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DEVOTION AND DEVELOPMENT: RELIGIOSITY, EDUCATION, AND ECONOMIC PROGRESS IN 19TH-CENTURY FRANCE

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Abstract

This paper studies when religion can hamper diffusion of knowledge and economic development, and through which mechanism. I examine Catholicism in France during the Second Industrial Revolution (1870–1914). In this period, technology became skill-intensive, leading to the introduction of technical education in primary schools. I find that more religious locations had lower economic development after 1870. Schooling appears to be the key mechanism: more religious areas saw a slower adoption of the technical curriculum and a push for religious education. In turn, religious education was negatively associated with industrial development 10 to 15 years later, when schoolchildren entered the labor market.

JEL Classification: J24, N13, Z12

Keywords: Human Capital, Religiosity, Industrialization

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This paper studies when religion can hamper diffusion of knowledge and economic development, and through which mechanism. I examine Catholicism in France during the Second Industrial Revolution (1870–1914). In this period, technology became skill-intensive, leading to the introduction of technical education in primary schools. I find that more religious locations had lower economic development after 1870. Schooling appears to be the key mechanism: more religious areas saw a slower adoption of the technical curriculum and a push for religious education. In turn, religious education was negatively associated with industrial development 10 to 15 years later, when schoolchildren entered the labor market.

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1 Introduction

Religion has played a primary role in human societies for millennia and continues to do so for billions of people around the globe. Given its importance in the private and public spheres, a broad literature—starting with the pioneering work of Max Weber (1905)—has pointed to different channels through which religion can affect economic development. Specifically, its relationship with scientific-technological progress has been particularly complex throughout history, and religion can still hamper the diffusion of knowledge and innovation in many regions today.[1] However, there is scant empirical evidence on when this happens and through which mechanism. It is challenging to measure religion and to find a context in which to study its interaction with the adoption of "useful knowledge."[2]

This paper examines a historical setting, focusing on 19th-century Catholicism in France during a crucial phase of modern economic growth, the Second Industrial Revolution (1870–1914). In this period, Western economies began adopting transformative, skill-intensive technologies. Providing technical education to the masses in primary school became an essential component of the industrialization process (Galor and Moav, 2006). Meanwhile, the Catholic Church was promoting a conservative, antiscientific program and hindered the introduction of the technical curriculum, while pushing for religious education. This tension was particularly strong in France, which experienced spectacular scientific and economic development, and where the relationship between the Church and science had been exacerbated by the events of the 1789 French Revolution. Importantly, while 98% of the French population was Catholic, there was large preexisting variation in the *intensity* of Catholicism (which I refer to as "religiosity").[3] I exploit this variation to study the differential diffusion of technical education and industrial development in 83 French departments and in approximately 2,000 French cantons (metropolitan areas).

To conduct the empirical analysis, I assembled a rich dataset from historical archives and secondary sources. My main measure of religiosity is the share of refractory clergy in 1791. This represents the share of French clergy that did not swear the oath of allegiance to the *Civil Constitution* promoted by the revolutionary government, but instead confirmed their loyalty to the Catholic Church. Since a clergyman's decision to accept or reject the oath was largely determined by the religious attitude of the local community, the share of refractory clergy reflected religiosity at the local level (Tackett, 1986). To further validate this measure, I use three other indicators for Catholic intensity (not related

[1] For several examples of the clash between religious doctrines and innovative activities, see Bénabou, Ticchi, and Vindigni (2015). Other authors have looked at how religion affects development through other factors, such as work ethic (Weber, 1905) and trust (Putnam, 1993; Guiso, Sapienza, and Zingales, 2003).

[2] Following Mokyr (2002), I refer to "useful knowledge" as knowledge that is "economically useful," i.e., necessary for economic development.

[3] Higher religiosity accentuates the effects of belonging to a particular religious affiliation and leads to stricter observance of religious rules (Lehrer, 2011).

to a political episode) and provide evidence of a stable spatial distribution of religiosity over time (see Figure 1).

I find that areas with higher religiosity had lower industrial and economic development only *during* the Second Industrial Revolution, but not before. I first provide cross-sectional evidence at the department and canton levels, using a host of outcome variables. These findings are supported by a difference-in-differences analysis, showing that the more religious departments had significantly lower industrial employment in the post-1870 period, and suggesting that preexisting variation in religiosity started to matter when skill-intensive technologies were introduced.

