THE MISSION: HUMAN CAPITAL TRANSMISSION, ECONOMIC PERSISTENCE, AND CULTURE IN SOUTH AMERICA*

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This article examines the long-term consequences of a historical human capital intervention. The Jesuit order founded religious missions in 1609 among the Guaraní, in modern-day Argentina, Brazil, and Paraguay. Before their expulsion in 1767, missionaries instructed indigenous inhabitants in reading, writing, and various crafts. Using archival records, as well as data at the individual and municipal level, I show that in areas of former Jesuit presence—within the Guaraní area—educational attainment was higher and remains so (by 10%–15%) 250 years later. These educational differences have also translated into incomes that are 10% higher today. The identification of the positive effect of the Guaraní Jesuit missions emerges after comparing them with abandoned Jesuit missions and neighboring Franciscan Guaraní missions. The enduring effects observed are consistent with transmission mechanisms of structural transformation, occupational specialization, and technology adoption in agriculture. *JEL* Codes: I25, L16, N36, O15, O43, Q16, Z12.

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When in 1768 the missions of Paraguay left the hands of the Jesuits, they had arrived at perhaps the highest degree of civilization to which it is possible to conduct a young people.

The Jesuits have civilized the [Guaraní], have taught them to be industrious, and have succeeded in governing a vast country (...) [making] a virtue of subduing savages by mildness and instruction.

—Voltaire (1756 and 1770)[1]

I. Introduction

This article shows that human capital transmission across generations is a main driver of economic outcomes in the long run. I exploit a unique historical experiment to study the persistence of income, human capital, and culture. I study religious missions, which played an important educational role and were founded—through colonial enterprises—in developing countries worldwide.[2] I focus on South America and demonstrate the important economic benefits of a specific type of European missionary activity. Jesuit missionaries settled in 1609 in what were essentially the frontier lands of the Spanish and Portuguese empires, before being expelled from the continent in 1767. While religious conversion was the official aim of the missions, they also invested heavily in education; schooling children and training adults in various crafts.[3]

I examine here the repercussions of the Guaraní Jesuit missions (1609–1767) in modern-day Argentina, Brazil, and Paraguay (Figure I). In municipalities where Jesuits carried out their apostolic activities, literacy rates and median years of schooling are 10%–15% higher today, 250 years after their expulsion. The same locations are also ahead by 10% in terms of per capita income. I use a novel identification strategy based

1. Quoted in Graham (1901), 52.

2. The effect of Protestant missions in Africa has been analyzed by Nunn (2010, 2014) and Cagé and Rueda (2016), while Waldinger (2016) examines Catholic missions in Mexico.

3. Compared to Barro and McCleary (2003), Guiso, Sapienza, and Zingales (2003), McCleary and Barro (2006), and Glaeser and Sacerdote (2008), I place less emphasis on the direct effects of religion and more on its human capital externalities, as in Becker and Woessmann (2008, 2009), and Botticini and Eckstein (2005, 2007, 2012).

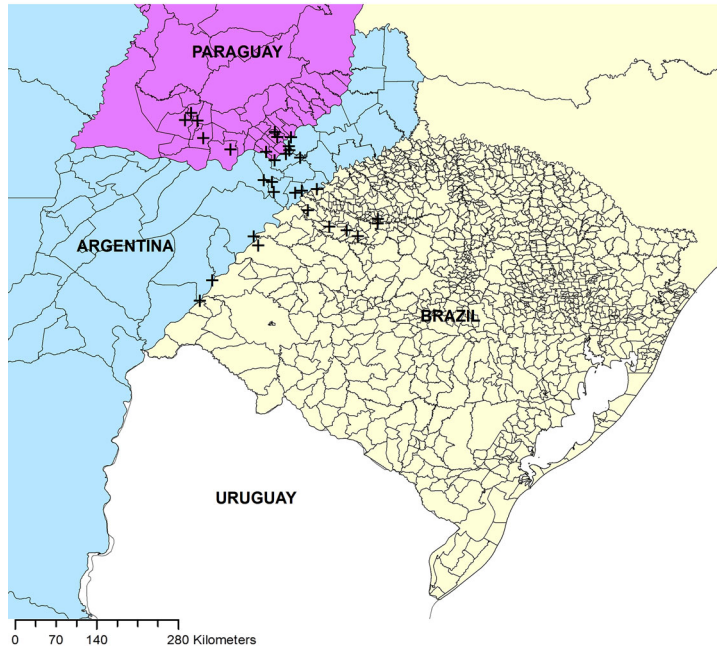


FIGURE I

Location of the Guaraní Jesuit Missions in Argentina, Brazil, and Paraguay

The map shows the exact location of the Guaraní Jesuit Missions, along with municipal level boundaries for the states of Corrientes and Misiones (Argentina), Itapúa and Misiones (Paraguay), and Rio Grande do Sul (Brazil); state boundaries for other states in Argentina, Brazil, and Paraguay; and national level boundaries for Uruguay. Color version available online.

on abandoned missions and exploit missionary variation within two Catholic orders, stressing the importance of educational investments. I also track the human capital shock through time, showing a decaying but persistent and differential impact. Critically, I propose new cultural mechanisms of transmission relating to occupational specialization, as well as structural transformation and technology adoption in agriculture—through the introduction of genetically engineered (GE) soy seeds.

To assess the economic impact of the Guaraní Jesuit missions, I assemble a new data set that combines archival information about these missions with modern-day outcomes at the municipal and individual levels. To disentangle the potential national institutional and historical effects from the human capital

shock, I exploit fine-grained variation in missionary activity in three different countries. The area under study was populated by a single semi-nomadic indigenous group, so I can abstract from the differential effects of particular precolonial ethnic tribes.[4] The geo-coded data set covers all of the municipalities in the provinces of Misiones and Corrientes in Argentina, the states of Rio Grande do Sul in Brazil, and Misiones and Itapúa in Paraguay, (Figure I). A total of 30 Jesuit missions (*treinta pueblos* in Spanish) were established: 15 in Argentina, 8 in Paraguay, and 7 in Brazil.

To quantify the Jesuit missionary treatment, I use distance to the nearest mission as the main explanatory variable. I then estimate an econometric model of contemporary outcomes—such as education and income—based on this measure of missionary presence. After controlling for geographic and weather characteristics, I find that moving 100 km closer to a mission brings a positive effect on educational attainment of around 0.7 years of schooling, and lower poverty rates (according to an Unsatisfied Basic Needs index) of 10%. The human capital effects appear larger during earlier historical periods and decline in the postwar era.

Despite extensive geographic and weather controls, the initial location of the Jesuit missions can still be nonrandom. To address the potential endogeneity of missionary placement, I conduct two empirical tests. The first one is a placebo-type test that looks at missions originally founded by the Jesuits but abandoned early on (before 1659). I thereby compare places that were initially picked by Jesuit missionaries but ended up not being treated with those that received the full missionary "treatment." I find no significant or consistent effects for missions that were abandoned by the Jesuits, which suggests that what mattered in the long run were the activities they carried out and not where they first settled. Second, I examine the impact of neighboring Guaraní Franciscan missions. The comparison is relevant in that both orders wanted to convert souls to Christianity, but the Jesuits emphasized education and technical training in their conversion, relative to the Franciscans. Contrary to the Jesuit case, I find no positive long-term economic effect of Franciscan missions, highlighting the role of human capital investments.

4. See Gennaioli and Rainer (2007), Michalopoulos and Papaioannou (2013), and Maloney and Valencia Caicedo (2016).

Finally, I present empirical evidence on cultural and occupational mechanisms of transmission. To this end, I build on growth theories of human capital accumulation, industrial specialization, and technology adoption—in the spirit of Nelson and Phelps (1966). Consistent with models of structural transformation, I document that people closer to historical missions have moved away from agriculture into manufacturing and services.[5] These sectoral changes extend to occupational specialization in more skill-intensive industries, following the categorization of Ciccone and Papaioannou (2009). Furthermore, I show that inhabitants closer to former missions—who have higher human capital—adopted newly available agricultural technologies faster (as in Foster and Rosenzweig 1995, 1996). In particular, these inhabitants were quicker to incorporate GE soy seeds, as in Bustos, Caprettini, and Ponticelli (2016).[6] Additional tests suggest that results are not driven by migration or urbanization and are concentrated among residents of these municipalities. There also appear to be complementary investments in infrastructure and health.

This article builds on the historical persistence literature, recently summarized by Nunn (2009, 2013), Galor (2011), Spolaore and Wacziarg (2013), Michalopoulos and Papaioannou (2017). In this literature, deep-rooted determinants of development have been shown to influence modern outcomes through geography and natural endowments, legal origins and institutions, genetics, human capital, and culture.[7] This article relates particularly to previous work studying the aftermath of colonialism and the impact of colonial investments.[8] Most notably, Dell (2010) stresses the negative impact of the *mita* labor system in Latin America, whereas Nunn and Wantchekon (2011) document the

5. See the pioneering work of Kuznets (1957), the handbook chapter by Syrquin (1988), the theoretical model of Murphy, Shleifer, and Vishny (1989), and the recent empirical evidence by Bustos, Caprettini, and Ponticelli (2016).

6. For related historical examples of technology adoption, see Dittmar (2011), Hornung (2014), Squicciarini and Voigtländer (2015), and Maloney and Valencia Caicedo (2017).

7. Seminal contributions on these determinants include Diamond (1997), Engerman and Sokoloff (1997), Landes (1998), La Porta et al. (1998), Gallup, Sachs, and Mellinger (1999), Acemoglu, Johnson, and Robinson (2001), Glaeser et al. (2004), Voigtländer and Voth (2012), and Ashraf and Galor (2013).

8. As in Feyrer and Sacerdote (2009), Huillery (2009), Bruhn and Gallego (2012), Becker et al. (2014), Grosfeld and Zhuravskaya (2013), and Jedwab, Kerby, and Moradi (2014).

adverse economic effect of African slavery through decreased trust. I contribute to this literature by broadening the colonialism spectrum, examining cultural and occupational mechanisms behind economic and human capital persistence.

The fundamental importance of human capital for economic growth is well established.[9] Questions remain, however, about the persistence and mechanisms of transmission of historical human capital shocks (Waldinger, 2012; Chen, Kung, and Ma, 2016). Natural historical experiments and colonial experiences in particular provide a setting in which to study such important economic questions. While European colonizers often imposed extractive institutions (Acemoglu, Johnson, and Robinson 2001), they also transferred human capital, cultural values, and technological know-how (Glaeser et al. 2004; Easterly and Levine 2016). Moral legitimacy aside, could some of these colonial interventions have led to positive economic outcomes in the long run?

