803	13.760	-1.958
			(8.008)
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	651	28	679

(a) Location Determinants

	No Printing	Printing	Diff
Arrival Date	1878	1872	7*
			(4)
Bible Society	0.052	0.357	-0.305***
			(0.051)
Number of Native Workers	3.422	1.786	1.637
			(3.202)
Total Population	327.822	413.464	-85.642
			(120.425)
Schools	0.261	1.643	-1.382***
			(0.174)
Number of Students	321.363	397.286	-75.923
			(119.386)
Schools per Student (%)	0.322	1.350	-1.028**
			(0.370)
Teachers per Student (%)	10.087	18.861	-8.773*
			(4.385)
Health Facilities	0.187	1.464	-1.277***
			(0.139)
Physicians per Capita (%)	0.345	0.952	-0.607
			(0.581)
Health Facilities per Capita (%)	1.521	2.302	-0.781
			(1.268)
Observations	651	28	679

(b) Characteristics and Investments

Notes: * p<0.10, ** p<0.05, *** p<0.01. The tables compares characteristics of 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 3: Distance to a Printing Press and Newspaper Readership, OLS Estimation

	(1) All b/se	(2) All b/se	(3) 200km b/se	(4) 150km b/se	(5) 100 km b/se
Distance Printing Press	-0.014**	-0.015**	-0.013*	-0.015**	-0.013*
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Distance Mission		0.004	0.005	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	0.357	0.353	0.357
F-Statistic	205.5	201.6	185.4	174.9	158.3

(a) Baseline Estimation

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Distance Printing Press	-0.018**	-0.023***	-0.021**
	(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	137.6	130.2	120.0

(b) Estimation with Additional Controls

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 4: Investments of Societies With and Without a Printing Press

	No Printing	Printing	Diff
Arrival Date	1867	1842	25**
			(8)
Bible Society	0.097	0.086	0.011
			(0.055)
Number of Native Workers	1.379	1.417	-0.038
			(1.431)
Total Population	219.806	171.971	47.835
			(61.303)
Schools (any kind) in mission	0.371	0.511	-0.140
			(0.109)
Number of Students	215.077	165.711	49.366
			(61.387)
Schools per Student (%)	0.542	0.658	-0.116
			(0.244)
Teachers per Student (%)	9.874	11.068	-1.195
			(3.423)
Health Facilities	0.259	0.460	-0.201
			(0.155)
Physicians per Capita (%)	0.558	0.185	0.372
			(0.594)
Health Facilities per Capita (%)	2.216	0.911	1.305
			(1.489)
Observations	40	29	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 5: 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)	-0.549**	-0.524**	-0.412**
	(0.174)	(0.192)	(0.200)
Panel B: Dependent Variable is News Readership			
Distance Printing Press	-0.045**	-0.040**	-0.042*
	(0.019)	(0.019)	(0.022)
Observations	11925	10583	9059
Baseline Controls	Yes	Yes	Yes
Clusters	1401	1267	1093
R2 First Stage	0.638	0.635	0.632
F First Stage	58.734	61.653	59.942

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. The outcome variable is newspaper readership. The distance to a printing press is instrumented by Village Printing$_j$(50). The controls are the individual-, village-, ethnicity- and mission-level controls described in the text.

Table 6: Proximity to a Printing Press and Education, Controlling for Observables

	Education		
	(1) 200km b/se	(2) 150 km b/se	(3) 100 km b/se
Distance Printing Press	-0.024	-0.032	-0.034
	(0.028)	(0.028)	(0.029)
Distance Any Schools	-0.018	-0.019	-0.018
	(0.050)	(0.049)	(0.051)
Distance High/Boarding School	-0.084*	-0.092*	-0.092*
	(0.050)	(0.049)	(0.050)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.381	0.396	0.389
F-Statistic	127.4	119.6	102.5

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 7: Proximity to a Printing Press and Newspaper Readership, Interactions

	(1) 200km b/se	(2) 150km b/se	(3) 100km b/se
Distance Printing Press	-0.009	-0.011	-0.008
	(0.010)	(0.010)	(0.010)
Distance PPx**1**{High Education}	-0.016*	-0.023***	-0.025***
	(0.008)	(0.008)	(0.008)
1{High Education}	0.167***	0.200***	0.205***
	(0.047)	(0.045)	(0.047)
Observations	12405	10970	9383
Baseline Controls	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes
Clusters	1456	1315	1136
R2	0.362	0.359	0.364
F-Statistic	142.6	134.2	123.6