Cultural explanations of economic performance date back to Max Weber's 1905 Protestant work ethic hypothesis (Weber 2011), while the role of culture and its interaction with institutions has been recently surveyed by Alesina and Giuliano (2015). Empirically, this literature has documented the persistence of cultural traits over centuries (Tabellini 2008; Grosjean 2010; Voigtländer and Voth 2012; Guiso, Sapienza, and Zingales 2016). Theoretical models have stressed the role of vertical and horizontal cultural transmission (Cavalli-Sforza and Feldman 1981; Boyd and Richerson, 1985; Bisin and Verdier 2000, 2001), especially with regard to education (Galor and Moav 2002). Here I emphasize occupational persistence and its relation to structural transformation and industrial specialization (as in Botticini and Eckstein 2005, 2007, 2012).

Religion is a fundamental aspect of culture and was an integral part of colonial enterprises worldwide.[10] An emerging

9. See, among others, Mankiw, Romer, and Weil (1992), Benhabib and Spiegel (1994), Barro (2001), Glaeser et al. (2004), Galor (2011), and Gennaioli et al. (2013, 2014).

10. Seminal papers on this topic include Iannaccone (1990), Guiso, Sapienza, and Zingales (2003), Barro and McCleary (2003), McCleary and Barro (2006), and Glaeser and Sacerdote (2008). Modern reinterpretations include Becker and Woessmann (2008, 2009), Botticini and Eckstein (2005, 2007, 2012), Clingingsmith, Khwaja, and Kremer (2009), Campante and Yanagizawa-Drott (2015), Cantoni (2015), Akcomak, Webbink, and Weel (2016), Andersen et al. (2017), Cantoni, Dittmar, and Yuchtman (2018).

literature has explored the aftereffects of nineteenth-century Christian missions in Africa. Across countries, Woodberry (2004, 2012) and Lankina and Getachew (2012) find a positive effect of Protestant missions on democracy. Subnationally, Nunn (2010) documents that missions resulted in higher religiosity, Gallego and Woodberry (2010) and Nunn (2014) show a positive effect on educational attainment, and Cagé and Rueda (2016) show a positive impact on newspaper readership. Wantchekon, Klašnja, and Novita (2015) find positive human capital externalities from religious schools in Benin, Meier zu Selhausen (2014) relate missions to female empowerment in Uganda, and Okoye and Pongou (2014) and Wietzke (2015) link them to school provision in Nigeria and Madagascar. Outside Africa, Mantovanelli (2013) and Castelló-Climent, Chaudhary, and Mukhopadhyay (2015) report a positive effect of missions on Indian literacy and tertiary education, while Bai and Kung (2015) find one on Chinese urbanization.

I contribute to the literature on the economic effects of missions in several ways. The existing papers have overlooked Latin America, an area with an extensive and long-standing missionary presence. I go further back in time than previous work has done—from the nineteenth to the seventeenth century—and focus on Catholic as opposed to Protestant missions.[11] The early stage of development of the indigenous inhabitants makes the setting unique, at a time when returns to human capital were presumably low. The article closest to this study is Waldinger (2016), which documents the positive impact of Mendicant orders in Mexico. As in her paper, I examine the effect of different Catholic orders. In contrast, here I document the impact of Catholic missionaries on the same indigenous tribe in three different South American countries. I employ a novel identification strategy based on abandoned missions. I find long-lasting effects on human capital for missions from the Jesuit order, which stressed education, relative to the Franciscans. Last, I propose new mechanisms of transmission,

11. McCleary and Pesina (2011) and McCleary (2017) show how Guatemalan Protestant missions established during the early twentieth century did not emphasize literacy in their conversion. I find the opposite effect here when I look at the prevalence of radio and newspapers in Online Appendix Table A.26, consistent with Cagé and Rueda (2016). Acemoglu, Gallego, and Robinson (2014) use Protestant missions as instruments for education.

focusing on structural transformation, industrial specialization, and the adoption of agricultural technologies.

The rest of the article is organized as follows. Section II provides the historical background. Section III describes the data and presents the empirical strategy. Section IV contains the main results on education and income, abandoned Jesuit missions, Franciscan missions, and human capital persistence. Section V presents mechanisms of transmission of persistence. Section VI presents alternative transmission mechanisms, and Section VII concludes.

II. Historical Background

The Society of Jesus was founded as part of the European Counter-Reformation movement in 1534, at the University of Paris, by the Basque knight St. Ignatius of Loyola, *ad maiorem Dei gloriam* (for the greater glory of God).[12] From the outset, it stressed education and papal obedience. It is a relatively new Catholic order compared with the Order of Saint Benedict (founded in 529), as well as the Franciscan, Dominican, and Carmelite orders (all founded in the 1200s). Jesuits were the last major Catholic order to arrive in the Americas—through the Spanish and Portuguese empires. Religion constituted one of the main reasons for embarking to the New World.

The first Jesuits arrived in South America at Salvador de Bahia, modern-day Brazil, in 1549 (Bethell 1984; Alden 1996). The Jesuit order followed a two-pronged strategy: educating the creole elites in the major colonial capitals (Mexico City, Lima, Bogotá, Buenos Aires, and Quito) while developing indigenous missions in some of the most remote areas of the Spanish and Portuguese empires (Bolton 1917; Bethell 1984). The first South American Jesuit mission was established in 1565 in Juli, modern-day Puno, at the border of Bolivia and Peru. Jesuits also started missions in Mainas (Peru), Moxos and Chiquitos (Bolivia), Casanare and Orinoco (Colombia and Venezuela), Baja California (Mexico), and Alta California (United States). Outside the Americas, the Jesuits established missions in China, India, and Japan during the sixteenth and seventeenth centuries.

12. For the history of the Jesuits, see Hernández (1913), Furlong and Muriel (1955), Palacios and Zoffoli (1991), Carbonell de Massy (1992), and more recently Ganson (2003), Maeder and Gutiérrez (2009), Wilde (2009), and Sarreal (2014).

It is hard to overemphasize the value of education for the Jesuit order. Jesuits were at the technological frontier of the time, and their cultural contributions to music and the arts are well known. Furlong and Storni (1994) stress the Jesuit achievements in cartography, ethnography, linguistics, botany, mathematics, and medicine. Jesuits introduced the printing press to Argentina, Brazil, and Paraguay and even established an astronomical observatory in San Cosme and Damián, in modern-day Paraguay. Jesuits played an important role in the historical development of tertiary education in Brazil (Tobias 1972). Even though the official aim of the Jesuit missions was to convert souls to Christianity, Jesuits taught children—boys and girls separately—how to read and write and do basic arithmetic (Ganson 2003). They also trained adults in masonry, wood carving, and embroidery (Gálvez 1995).[13]

The Guaraní missions constituted the heart of the Jesuit missionary efforts (Figure I and Online Appendix Figure A.1). Jesuits arrived in Asunción, Paraguay, on August 11, 1588. From Asunción, they explored the surrounding area and established the first Guaraní Jesuit mission in 1609 (Online Appendix Figure A.2). Jesuits were not the first to establish religious missions among the Guaraní, since the Franciscans had established their first Guaraní mission in 1580 (Durán Estragó 1987; Necker 1990). Jesuit missions remained isolated from the colonial capital of Asunción, which itself barely numbered 6,451 inhabitants in 1761, and were only allowed to barter restrictively (Ganson 2003). The initial Jesuit foundation was followed by a period of exploration that lasted around 50 years, until 1659. Jesuits founded a total of 30 missions or *reducciones* (reductions) in the modern-day territories of Argentina, Brazil, and Paraguay (Online Appendix Table A.1): 15 of them in Argentina, 8 in Paraguay, and the famous *sete povos* (7 missions) in Brazil. At their peak, the Guaraní Jesuit missions contained more than 120,000 inhabitants (Online Appendix Figure A.3), four times the population of Buenos Aires in 1779 (Ganson 2003). Guaraní Jesuit missions constituted one of "the most original experiments of the spiritual conquest of the New

13. In the Online Appendix, I document that these places still produce more handicrafts, such as embroidery, a skill introduced by the Jesuits. They also have more professionals and workers in fields related to the Jesuit intervention. Online Appendix Figure A.4 provides a blueprint of the San Ignacio Miní Guaraní mission along with its school and workshop.

World" (Roa Bastos, quoted in Saguier 1991, 9) and were admired by contemporaries as prominent, and anticlerical, as Voltaire.

The Guaraní area was populated by a single indigenous tribe, also known as the Tupis in Portuguese. When the Jesuit priests arrived, the Guaraní were considered to be at a Neolithic stage of development, lacking iron weapons and tools (Ganson 2003), which makes the conversion setting unique. The Guaraní were semi-sedentary and cultivated manioc root and maize through slash-and-burn agriculture. The territory has relatively uniform geographic and weather characteristics, is covered by subtropical forests, and contains no major mineral resources (Palacios and Zoffoli 1991).

The expulsion of the Jesuits represents a watershed moment in colonial history, abruptly ending their missionary activities in the Guaraní area. After intense political infighting in Europe, the Jesuits were expelled from Spain and Portugal—and their Latin American colonies—in 1767. Kings Charles III of Spain and Joseph I of Portugal, counseled by the Marquis of Pombal, pressured the (Franciscan) Pope Clement XIV to issue the order of expulsion. The order was carried out effectively in the Guaraní area by the governor of Buenos Aires, Francisco de Paula Bucarelli, and by 1768 no Jesuit missionaries remained in the area. In 1773, Clement XIV proceeded to dissolve the Society of Jesus, and priests were exiled in Frederick the Great's Prussia and Catherine the Great's Russia. The Jesuit order was not restored until 1814 by Pope Pius VII, but by then indigenous missions in the Americas had been abandoned. Jesuit missionaries never returned to the Guaraní area.

III. Data and Empirical Strategy

III.A. Data

I use archival records, census data, and household surveys to conduct my empirical analyses. To extract usable data from historical sources, I use ArcGIS. An illustration of the documents available can be seen in Online Appendix Figure A.5, which depicts a historical map of the Jesuit missions of Paraguay. My data set covers all the municipalities in the five states (or provinces) of the three countries where the Guaraní Jesuit missions were originally located (Figure I). These are the provinces of Misiones and Corrientes in Argentina, and the states Rio Grande do Sul in

Brazil and Misiones and Itapúa in Paraguay. In total, there are 549 observations, covering around 10 million inhabitants, that correspond to the municipal or third-level divisions of these countries (*departamentos* in Argentina, *municipios* in Brazil, and *distritos* in Paraguay). The area under consideration is comparable in size to Uruguay and Ecuador.

The data come from three main sources. First, there is information taken from historical archives on the location, year of foundation, population, and general workings of the Guaraní Jesuit missions. These include the Archivo de Indias (Seville), Archivo General de la Nación (Buenos Aires), Archivo Nacional (Asunción), and the Roman Jesuit Archives (Vatican). Primary sources include the *Cartas Anuas* (annual letters) of Jesuit fathers such as Ruiz de Montoya and Cardiel. These key documents on the missions' state of affairs were sent directly by the provincial fathers to Rome. This information is complemented by contemporary accounts and visits, such as those by Father Charlevoix and naturalist Alcide d'Orbigny. For the postexpulsion period, there are extant government reports and official correspondences of Governors Bucarelli and Zavala. Additional official historical data are taken from the national censuses of Argentina in 1895 and 1914; Brazil in 1890, 1920, and 1940; and Paraguay in 1950, plus decadal national censuses from the postwar era. I also collect a large set of geographic and weather controls at a highly disaggregated level from Hijmans et al. (2005). Last, I assemble a series of educational outcomes—literacy and median years of schooling—and income (or poverty) measures from modern censuses for Argentina (2001, 2010), Brazil (2000, 2010), and Paraguay (2002, 2012). Modern census data for these countries on occupations and industries are in turn complemented by two specialized survey modules on culture from the 2006 Brazilian Municipal Survey and the Paraguay Public Household Survey of 2011.

Summary statistics for key variables can be found in Table I, divided by missionary proximity, for education, income, and geographic and weather characteristics. Distance to the nearest mission is measured from the centroid of the municipality. Median years of schooling (a finer education measure) is only available for Brazil, and income is not available for Argentina at this level of disaggregation, so I use instead a multidimensional (Unsatisfied Basic Needs) poverty index. Aside from standard geographic and weather controls, I include more sophisticated

TABLE I

SUMMARY STATISTICS: MUNICIPAL-LEVEL DATA FOR ARGENTINA, BRAZIL, AND PARAGUAY BY MISSIONARY DISTANCE

		Less than 50 km					More than 50 km				
Category	Variables	N	Mean	Std. dev.	Min	Max	N	Mean	Std. dev.	Min	Max
Education	Literacy	87	91.4	3.0	80.1	97.8	462	90.8	4.2	75.7	98.4
	Illiteracy	87	8.4	3.0	2.2	19.9	462	9.2	4.2	1.6	24.3
	Median years of schooling	39	5.1	0.7	3.8	6.8	428	5.08	0.8	3.3	9.0
Income	Ln income	74	6.7	1.6	4.7	9.2	432	5.5	0.4	4.4	8.8
	Individual poverty index	16	42.2	13.6	27.7	64.0	66	43.6	13.6	20.8	75.9
Mission	Mission distance	87	22.17	14.08	0.12	48.72	462	228.60	106.11	50.57	567.02
Geo controls	Latitude	87	−27.7	0.7	−29.8	−26.5	462	−28.9	1.2	−33.7	−25.9
	Longitude	87	−55.5	0.9	−57.4	−53.8	462	−52.7	1.7	−59.3	−49.7
	Area	87	990	1,503	94	8,613	462	688	1,151	28	9,588
	Temperature	87	209	7	193	226	462	188	11	146	222
	Altitude	87	182	83	67	385	462	348	234	3	1,157
	Rainfall	87	1,714	126	1,291	1,875	462	1,608	194	1,050	1,995
	Ruggedness	87	55,008	36,347	7,397	158,153	462	52,705	41,616	6,335	173,076
	Slope	87	1,750	927	199	4,372	462	1,388	1,216	32	6,739
	Distance to river	87	0.1	0.2	0	0.7	462	0.3	0.3	0	1.3
	Distance to coast	87	4.9	1.0	3.1	7.0	462	2.1	1.4	0	6.5
	Landlocked	87	1	0	1	1	462	0.95	0.22	0	1

Notes. For specific descriptions and sources, please refer to Section I of the Online Appendix. Median years of schooling is only available for Brazil at the municipal level and income is not available for Argentina. Poverty data are for Argentina and Paraguay, where I use instead a missionary dummy.

measures such as ruggedness, slope, and distance to rivers, which may have been relevant for missionary settlement. Literacy levels border on 90% and median years of schooling average five years, which are typical values for rural areas in Latin America. Municipalities closer to former missions already appear more literate and have higher income. The specific variables used, along with their sources and units, are described in more detail in Section I of the Online Appendix.

III.B. Estimating Equation

To estimate the effect of Jesuit missions on contemporary outcomes, I use the following econometric specification:

$$Y_{2000,ij} = \alpha + \beta d(M_{ij}) + \gamma GEO_{ij} + \mu_j + \epsilon_{ij}, \quad (1)$$

where Y_{2000} denotes either modern human capital or income in municipality i in state j. M measures missionary presence at the municipality level, and the d function is either a missionary dummy or the distance to the nearest mission in kilometers. The coefficient of interest is β, which in the case of a beneficial effect would be negative in the distance to the nearest mission specification and positive in the dummy specification (reported in the Online Appendix). GEO is a vector of geographic and weather controls—including area, altitude, latitude, longitude, temperature, rainfall, ruggedness, slope, distance to the nearest river, distance to the nearest coast, and a landlocked dummy—with a corresponding vector of coefficients γ. Importantly, I control for distance to the nearest Franciscan mission in all specifications, except for the baseline regressions. The variable μ captures a state-fixed effect, α is a generic constant, and ϵ is an idiosyncratic error term. I employ a similar specification when I examine cultural and occupational outcomes in the mechanisms section. To actually estimate equation (1), I use OLS. I use robust standard errors throughout and also report Conley (spatial) standard errors at 0.1 degrees.[14]

14. Online Appendix Table A.2 reports Conley standard errors using larger windows, for robustness. When individual data are available, as in the occupational regressions, I employ probit specifications and cluster standard errors at the municipality level. When the number of observations is too small, as is the case with the historical censuses, I also report bootstrapped standard errors.

III.C. Identification

For identification, I exploit the fact that Jesuits were expelled from the Americas in 1767, following political disputes in Europe. The rupture between the Jesuit order and the Spanish Crown was external to the location of proselytizing activities among the Guaraní. The one-off religious intervention also happened at an early stage of development, making the setting appealing for examining the persistence of income, human capital, and culture. The actual identification of the missionary effect hinges on several assumptions. First, the historical record suggests that the foundation of the missions proceeded in a relatively haphazard manner. Hernández (1913) describes as a "coincidence" the entrance of the Jesuit priests to Paraguay. Historians describe the foundation of San Ignacio Guazú in 1609 as an unprecedented "adventure" and the establishment of the first missions as "perilous and random" (Astrain 1996). Priests such as Antonio Ruiz de Montoya were very successful in founding several missions, while others such as Diego de Alfaro and Alfonso Arias died in the process. Second, I control directly for a host of geographic conditions such as low altitude and proximity to rivers that might have influenced the initial settlement choices. I show, moreover, that the Jesuit areas did not have higher population densities during precolonial times. Being the last Catholic order to arrive to the Americas, Jesuit missionaries had "last pick" and presumably ended up in more peripheral areas. I test this claim empirically in the section contrasting Jesuit and Franciscan missions. This comparison within orders, along with the study of abandoned missions, aims to establish the causal effect of the Guaraní Jesuit missions.[15] I present evidence for persistence mechanisms of transmission, while additional empirical tests help rule out alternative transmission channels.

IV. Main Results

IV.A. Human Capital

Prior to running any regression, Figure II, Panel A illustrates the main findings of this section. The graph plots modern literacy

15. I also use an instrumental variables estimation strategy, using the distance from the first European (pre-Jesuit) exploration routes and distance to Asunción, for the Brazilian subsample of the data only (Online Appendix Table A.18).

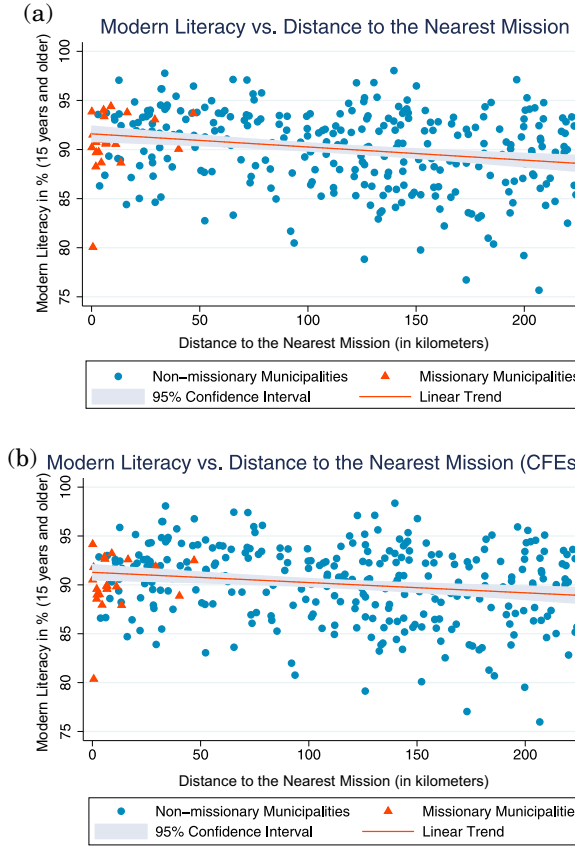
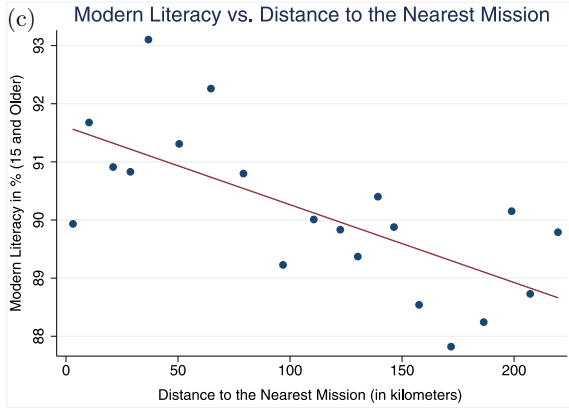


FIGURE II

Literacy versus Missionary Distance

Panel A: Unconditional plot of literacy in 2000 in percentages for people aged 15 and older in Argentina, Brazil, and Paraguay versus distance (of the municipality centroid) to the nearest Jesuit mission in kilometers. Triangles represent missionary municipalities and circles nonmissionary ones. The line is a linear trend with a 95% confidence interval. The sample is restricted to a distance of 225 km. Color version available online. Panel B: Relationship between distance to mission and literacy, conditional on country fixed effects (CFEs). Plot of literacy in 2000 in percentages for people aged 15 and older in Argentina, Brazil, and Paraguay versus distance (of the municipality centroid) to the nearest Jesuit mission in kilometers, with country fixed effects. Triangles represent missionary municipalities and circles nonmissionary ones. The line is a linear trend with a 95% confidence interval. The sample is restricted to a distance of 225 km.