(a) Interaction with Education

	(1) 200km b/se	(2) 200km b/se	(3) 150km b/se	(4) 100km b/se
Distance Printing Press		0.011	0.010	0.012
		(0.023)	(0.023)	(0.023)
Distance PP with Publication	-0.047***	-0.060**	-0.060**	-0.055*
	(0.013)	(0.029)	(0.029)	(0.031)
Observations	9195	9195	7992	6782
Baseline Controls	Yes	Yes	Yes	Yes
Additional Controls	Yes	Yes	Yes	Yes
Clusters	1043	1043	927	795
R2	0.360	0.360	0.356	0.360
F-Statistic	97.77	97.07	92.37	87.27

(b) Interaction with Publication Records

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 8: Proximity to a Printing Press and Civic Attitudes (200km)

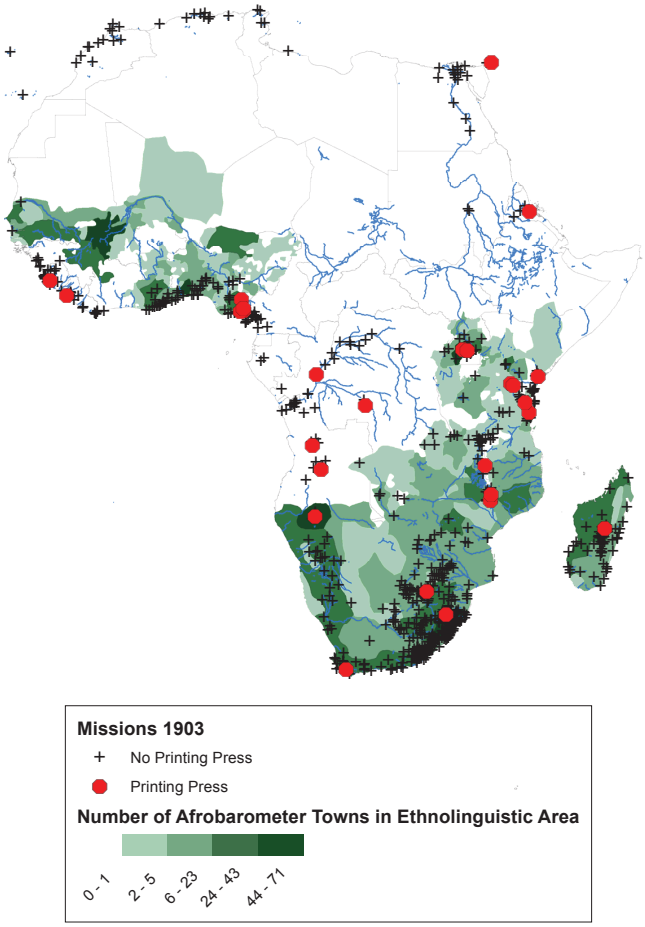
	(1) Register b/se	(2) Register b/se	(3) Turnout b/se	(4) Turnout b/se	(5) Action b/se	(6) Action b/se	(7) Listen b/se	(8) Listen b/se	(9) Satisfaction b/se	(10) Satisfaction b/se
Distance Printing Press	0.004	0.004	0.005	0.005	-0.024***	-0.024***	-0.018	-0.016	-0.012	-0.012
	(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.011)	(0.011)	(0.009)	(0.009)
Read News		0.002		0.004		0.057***		0.061***		-0.004
		(0.009)		(0.009)		(0.011)		(0.014)		(0.012)
Listen News		0.037***		0.037***		0.063***		0.029		0.058***
		(0.011)		(0.012)		(0.014)		(0.019)		(0.016)
Watch News		0.002		0.008		0.006		0.010		-0.011
		(0.009)		(0.010)		(0.012)		(0.015)		(0.013)
Observations	12362	12362	12405	12405	12405	12405	8849	8849	10131	10131
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	1456	1456	1456	1456	1456	1456	1391	1391	1431	1431
R2	0.221	0.222	0.198	0.199	0.130	0.134	0.0591	0.0622	0.190	0.191
F-Statistic	48.43	46.31	48.13	46.36	39.29	39.98	9.828	9.818	43.90	42.21

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports OLS estimates. The unit of observation is the individual. The controls are the average individual (per village)-, village-, ethnicity- and mission-level controls described in the text. The dependent variable is the log of average light density in a 10km buffer around the town. The sample is restricted to individuals living at less than 200 km from a historical mission settlement.