(c) Binscatter of Literacy on Missionary Distance

Panel C: Unconditional binned scatter plot of literacy in 2000 in percentages for people aged 15 and older in Argentina, Brazil, and Paraguay with fitted line versus distance to the nearest Jesuit mission in kilometers. The sample is restricted to a distance of 225 km.

rates for people aged 15 and older versus distance to the nearest Jesuit mission in kilometers. Municipalities that had missions (depicted using triangles) cluster in the upper left corner with rates above 90%.[16] The farther away a municipality (in circles) is from a historical mission, the lower its literacy level today. This unconditional relationship is negative and highly significant with a t-statistic of -4.36. A similar pattern is observed net of country fixed effects in Figure II, Panel B, and using a binned scatter plot in Figure II, Panel C. Although literacy rates have converged in modern times, the negative relationship appears pronounced and remarkable given the 250-year lag. To better quantify this phenomenon, I estimate equation (1) using illiteracy rates for the three countries and median years of schooling for Brazil. The pattern already observable in the raw data is confirmed in the regressions.

The point estimates are positive and significant without and with geographic controls (Table II, columns (1) and (2)) for the three countries. The corresponding (standardized) beta coefficients are around 0.35, and the estimated effect suggests a

16. Note that distances for missionary districts are not necessarily zero, as they are measured from the municipality's centroid.

TABLE II

MISSIONARY EFFECT ON MODERN EDUCATION

	Illiteracy							
	Argentina, Brazil, and Paraguay		Brazil		Argentina		Paraguay	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mission distance	0.0105***	0.0112**	0.0200***	0.0313***	0.0157**	0.0669***	0.00451	0.0138
	(0.004)	(0.005)	(0.007)	(0.010)	(0.007)	(0.022)	(0.012)	(0.027)
	{0.004}	{0.005}	{0.007}	{0.010}	{0.008}	{0.023}	{0.016}	{0.026}
Geo controls	No	Yes	No	Yes	No	Yes	No	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	547	548	467	467	42	42	40	39
Within R^2	0.037	0.068	0.052	0.091	0.102	0.567	0.003	0.250
R^2	0.042	0.073	0.056	0.095	0.165	0.669	0.004	0.251

Notes. The table shows the coefficient of distance to the nearest Jesuit mission in kilometers (equation (1)). The dependent variable is illiteracy for people aged 15 years and older in 2000 in percentages for Argentina, Brazil, and Paraguay. Geographic controls include distance to the nearest coast, distance to the nearest river, altitude, ruggedness, temperature, area, rainfall, latitude, and longitude. Mesoregion fixed effects are included for Brazil. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS with state fixed effects. Robust standard errors are in parentheses and Conley standard errors are in curly brackets *** $p < .01$, ** $p < .05$.

reduction in illiteracy of at least 10% when moving 100 km closer to a mission. The education results are comparable in size and slightly larger than those found by Nunn (2014) for Christian missions in Africa. In terms of individual countries, the effect is strong without and with geographic controls for Brazil (columns (3) and (4)) and Argentina (columns (5) and (6)), whereas it maintains its sign but not its significance for Paraguay (columns (7) and (8)). The corresponding beta coefficients are 0.46 for Brazil, 0.41 for Argentina, and 0.14 for Paraguay.

Results using median years of schooling for Brazil are similar to those for illiteracy (Table III, columns (1) and (2)). The estimates suggest that moving 100 km closer to a mission increases median years of schooling by 0.67 years, or almost 15%. These magnitudes are economically important, especially when considering that Brazil has a relatively low level of education, even by Latin American standards (Hanushek and Woessmann 2012). The results are in the 10% ballpark of educational benefits attributed to the well-established Bolsa Familia conditional cash transfer program in Brazil (Glewwe and Kassouf 2012).

IV.B. Income and Poverty

Figure III, Panel A plots the logarithm of income in 2000 versus distance to the nearest mission. As before, former missionary municipalities cluster in the upper left corner, and there appears to be a negatively significant relationship between the two variables, with a t-statistic of -3.83. The relationship is less pronounced, but still present, net of country fixed effects in Figure III, Panel B. Figure III, Panel C presents the binned scatter plot, which again reveals a significant downward pattern. The results of estimating equation (1) using the distance specification for income per capita can be seen in Table III for Brazil and Paraguay. The coefficients appear negative and strongly significant without and with geographic controls (columns (3) and (4)), and the corresponding beta coefficients are approximately -0.3. Being 100 km closer to a mission raises per capita income by about 0.2 log points. To gauge the economic importance of the human capital results, I run a specification of income on literacy, instrumented by distance to the nearest Jesuit mission (not reported). These rough estimates are in line with the returns to schooling estimates for Argentina, Brazil, and Paraguay (Psacharopoulos and Patrinos 2004). Lastly, I perform

TABLE III

MISSIONARY EFFECT ON DEVELOPMENT PROXIES IN BRAZIL, ARGENTINA, AND PARAGUAY

	Median years of schooling Brazil		Ln income Brazil and Paraguay		Individual poverty index Argentina and Paraguay	
	(1)	(2)	(3)	(4)	(5)	(6)
Mission distance	−0.00247**	−0.00679***	−0.00166***	−0.00204***	0.0409***	0.0938**
	(0.001)	(0.002)	(0.000)	(0.001)	(0.014)	(0.043)
	{0.001}	{0.002}	{0.000}	{0.001}	{0.018}	{0.046}
Geo controls	No	Yes	No	Yes	No	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	427	427	506	506	82	81
Within R^2	0.013	0.142	0.029	0.036	0.035	0.064
R^2	0.042	0.171	0.869	0.876	0.704	0.733

Notes. The table shows the coefficient of distance to the nearest Jesuit missions in kilometers (equation (1)). The dependent variables are median years of schooling in Brazil in columns (1) and (2), the logarithm of income per capita in 2000 in Brazil and Paraguay in columns (3) and (4), and the Unsatisfied Basic Needs (UBN) poverty index in Argentina and Paraguay at the individual level in columns (5) and (6). Median years of schooling is only available for Brazil at the municipal level and income is not available for Argentina. Mesoregion fixed effects are included for Brazil. Geographic controls include distance to the nearest coast, distance to the nearest river, altitude, ruggedness, temperature, area, rainfall, latitude, and longitude. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS with state fixed effects. Robust standard errors are in parentheses and Conley standard errors are in curly brackets *** $p < .01$, ** $p < .05$.

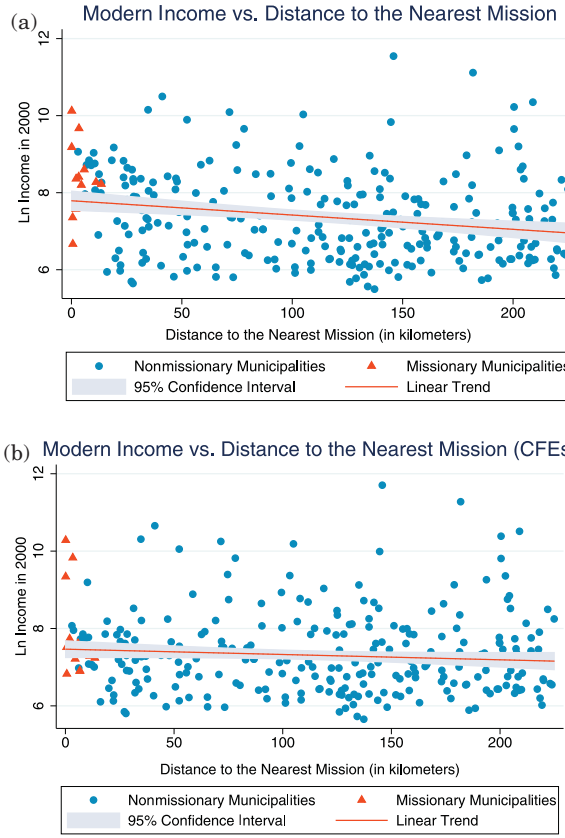
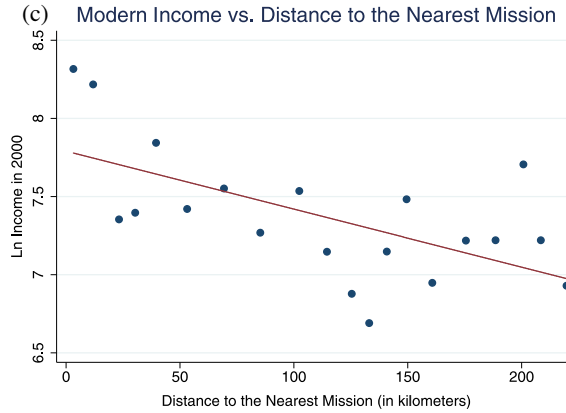


FIGURE III

Income versus Missionary Distance

Panel A: Unconditional plot of logarithm of income in 2000 in Brazil and Paraguay versus distance (of the municipality centroid) to the nearest Jesuit mission in kilometers. Data at this level of disaggregation are not available for Argentina. Triangles represent missionary municipalities and circles nonmissionary ones. The line is a linear trend with a 95% confidence interval. The sample is restricted to a distance of 225 km. Color version available online.
Panel B: Relationship between distance to mission and log income, conditional on country fixed effects (CFEs). Plot of logarithm of income in 2000 in Brazil and Paraguay versus distance (of the municipality centroid) to the nearest Jesuit mission in kilometers, with country fixed effects. Data at this level of disaggregation are not available for Argentina. Triangles represent missionary municipalities and circles nonmissionary ones. The line is a linear trend with a 95% confidence interval. The sample is restricted to a distance of 225 km.



(c) Binscatter of Income on Missionary Distance

Panel C: Unconditional binned scatter plot of logarithm of income in 2000 in Brazil and Paraguay with fitted line versus distance to the nearest Jesuit mission in kilometers. Data at this level of disaggregation are not available for Argentina. The sample is restricted to a distance of 225 km.

a principal component analysis (PCA) combining education and income. As can be seen in Figure IV, moving farther away from the nearest mission leads to worse outcomes.[17]

As an alternative measure of income, I use the unsatisfied basic needs (UBN) index for Paraguay and Argentina.[18] The coefficient for distance to the nearest mission now emerges significantly positive in Table III, columns (5) and (6), without and with geographic controls, with a corresponding beta coefficient of 0.5. By construction, the poverty index allows for an easier interpretation of the results: as one moves 100 km farther away from

17. Online Appendix Table A.6, column (5), confirms the statistical significance of this joint relationship. Income per capita is not available for Argentina at this level of disaggregation. Online Appendix Figures A.6 and A.7 show the results by country. Online Appendix Figures A.8 and A.9 present the binned scatter plots for education and income net of country fixed effects. Results at different distance thresholds are in Online Appendix Figure A.11 and Table A.3. The effects are stable and larger at the local level.

18. The UBN methodology seeks to determine, with the help of a few indicators, whether the population' s basic needs are being satisfied. The groups that do not reach the minimum threshold are classified as poor. The selected indicators are inadequate housing, housing with critical overcrowding, housing with inadequate services, households with high levels of economic dependence, and households with school-age children not enrolled in school.

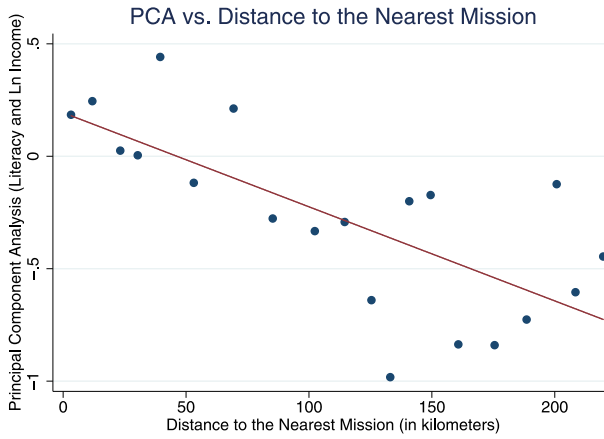


FIGURE IV

Literacy and Income on Missionary Distance: Principal Component Analysis

Unconditional binned scatter plot of PCA of literacy and the logarithm of income (circles) with fitted line for Brazil and Paraguay versus distance to the nearest Jesuit mission in kilometers. The sample is restricted to a distance of 225 km. Color version available online.

a missionary district, the individual poverty index increases by approximately 10% (10 points). The empirical results presented in this section are robust to alternative proxies for income, and formulations such as logarithms and dummies, reported in the Online Appendix.[19]

IV.C. Abandoned Missions

Jesuit missions might have been established in better places, beyond observable geographic and weather characteristics.[20] To

19. Results are robust to using the household as opposed to the individual UBN index (Online Appendix Table A.5, column (9)). Online Appendix Figure A.10 displays poverty results by country. I present alternative formulations such as logarithmic specifications and income proxies using nighttime satellite data in Online Appendix Figure A.12 and Tables A.4 and A.5. Online Appendix Table A.6 shows results for illiteracy and income using dummies and Table A.7 for median years of schooling and the poverty index.

20. I quantify this possibility by calculating Altonji ratios (Altonji, Elder, and Taber 2005), which suggest that selection on unobservables would have to be more than four times larger than selection on observables to drive the results. I also show in Online Appendix Table A.16 that places close to Jesuit missions have worse geographic and weather attributes.

address the potential endogeneity of missionary location, I conduct a placebo-type test where I look at missions that were initially founded but soon abandoned by the Jesuits. This goes to the heart of the question as to whether Jesuits simply picked better places ex ante. I retrieve the coordinates for the abandoned missionary nuclei of Guayrá, Alto Paraná, and Itatín, all places that did not receive the full treatment of the Guaraní Jesuit missions. Because abandoning these places may itself have been endogenous, I analyze the case of the nonabandoned Franciscan Guaraní missions in the next section.

The missionary nuclei of Guayrá, Alto Paraná, and Itatín were founded during the Jesuit exploratory period (1609–1659). In the Guayrá region, the Jesuits founded Loreto and San Ignacio in 1610, and in Alto Paraná the missions of Nuestra Señora de la Natividad de Acaray in 1624 and Santa María la Mayor de Iguazú in 1626. The Guayrá foundations lasted from 1610 to 1630 and the Alto Paraná nuclei from 1609 to 1638. In the Itatín region, they founded several missions, the last of which was Yatebó in 1634. The Itatín reductions were first disbanded in 1648 and then relocated in 1659. All of these missions were abandoned early on and not integrated with the rest of the Guaraní system of missions (Hernández 1913; Furlong and Muriel 1955). This might have been due to the threat of Portuguese slave-hunting *bandeiras* and the death of priests, at a time of low missionary recruitment in Europe (García, 1995; Ganson 2003).[21] Such deaths were critical blows to fledging missions, which counted only one or two Jesuit priests per mission.

I find no consistent effects of the abandoned missions on modern education. For literacy (Table IV, columns (1) to (3)), some coefficients are significant separately, but now appear with the opposite (negative) sign. When estimated jointly, they lose significance (column (4)) with one exception (column (5)). The effect of the Guaraní Jesuit missions is robust to controlling for all of the abandoned missions, without and with geographic controls (columns (6) and (7)). The same pattern can be observed using median years of schooling as an alternative measure for education (Table V, columns (1) and (2)). The coefficients on income for

21. Online Appendix Table A.14 controls directly for distance to the Tordesillas line, which divided the Spanish from the Portuguese empires. Online Appendix Table A.17 controls for distance to the capital and Table A.18 for distance to São Paulo.

TABLE IV

PLACEBO EFFECT OF ABANDONED JESUIT MISSIONS ON MODERN EDUCATION

	Illiteracy						
	Argentina, Brazil, and Paraguay						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Alto Paraná mission distance	−0.0201***			−0.000503	0.0185	−0.0031	0.00399
	(0.007)			(0.013)	(0.028)	(0.017)	(0.027)
	{0.007}			{0.019}	{0.028}	{0.019}	{0.027}
Guayrá mission distance		0.00422		−0.0015	0.0476***	−0.00932	0.0267*
		(0.009)		(0.010)	(0.015)	(0.010)	(0.016)
		{0.010}		{0.010}	{0.015}	{0.011}	{0.016}
Itatín mission distance			−0.0497***	−0.00728	−0.135**	−0.0469	−0.0956*
			(0.014)	(0.023)	(0.055)	(0.030)	(0.052)
			{0.014}	{0.033}	{0.055}	{0.034}	{0.052}
Jesuit mission distance						0.0244***	0.0216***
						(0.005)	(0.006)
						{0.010}	{0.006}
Geo controls	Yes	Yes	Yes	No	Yes	No	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	548	548	548	549	548	549	548
Within R^2	0.077	0.063	0.083	0.028	0.108	0.078	0.121
R^2	0.082	0.068	0.088	0.032	0.113	0.078	0.126

Notes. The table shows the coefficients for distance to the nearest abandoned and Jesuit missions in kilometers (equation (1)). The dependent variable is illiteracy for people aged 15 years and older in 2000 in percentages for Argentina, Brazil, and Paraguay. Geographic controls include distance to the nearest coast, distance to the nearest Franciscan mission, distance to the nearest river, altitude, temperature, area, rainfall, latitude, and longitude. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS with country fixed effects. Robust standard errors are in parentheses and Conley standard errors are in curly brackets *** $p < .01$, ** $p < .05$, * $p < .1$.

TABLE V

PLACEBO EFFECT OF ABANDONED JESUIT MISSIONS ON DEVELOPMENT PROXIES IN BRAZIL, ARGENTINA, AND PARAGUAY

	Median years of schooling Brazil		Ln income Brazil and Paraguay		Individual Poverty index Argentina and Paraguay	
	(1)	(2)	(3)	(4)	(5)	(6)
Alto Paraná mission distance	0.0155	0.0245	−0.0005	−0.0012	−0.387**	−0.224
	(0.018)	(0.019)	(0.003)	(0.002)	(0.155)	(0.155)
	{0.017}	{0.018}	{0.002}	{0.001}	{0.151}	{0.157}
Guayrá mission distance	−0.009	0.00501	−0.00555***	−0.00386***	−0.0073	0.375
	(0.010)	(0.013)	(0.001)	(0.001)	(0.212)	(0.255)
	{0.010}	{0.013}	{0.001}	{0.001}	{0.246}	{0.275}
Itatín mission distance	0.0027	−0.0346	0.00864*	0.00699	0.408	0.126
	(0.039)	(0.046)	(0.005)	(0.005)	(0.273)	(0.292)
	{0.038}	{0.045}	{0.005}	{0.005}	{0.248}	{0.261}
Jesuit mission distance		−0.00681**		−0.00252***		0.137***
		(0.003)		(0.001)		(0.042)
		{0.003}		{0.001}		{0.051}
Geo controls	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	427	427	506	506	81	81
Within R^2	0.161	0.169	0.039	0.041	0.110	0.132
R^2	0.190	0.198	0.879	0.881	0.758	0.777

Notes. The table shows the coefficients for distance to the nearest abandoned and Jesuit missions in kilometers (equation (1)). The dependent variables are median years of schooling in Brazil in columns (1) and (2), the logarithm of income per capita in 2000 in Brazil and Paraguay in columns (3) and (4), and the Unsatisfied Basic Needs (UBN) poverty index in Argentina and Paraguay at the individual level in columns (5) and (6). Median years of schooling is only available for Brazil at the municipal level and income is not available for Argentina. Mesoregion fixed effects are included for Brazil. Geographic controls include distance to the nearest coast, distance to the nearest Franciscan mission, distance to the nearest river, altitude, temperature, area, rainfall, latitude, and longitude. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS with country fixed effects. Robust standard errors are in parentheses and Conley standard errors are in curly brackets *** $p < .01$, ** $p < .05$, * $p < .1$.

the abandoned missions are only significant in one case, whereas the Jesuit effect remains robust to their inclusion (columns (3) and (4)).[22] When using the individual poverty index for Argentina and Paraguay, none of the coefficients for the abandoned missions are significantly positive (column (5)). The effect of the Guaraní Jesuit missions is again robust to controlling for the abandoned missions of Alto Paraná, Guayrá, and Itatín (column (6)).[23] The findings in this section suggest that it was not simply the original placement of missions but the actual development of the missionary activities over centuries that had a long-lasting effect.

IV.D. Franciscan Guaraní Missions

The study of Franciscan Guaraní missions allows for the analysis of two Catholic orders in a similar area. The comparison is relevant, as many of the elements that determined their location—such as indigenous and European presence, as well as suitable climatic and geographic conditions—were common to both sets of missions. Catholic missionaries aimed to maximize the number of souls converted to Christianity. Nonetheless, Franciscans did not stress human capital formation in their conversion, relative to the Jesuits. As discussed next, members of this Mendicant order took strict poverty vows, following the example of their Italian founder, Saint Francis of Assisi.

Franciscans arrived very early to the Americas during the colonization of New Spain (Mexico) in 1524. The first Guaraní Franciscan missions were established between 1580 and 1615 by Fathers Bolaños and Alonso, and the first Guaraní Jesuit mission was founded in 1609 (Durán Estragó 1987). I focus here on the Franciscan missions of Altos founded in 1580; Itá in 1585; Yaguarón in 1586; Atyrá, Guarambaré, Tobatí, and Ypané from 1580 to 1600; Caazapá in 1606; and Yuty in 1611. I use the exact location and historical population data for these Franciscan Guaraní missions. Online Appendix Figure A.16 shows how the population of these two sets of missions diverged historically from

22. This might be due to the eventual importance of Guayrá as a colonial center. To this end, I reestimate all placebo missions jointly in Online Appendix Table A.14 (columns (4) and (9)) and report a specification controlling directly for distance to European exploration routes (Table A.14, columns (1) and (6)).

23. Online Appendix Table A.8 shows results without geographic controls, Table A.9 by country, and Tables A.10 and A.11 without controlling for Franciscan missions. Online Appendix Table A.15 and Figure A.18 present intensity of treatment effects.