Table 9: Proximity to a Printing Press and Light Density (200km)

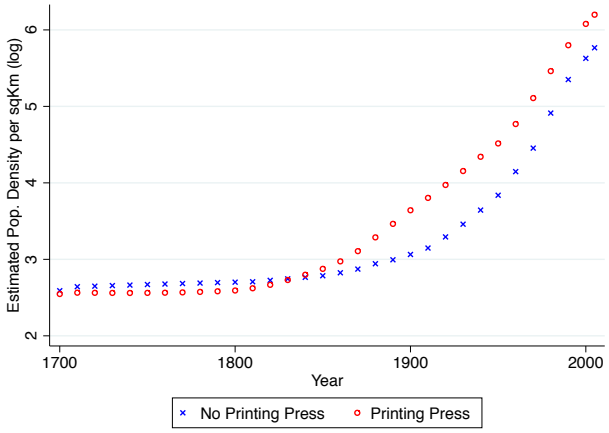
	(1) b/se	(2) b/se
Distance Printing Press	-0.292**	-0.098
	(0.136)	(0.164)
Distance PP with Publication		-0.358**
		(0.167)
Observations (towns)	1307	1307
All Controls	Yes	Yes
R2	0.612	0.615
Clusters	320	320

Notes: * p<0.10, ** p<0.05, *** p<0.01. The table reports OLS estimates. The unit of observation is the town. The controls are the average individual (per village)-, village, ethnicity- and mission-level controls described in the text. The regressions are weighted by the population size of each town. The sample is restricted to towns located at less than 200km from a historical mission settlement.



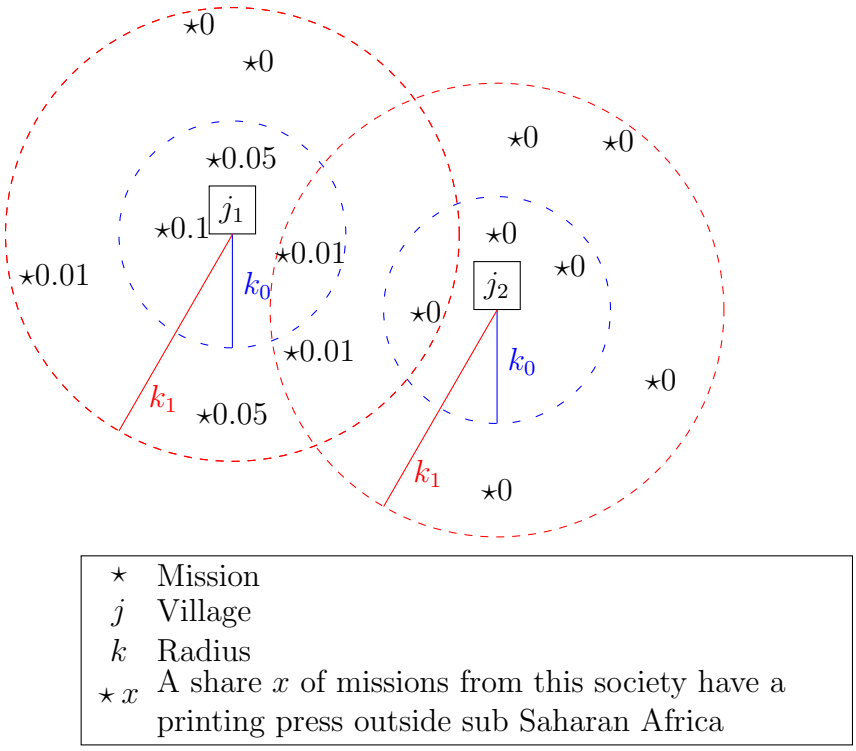
Notes: This map is a digitized and geocoded version of plates 14 to 18 of Dennis et al., eds (1903). The geocoding was conducted by the authors.

Figure 1: Mission Stations With and Without a Printing Press in 1903



Notes: The graph plots the time series of average population density as estimated in the HYDE database, in a 10 km buffer around each mission station. The sample is split in two groups depending on whether the mission had a printing press in 1903.

Figure 2: Population Density around Missions, using HYDE 3.1 data



Notes: Figure 3 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 3: Instrumenting the Distance to the Printing Press Using Missions' Society: A Graphical Illustration