1640 to 1760. By choosing first, Franciscans located themselves further north and closer to the existing population centers. I show in Online Appendix Table A.16 that places closer to Franciscan missions are larger, have lower altitude, are less rugged, have lower rainfall and warmer climates, are closer to rivers, have a lower probability of being landlocked, and are closer to the capital. Overall, they appear to be selected positively on these geographic attributes, consistent with the historical record.

I test whether Franciscan missions had persistent effects similar to those of Jesuits by reestimating the human capital and income specifications, using instead distance to the nearest Franciscan mission. The results, or lack thereof, can be seen in Tables VI and VII. I find no effect for either modern illiteracy without and with geographic controls (Table VI, columns (1) and (2)). In a specification including missions from the two orders, I show that the beneficial effect on education is preserved for the Jesuits and now appears negative for the Franciscans, without and with geographic controls (columns (3) and (4)). A similar pattern is observed for each of the countries separately (columns (5) to (7)) and for Brazil using median years of schooling (Table VII, columns (1) and (2)). For income, again I do not find an effect for Franciscan missions when estimated separately (Table VII, column (3)), whereas a joint specification reveals a beneficial effect for Jesuit missions and the opposite for Franciscan ones (column (4)). These effects are confirmed when using the poverty index for Argentina and Paraguay, in columns (5) and (6).[24]

I now turn to the reasons for the different results observed. A primary candidate is the distinct focus of the two orders. From the outset, the Jesuits strongly emphasized human capital formation and technical training, a difference that prevails even today (Langer and Jackson 1995). In contrast, the Mendicant orders, to which the Franciscans belonged, were characterized since their inception by tending to the sick and the poor, charitable giving, and reducing inequality—for the case of Mexico, see Waldinger (2016).[25] A key distinction between the two settings is that

24. These results also hold without geographic controls, shown in Online Appendix Table A.12. Online Appendix Table A.13 presents comparable illiteracy results for each country separately.

25. Even when devoted to similar activities (cattle raising and yerba mate cultivation), the Jesuits proved more effective (Maeder 1995). Waldinger (2016) provides results only for education and not for income. Additional results show

TABLE VI

FRANCISCAN AND JESUIT MISSIONARY EFFECT ON MODERN EDUCATION

	Illiteracy						
	Argentina, Brazil, and Paraguay				Brazil	Argentina	Paraguay
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Franciscan mission distance	0.00579	−0.00899	−0.01200	−0.0335***	−0.0618***	−0.0529*	−0.03500
	(0.005)	(0.008)	(0.008)	(0.008)	(0.019)	(0.029)	(0.025)
	{0.006}	{0.011}	{0.009}	{0.012}	{0.019}	{0.030}	{0.026}
Jesuit mission distance			0.0131**	0.0183***	0.0518***	0.111***	0.0208
			(0.005)	(0.005)	(0.009)	(0.029)	(0.024)
			{0.005}	{0.006}	{0.010}	{0.032}	{0.029}
Geo controls	No	Yes	No	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	549	548	549	548	467	42	39
Within R^2	0.026	0.062	0.036	0.077	0.116	0.674	0.494
R^2	0.031	0.067	0.041	0.082	0.120	0.737	0.495

Notes. The table shows the coefficients for distance to the nearest Franciscan and Jesuit missions in kilometers (equation (1)). The dependent variable is illiteracy for people aged 15 years and older in 2000 in percentages for Argentina, Brazil, and Paraguay. Geographic controls include distance to the nearest coast, distance to the nearest river, altitude, ruggedness, temperature, area, rainfall, latitude, and longitude. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS with state fixed effects. Robust standard errors are in parentheses and Conley standard errors are in curly brackets *** $p < .01$, ** $p < .05$, * $p < .1$.

TABLE VII

FRANCISCAN AND JESUIT MISSIONARY EFFECT ON DEVELOPMENT PROXIES IN BRAZIL, ARGENTINA, AND PARAGUAY

	Median years of schooling Brazil		Ln income Brazil and Paraguay		Individual poverty index Argentina and Paraguay	
	(1)	(2)	(3)	(4)	(5)	(6)
Franciscan mission distance	−0.00175	0.0111***	−0.00010	0.00356***	−0.0225	−0.0867
	(0.004)	(0.004)	(0.001)	(0.001)	(0.042)	(0.056)
	{0.004}	{0.004}	{0.001}	{0.001}	{0.045}	{0.052}
Jesuit mission distance		−0.0103***		−0.00356***		0.130**
		(0.002)		(0.001)		(0.062)
		{0.002}		{0.001}		{0.057}
Geo controls	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	427	427	506	506	81	81
Within R^2	0.119	0.166	0.032	0.039	0.070	0.088
R^2	0.138	0.185	0.872	0.879	0.762	0.780

Notes. The table shows the coefficients for distance to the nearest Franciscan and Jesuit missions in kilometers (equation (1)). The dependent variables are median years of schooling in Brazil in columns (1) and (2), the logarithm of income per capita in 2000 in Brazil and Paraguay in columns (3) and (4), and the Unsatisfied Basic Needs (UBN) poverty index in Argentina and Paraguay at the individual level in columns (5) and (6). Median years of schooling is only available for Brazil at the municipal level and income is not available for Argentina. Mesoregion fixed effects are included for Brazil. Geographic controls include distance to the nearest coast, distance to the nearest river, altitude, ruggedness, temperature, area, rainfall, latitude, and longitude. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS with state fixed effects. Robust standard errors are in parentheses and Conley standard errors are in curly brackets *** $p < .01$, ** $p < .05$, * $p < .1$.

Jesuits focused more on elite education in Mexico City relative to Paraguay, where Asunción remained relatively small, and the indigenous missions took the lion's share of the apostolic efforts. The Jesuit focus on human capital appears to have had a beneficial impact in the long run.

IV.E. Human Capital Persistence

I use the Argentinean census of 1895, the Brazilian census of 1920, and the (first) Paraguayan census of 1950 to study the differential accumulation of human capital over time. To complement the analysis, I analyze human capital outcomes during the postwar era, focusing on illiteracy in Argentina (1970, 1980, and 1991) and Paraguay (1962 and 1982), and median years of schooling in Brazil (1980 and 1991). Overall, I find that Jesuit missions had an even larger effect on human capital during these intermediate historical time periods.

Table VIII, Panel A, presents the results for Argentina. In the 1895 census, illiteracy appears higher the further away the municipality is from a Jesuit mission (column (1)).[26] Being 100 km closer to a mission leads to a reduction in illiteracy of 5% and a corresponding beta coefficient of 0.5. The larger historical effect might be due to the more recent nature of the Jesuit intervention and the lower levels of literacy during this period, which averaged 23% (with a standard deviation of 8%). In terms of heterogeneity, the literacy gap is higher for women than for men (columns (2) and (3)), consistent with the historical record on female instruction. They also appear concentrated among Argentineans as opposed to foreigners (column (4)), suggesting a mechanism of vertical cultural transmission for the postexpulsion period.[27] Results for the 1920 Brazilian census are similar to those for Argentina. The effect on illiteracy is positive

that Guaraní areas closer to Franciscan missions do not seem to have lower levels of inequality or higher levels of health (Online Appendix Table A.17).

26. Due to the small number of observations, I also report bootstrapped standard errors, which emerge larger than the Conley standard errors at 0.1 degrees.

27. The human capital results also hold when using the 1914 Argentinean census (Online Appendix Table A.19, columns (1) to (4)), where I find additionally that missionary areas have higher levels of educational instruction and schools per capita, and for the 1940 Brazilian census, which provides literacy for different age groups and educational instruction as an alternative educational proxy (columns (5) to (8)). For an analysis of historical migration and human capital in Argentina and Brazil, see Droller (forthcoming) and Rocha, Ferraz, and Soares (2015).

TABLE VIII

MISSIONARY EFFECT ON HISTORICAL AND POSTWAR EDUCATION

Panel A: Illiteracy in Argentina

	1895, OLS				ML Probit		
	Argentinean	Males	Females	Foreigners	1970	1980	1991
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mission distance	0.0505***	0.0395**	0.0841***	−0.0412***	0.00439*	0.00462***	0.00368***
	(0.018)	(0.016)	(0.017)	(0.005)	(0.002)	(0.002)	(0.001)
	{0.029}	{0.020}	{0.021}	{0.006}			
Geo controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	No	No	No	No	Yes	Yes	Yes
Observations	32	33	34	33	13,532	175,706	109,887
Within R^2	—	—	—	—	0.023	0.008	0.009
R^2	0.598	0.714	0.872	0.877	0.023	0.009	0.010

Panel B: Education in Brazil

	Illiteracy in Brazil 1920, OLS			Median years of schooling ML probit	
	Total	Brazilian	Foreigners	1980	1991
	(1)	(2)	(3)	(4)	(5)
Mission distance	0.176**	0.183***	0.110	−0.00993***	−0.00909***
	(0.071)	(0.066)	(0.071)	(0.003)	(0.003)
	{0.081}	{0.087}	{0.076}		
Geo controls	Yes	Yes	Yes	Yes	Yes
State fixed effects	No	No	No	Yes	Yes
Observations	71	71	71	232,717	331,498
Within R^2	—	—	—	0.0583	0.051
R^2	0.149	0.17	0.444	0.061	0.054

TABLE VIII
CONTINUED

Panel C: Illiteracy in Paraguay

	1950, OLS	ML probit	
	Total	1962	1982
	(1)	(2)	(3)
Mission distance	0.232*	0.0762***	0.0848*
	(0.105)	(0.016)	(0.046)
	{0.177}		
Geo controls	Yes	Yes	Yes
State fixed effects	Yes	No	No
Observations	20	10,457	33,982
Within R^2	0.699	—	—
R^2	0.784	0.007	0.006

Notes. The table shows the coefficient of distance to the nearest Jesuit mission in kilometers (equation (1)). The dependent variables are illiteracy in percentages in Argentina in 1895 in Panel A, columns (1) to (4), and illiteracy at the individual level in 1970, 1980, and 1991 in columns (5) to (7); illiteracy in Brazil in 1920 in Panel B, columns (1) to (3), and years of schooling in Brazil at the individual level in 1980 and 1991 in columns (4) and (5); and illiteracy in Paraguay in 1950 in Panel C, column (1), and illiteracy at the individual level in 1962 and 1982. Median years of schooling is only available for Brazil. Geographic controls include distance to the nearest coast, distance to the nearest Franciscan mission, distance to the nearest river, altitude, ruggedness, temperature, area, rainfall, latitude, and longitude. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS and probit. Robust standard errors and standard errors clustered at the district level are in parentheses; bootstrapped errors are in curly brackets *** $p < .01$, ** $p < .05$, * $p < .1$.

and statistically significant for the entire sample (Panel B, column (1)). It is also larger historically, on the order of 17% with a base of 35%, and again appears concentrated among Brazilians as opposed to foreigners, as expected (columns (2) and (3)). Estimates using the Paraguayan census of 1950 also reveal greater effects historically (Panel C, column (1)), with a base of 74% and a corresponding beta coefficient of 0.54.[28]

Results for the postwar era show how the effect of Jesuit missions has decreased over time but is still statistically and economically significant (as in Iyer 2010). This is most cleanly seen for illiteracy in Argentina (Panel A, columns (5) to (7)), but is also observable using median years of schooling in Brazil (Panel B, columns (4) and (5)), and illiteracy in Paraguay (Panel C, columns

28. Additional results show strong persistence between historical and modern levels of literacy (Online Appendix Figure A.17). This is especially true for Argentina, with a slope of 0.23; for Paraguay, with a slope of 0.217; and for Brazil, with a slope of 0.193 (Hertz et al. 2008 calculate an intergenerational elasticity of educational attainment of 0.5).

(2) and (3)).[29] The postwar missionary education results are compatible with a broader process of educational convergence in Latin America (Hanushek and Woessmann 2012).

V. Persistence Mechanisms

This section presents cultural and occupational mechanisms that can help explain the persistent differences in human capital and income. In his 1827 visit to the former mission of Loreto, Argentina, French naturalist Alcide d'Orbigny reported how indigenous inhabitants still lived "following the old missionary customs" (cited in Gálvez 1995, 392). I focus here on occupational specialization, structural transformation, and technology adoption in agriculture—using the introduction of GE soy seeds.

V.A. Occupational Specialization

An important channel of transmission generating economic persistence is the transformation of occupational structures. There is a strong relationship between human capital investment decisions and occupational choices (Doepke and Zilibotti 2008). As in Botticini and Eckstein (2005, 2007, 2012), individuals that attended religious missions, receiving instruction and technical training, moved away from agriculture to start a proto-artisan class. Two pieces of empirical evidence point in this direction.

First, I examine the broad occupational structure of Brazil, Paraguay, and Argentina using the 2010 census, the 2012 Household Labor Survey, and the 2001 census, respectively. Table IX presents the results without geographic controls in Panel A and with such controls in Panel B. We see that areas closer to missions in Brazil have moved away from agriculture to manufacturing and commerce, a proxy for services (columns (1)–(3)). The same is true using individual-level data for Argentina (columns (4)–(6)), though the effect is now insignificant for manufacturing. The occupational results are strongly present in Paraguay too

29. Individual-level data are from the IPUMS project (Minnesota Population Center 2018), so I use a probit specification and cluster the standard errors at the municipality level. The beta coefficients range from 0.6 in Argentina in the 1970s and hover around 0.3 and 0.2 during the 1980s and 1990s for the other countries (plotted in Online Appendix Figure A.19).

TABLE IX

MISSIONARY EFFECT ON STRUCTURAL TRANSFORMATION IN BRAZIL, ARGENTINA, AND PARAGUAY

	Brazil 2010 Employed in			Argentina 2001 Employed in			Paraguay 2012 Employed in		
	Agriculture (1)	Manufacturing (2)	Commerce (3)	Agriculture (4)	Manufacturing (5)	Commerce (6)	Agriculture (7)	Manufacturing (8)	Commerce (9)
Panel A: Without Geographic Controls									
Mission distance	0.0174	−0.0587***	0.00737	0.00543***	−0.00022	−0.00164***	0.0133**	−0.00755	−0.0112**
	{0.027}	{0.012}	{0.008}	(0.002)	(0.001)	(0.001)	(0.006)	(0.005)	(0.005)
Observations	466	466	466	48,476	48,476	48,476	1,962	1,962	1,962
Within R^2	0.045	0.221	0.032	0.079	0.001	0.007	0.044	0.014	0.026
R^2	0.168	0.274	0.104	0.105	0.002	0.008	0.061	0.014	0.026
Panel B: With Geographic Controls									
Mission distance	0.151***	-0.0877***	-0.0300**	0.0218***	-0.000228	-0.00908***	0.0147*	-0.0189***	-0.0171***
	{0.048}	{0.022}	{0.013}	(0.008)	(0.003)	(0.003)	(0.009)	(0.007)	(0.005)
Observations	426	426	426	48,476	48,476	48,476	1,928	1,928	1,928
Within R^2	0.135	0.287	0.190	0.148	0.013	0.014	0.100	0.050	0.054
R^2	0.301	0.357	0.272	0.167	0.014	0.014	0.117	0.051	0.054

Notes. The table shows the coefficient of distance to the nearest Jesuit mission in kilometers. The dependent variables are the percentage of the population working in agriculture, manufacturing, and commerce in Brazil in columns (1) to (3); whether a person is working in agriculture, manufacturing, and commerce in Argentina in 2001 in columns (4) to (6); and Paraguay in 2012 in columns (7) to (9). Mesoregion fixed effects are included for Brazil and state fixed effects for Argentina and Paraguay throughout. Geographic controls in Panel B include distance to the nearest coast, distance to the nearest river, distance to the nearest Franciscan mission, altitude, ruggedness, temperature, area, rainfall, latitude, and longitude. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS in columns (1) to (3) and probit elsewhere with standard errors clustered at the district level in parentheses and Conley standard errors in curly brackets *** $p < .01$, ** $p < .05$, * $p < .1$.

TABLE X

MISSIONARY EFFECT ON SKILL-INTENSIVE INDUSTRIES IN BRAZIL

	Brazil 2010									
	Iron and steel	Tobacco products	Nonferrous metals	Fabricated metal products	Plastic products	Beverages industries	Transport equipment	Electric machinery	Industrial chemicals	Chemicals other
HCINT	11.425	11.509	11.547	11.577	11.678	11.967	12.346	12.357	12.704	13.031
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mission distance	−0.00255**	−0.000104***	−0.0265***	−0.00230***	−0.000349	−0.0103***	−0.00552**	−0.00685*	−0.00367*	−0.00203
	(0.001)	(0.000)	(0.009)	(0.001)	(0.003)	(0.003)	(0.002)	(0.004)	(0.002)	(0.002)
Geo controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	174,964	174,964	174,964	174,964	174,964	174,964	174,964	174,964	174,964	174,964
Within R^2	0.025	0.007	0.046	0.072	0.077	0.026	0.123	0.051	0.013	0.044
R^2	0.025	0.009	0.046	0.075	0.084	0.034	0.124	0.055	0.024	0.046

Notes. The table shows the coefficient of distance to the nearest Jesuit mission in kilometers. The dependent variable is an indicator variable that equals 1 if an individual reports working in the iron and steel, tobacco products, nonferrous metals, fabricated metal products, plastic products, beverages industries, transport equipment, electric machinery, industrial chemicals, and other chemicals industries in Brazil in 2010, ordered from least to most by their HCINT according to Ciccone and Papaioannou (2009). Mesoregion fixed effects are included. Geographic controls include distance to the nearest coast, distance to the nearest river, distance to the nearest Franciscan mission, altitude, ruggedness, temperature, area, rainfall, latitude, and longitude. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is for a probit model and errors clustered at the municipality level are in parentheses *** $p < .01$, ** $p < .05$, * $p < .1$.

(columns (7)–(9)), suggesting that structural transformation is a mechanism of persistence for the missionary effect.[30]

I expand the occupational analysis by looking at skill-intensive manufacturing industries following the categorization of Ciccone and Papaioannou (2009). I test whether higher human capital accumulation led to specialization in industries that depend more intensely on this factor. Namely, the dependent variable is an indicator variable that equals 1 if an individual reports working in one of their top 10 industries in terms of human capital intensity. These are, ordered from least to most human capital skill intensive (HCINT, in years): iron and steel, tobacco products, nonferrous metals, fabricated metal products, plastic products, beverages, transport equipment, electric machinery, industrial chemicals, and other chemicals.[31] I find a negative and significant effect for practically all of the industries in the top 10 skill intensity ranking (Table X). Interestingly, I also find an insignificant or opposite effect for what they rank as the least skill-intensive sectors: leather, apparel (clothing), footwear, textiles, furniture, and wooden products (Online Appendix Table A.22). I plot the skill-intensity measure against the coefficient of distance to the nearest mission in Online Appendix Figure A.22, revealing a significantly negative relationship. The findings within industries complement at the intensive margin the broader structural transformation results.

V.B. Technology Adoption

Another important mechanism of transmission relates to the adoption of new technologies. Nelson and Phelps (1966) and Benhabib and Spiegel (2005) argue for the importance of human capital for technology adoption and modern economic growth, whereas Foster and Rosenzweig (1995, 1996, 2010) focus on agricultural technologies with the adoption of high-yield variety seeds during India's Green Revolution. Here I study the

30. I include an alternative specification using dummies in Online Appendix Table A.20, and I find the opposite or insignificant effects for abandoned missions in Table A.21.

31. I thank an anonymous referee for suggesting this point. Such disaggregated data are only available for Brazil. The alternative Romalis (2004) classification overlaps with the categorization used for products such as machinery and electrical equipment. Online Appendix Table A.23 presents additional results for abandoned missions, which are insignificant or have the opposite sign. I further document higher labor force participation closer to missionary areas in Online Appendix Figure A.23 and results for specific professions in Table A.25.

TABLE XI

MISSIONARY EFFECT ON TECHNOLOGY ADOPTION IN AGRICULTURE (GENETICALLY ENGINEERED SOY) AND STRUCTURAL TRANSFORMATION IN BRAZIL

	Brazil 1996–2006						
		Change in			Share in		
	Total soy farmed (1)	GE soy (2)	Non-GE soy (3)	Agricultural productivity (4)	Agriculture (5)	Manufacturing (6)	Services (7)
Mission distance	−0.00117***	−0.00164***	0.000721***	−0.00240*	0.0507**	−0.0393***	−0.00907
	(0.0002)	(0.0003)	(0.0002)	(0.0012)	(0.0233)	(0.0094)	(0.0166)
	{0.0002}	{0.0003}	{0.0002}	{0.0012}	{0.0324}	{0.0129}	{0.0231}
Geo controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	509	245	239	262	524	524	524
Within R^2	0.259	0.362	0.229	0.069	0.065	0.249	0.029
R^2	0.608	0.552	0.553	0.117	0.329	0.313	0.254

Notes. The table shows the coefficient of distance to the nearest Jesuit mission in kilometers. The dependent variables are total area planted with soy, changes in genetically engineered (GE) soy and non-GE soy from 1996 to 2006, the logarithm of agricultural productivity, and the share of the labor force in agriculture, manufacturing, and services in Brazil in percentages in 1996 and 2006. Mesoregion fixed effects are included. Geographic controls include latitude, longitude, distance to the nearest Franciscan mission, and soy suitability in columns (1) to (3). Data are from Bustos, Caprettini, and Ponticelli (2016). Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS. Robust standard errors are in parentheses and Conley standard errors are in curly brackets *** $p < .01$, ** $p < .05$, * $p < .1$.

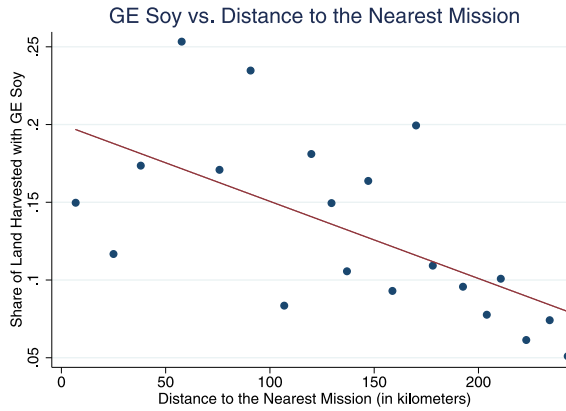


FIGURE V

Binscatter of Technology Adoption in Agriculture on Missionary Distance: Genetically Engineered Soy in Brazil

Unconditional binned scatter plot of share of land in farms harvested with GE soy in Brazil in 2006 versus distance to the nearest Jesuit mission in kilometers. The sample is restricted to a distance of 225 km. Color version available online.

adoption of GE soy seeds in Brazil, in the spirit of Griliches (1957) and following Bustos, Caprettini, and Ponticelli (2016). I test whether areas with higher human capital—close to Jesuit missions—adopted this new agricultural technology faster.[32]

Initially there is a higher share of land harvested with soy closer to former Jesuit areas, controlling for soy suitability (Table XI, column (1)). Interestingly, we see in Figure V and in Table XI, columns (2) and (3), that areas further away from former Jesuit missions have a lower share of land harvested with GE soy, while the opposite is true for non-GE varieties. The respective beta coefficients of −0.86 and 0.49 are large in magnitude. I also find increased agricultural productivity closer to Jesuit areas (column (4)). Consistent with the argument in Bustos, Caprettini, and Ponticelli (2016) that GE soy is a labor-saving technology, I find

32. I thank an anonymous referee for suggesting this point and Bruno Caprettini for sharing the data in Bustos, Caprettini, and Ponticelli (2016). Here I follow a linear specification for consistency, though results are robust to using the changes specification with logarithms employed in their paper. Placebo results for abandoned missions in Online Appendix Table A.24 reveal insignificant coefficients for GE soy adoption and the opposite coefficients for agricultural productivity and structural transformation.

that municipalities closer to Jesuit territories have a lower share of workers in agriculture and a higher share in manufacturing (columns (5) and (6)). As in their paper, I obtain a negative but insignificant coefficient for services (column (7)). These findings for Brazil are in line with those presented before on structural transformation for the three countries.

One way to interpret these results is as a heterogeneous effect of the findings in Bustos, Caprettini, and Ponticelli (2016). Areas with higher human capital due to the historical Jesuit intervention were better able to incorporate a newly introduced agricultural technology and grow faster. The results also speak to the issue of historical persistence and change. In this case, a historical human capital intervention allowed individuals to adapt to their changing environment through the implementation of a newly available technology, consistent with the classic development literature, and Giuliano and Nunn (2017).

VI. Alternative Mechanisms

In this last section, I present complementary evidence for the Jesuit missionary effect on modern human capital and income. I do so by exploring alternative transmission channels such as population density, and complementary investments in infrastructure, health, and tourism. I also estimate heterogeneous effects by migratory status.[33]

One plausible alternative channel of transmission of the missionary effect is population density. Missions may have created the seeds for future urban agglomerations (Becker, Cinnirella, and Woessmann 2010; Bai and Kung 2015). The results of this empirical test can be found in Table XII, Panel A. I find, if anything, that places close to Jesuit missions are less dense today (column (1)). These results are consistent with the historical record, since Jesuit missionaries went to remote areas, isolated from existing population centers. I also explore the possible role of prior precolonial population density in column (2).[34] I do not find that the states where Guaraní Jesuit missions were located were significantly

33. I provide additional evidence of intergenerational (vertical) knowledge transmission in Online Appendix Table A.26 and differential indigenous assimilation in Table A.27, finding more mixed marriages, indigenous people, and bilingual speakers.

34. Data come from Maloney and Valencia Caicedo (2016) and are only available at the state level.

TABLE XII
MISSIONARY EFFECT ON ALTERNATIVE TRANSMISSION MECHANISMS

	Argentina, Brazil, and Paraguay			
	Population density (1)	Precolonial pop. density (2)	Road density (3)	Railroad density (4)
Panel A				
Mission distance	0.340*	1.028	−0.00916***	0.00136***
	(0.205)	(1.119)	(0.002)	(0.0004)
	{0.207}	{1.138}	{0.002}	{0.0004}
Geo controls	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Observations	548	69	548	548
Within R^2	0.176	0.057	0.408	0.181
R^2	0.180	0.302	0.626	0.351

TABLE XII

CONTINUED

	Brazil		Paraguay Visits		Brazil Median years of schooling	
	Health index (1)	Touristic activities (2)	Museum (3)	Monument (4)	Resident (5)	Nonresident (6)
Panel B						
Mission distance	−0.0889***	0.0009	−0.00116*	−0.00333**	−0.00281***	−0.00019
	(0.021)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)
	{0.022}	{0.001}	{0.001}	{0.001}	{0.001}	{0.002}
Geo controls	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	467	427	890	890	266	201
Within R^2	0.162	0.033	0.020	0.039	0.123	0.093
R^2	0.164	0.048	0.021	0.042	0.130	0.114

Notes. The table shows the coefficient of distance to the nearest Jesuit mission in kilometers. The dependent variables are population density and precolonial population density in Panel A, columns (1) and (2), and road and railroad density in columns (3) and (4). The Brazilian IFDM Health Index is the dependent variable in Panel B column (1), prevalence of tourism in percentages in column (2), visits to museums and national monuments in columns (3) and (4), and median years of schooling in Brazil for residents and nonresidents in columns (5) and (6). Mesoregion fixed effects are included for Brazil. Geographic controls include distance to the nearest coast, distance to the nearest river, distance to the nearest Franciscan mission, altitude, ruggedness, temperature, area, rainfall, latitude, and longitude. Please refer to Section I of the Online Appendix for units and additional details of these variables. Estimation is by OLS with state fixed effects. Robust standard errors are in parentheses and Conley standard errors are in curly brackets *** $p < .01$, ** $p < .05$, * $p < .1$.

denser relative to their Argentinean, Brazilian, and Paraguayan counterparts. I analyze the role of infrastructure as an alternative mechanism of transmission, using current road and railway networks (see Dell 2010). I obtain a significant effect of missionary distance on modern road network density (column (3)) and the opposite effect for railroad density (column (4)), reflecting the few tracks on the Brazilian coast. These results are corroborated when I look at these outcomes separately by country in Online Appendix Table A.28.[35]

I study health as a human capital investment complementary to education (Calvi and Mantovanelli 2017; Cagé and Rueda 2018). I show negative and significant coefficients on distance from Jesuit missions for the Brazilian health index (Table XII, Panel B, column (1)).[36] Moving 100 km away from a mission is enough to go from a high to a fair level of health development, a sizable step down. Another possible mechanism of transmission could be tourism. I find no effect on tourist activities when using distance to the nearest Jesuit mission for Brazil (Panel B, column (2)). However, more people report visiting museums and historical monuments in Paraguay, closer to the former missionary areas (columns (3) and (4)). These specific results for services are consistent with the broader structural transformation results described previously.

Lastly, to test for the possible role of migration, I divide the Brazilian sample into municipalities with high and low mobility, namely, where people predominantly report that they are residents or nonresident of that municipality. It appears that the human capital results are concentrated among residents as opposed to nonresidents (Panel B, columns (5) and (6)). As in the historical human capital results, it does not seem that people are sorting themselves into former missionary locations during modern times. Overall, there was historical outmigration from the area after the

35. I do not find any interaction effect of these variables with the human capital or income effects. I find instead interaction effects with rivers, the original transportation networks Online Appendix (Table A.15). To give a sense of the magnitude of the missionary results, I compare them with distance to the capital, which gives beta coefficients of similar magnitude (0.4 for literacy and −0.2 for income) in Online Appendix Table A.17.

36. The Indice FIRJAN de Desenvolvimento Municipal is the Brazilian counterpart to the UN Health Development Index.

missionary period (Jackson 2009), so the results obtained can be interpreted as lower bounds.[37]

VII. Conclusion

In line with Voltaire, I document significant long-lasting effects of the Guaraní Jesuit missions on education and income. I show that Jesuit missions had a positive and significant effect of raising modern-day median years of schooling and literacy rates by 10%–15%, and had even larger impacts historically. Places closer to historical missions also have incomes that are 10% higher today. The human capital and income effects do not extend to abandoned Jesuit missions, which only received partial treatment. The economic impact is also specific to missions from the Jesuit as opposed to the Franciscan order, which placed less emphasis on education and technical training in their conversion. The enduring differences are consistent with cultural mechanisms of occupational specialization, structural transformation, and technology adoption in agriculture. Additional empirical tests suggest that results are not driven by urbanization or migration, while there appear to be complementary investments in health and infrastructure.

The case of the Guaraní Jesuit missions serves as a microcosm in which to study important economic questions. The Jesuit missionary results on human capital formation are consistent with those of Nunn (2014) for nineteenth-century Christian missions in Africa, and are similar in magnitude to well-established conditional cash transfer programs such as Bolsa Familia in Brazil. It is remarkable that these effects are still observable centuries after the Jesuit expulsion and are present in Argentina, Brazil, and Paraguay, despite their different national and institutional trajectories. The overall results underscore the prominence of human capital investments for long-term economic development.

More generally, the findings presented in this article underscore the importance of particular historical institutions and interventions for driving economic growth in the long run

37. After their initial establishment, missions grew through natural reproduction rather than immigration (Livi-Bacci and Maeder 2004). To test a spillovers hypothesis, I run specifications where I exclude missionary districts, which leaves the results unchanged (Online Appendix Table A.17). See Wantchekon, Klašnja, and Novita (2015) for such externalities in Benin.

(Nunn 2009, 2013; Michalopoulos and Papaioannou 2017). Such historical experiments can be instrumental in answering policy-relevant questions for which limited counterfactuals exist today. This type of research can help us uncover and better understand deep-rooted factors of comparative development (Spolaore and Wacziarg 2013). Far from advocating historical determinism, a thorough understanding of these historical forces, and their implied constraints, offers the opportunity to make modern economic policies more targeted and effective.

Supplementary Material

An Online Appendix for this article can be found at *The Quarterly Journal of Economics* online. Data and code replicating tables and figures in this article can be found in Valencia Caicedo (2018), in the Harvard Dataverse, doi:10.7910/DVN/ML1155.

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