What explains the negative relationship between religiosity and industrialization after 1870? In these decades, the contribution of human capital to industrialization changed dramatically: contrary to the First Industrial Revolution—when the upper tail of the skill distribution was crucial for industrial development and worker skills mattered less (Mokyr, 2005; Squicciarini and Voigtländer, 2015)—the more sophisticated industrial machinery of the Second Industrial Revolution required a technically skilled workforce to be operated, installed, and maintained (Galor and Moav, 2006). Consequently, the French state took an active role in primary education, promoting a more technical curriculum to form a skilled labor force.[4] While educational policies were adopted at the national level, religiosity played a key role in their local implementation. Using department-level information from the *Statistique de l'Enseignement Primaire* and newly assembled canton-level data from the French *Archives Nationales*, I find that more religious locations experienced a slower adoption of the technical curriculum and a push for Catholic education. Historical records suggest that this was driven by parents' preference for religious education for their children—because their Catholic identity was being threatened by the introduction of the secular, technical curriculum (Harrigan, 2001).

Next, I investigate the role of secular vs. Catholic education for the industrialization process. Using panel data from 1871 to 1911, I show that the share of Catholic schools was negatively and significantly associated with employment in industry a decade later. Specifically, "moving" from the 10th to the 90th percentile of the share of Catholic schools distribution would decrease the share of industrial employment by 6.2 percentage points (relative to a mean of 28% with a standard deviation of 11%). Then, using different lags for the share of Catholic schools, I find that the effect of education was strongest about 10 to 15 years later, while lagged industrialization does not predict the type of schooling later on. This specific time pattern alleviates concerns of reverse causation and suggests that the type of primary education (Catholic vs. secular) was crucial for the diffusion of "useful knowledge," for the formation of a skilled labor force, and for industrial and economic development.

When interpreting the above findings, three main concerns could arise. First, the spatial distri-

[4]This included, for instance, basics of arithmetic, geometry, and the metric system, as well as their practical applications to objects and tools. For more details, see Section 2.3.

bution of religiosity may be related to other factors also affecting economic development during the Second Industrial Revolution (but not before). I employ several strategies to mitigate this concern. The department-level analysis accounts for a large set of confounding characteristics, such as geographic factors and core-periphery patterns, as well as differences in average and upper-tail human capital. The difference-in-differences specification controls for unobserved time-invariant department characteristics and nationwide common trends. In addition, when disaggregated data are available, the analysis is conducted at the the canton level, thus exploiting within-department variation in religiosity. Finally, to address remaining endogeneity concerns, I use an instrumental variable strategy. Similar to the approach of Dittmar and Meisenzahl (2019), I consider plague outbreaks during a narrow period (i.e., the Protestant Reformation in France) as a source of exogenous variation in Catholic intensity and find support for a causal interpretation of the relationship between religiosity and economic development.[5]

The second concern regards the mechanism: Does religiosity affect economic development by slowing down the spreading of secular education? My results show that when the two school systems started to differ, the more religious areas experienced a push for Catholic education and that, in turn, Catholic education was negatively associated with industrialization a decade later. However, the antiscientific and antimodern program of the Church may have also reached other aspects of people's lives: for instance, local clergymen opposed the introduction of vaccinations and birth control (Minois, 1991). Accordingly, the paper's claim is not that schooling was the *only* mechanism through which religiosity affected economic progress during the Second Industrial Revolution. Nevertheless, when I analyze the role of these alternative channels, I find that they are uncorrelated with industrial development. In addition, to further validate the role of primary education for industrial-economic progress, I show that the results hold when accounting for other factors that could be associated with changes in Catholic/secular education and in industrial employment, such as government spending, agricultural shocks, changes in urban population, and immigration. Thus, the empirical evidence, together with a rich historical record, makes it hard to imagine that schooling was not a *key* mechanism explaining the negative relationship between religiosity and economic outcomes during the Second Industrial Revolution.

The third concern regards the specific channel through which Catholic education may have hampered industrialization. I discuss detailed historical records documenting large differences in the curricula of secular and religious schools—with the former introducing "technical" subjects and becoming increasingly modern and professional, and the latter remaining "the bastions of a Catholic subculture" (Grew and Harrigan, 1991, p. 221). Then, using data by sector and worker cohort, I find that "reli-

[5]The results suggest that the interaction between global religious competition (introduced by the Reformation) and local plague shocks fostered criticism against the prophetic approach of the Church and strong dissent from the Catholic doctrine. Appendix B discusses the exclusion restriction and provides details on the instrumental variable strategy.

giously educated" cohorts were less likely to be employed in skill-intensive sectors, probably because they lacked the knowledge needed to operate the more complex industrial machinery. In addition, I discuss and explore other critical educational dimensions that could distinguish Catholic and secular education and affect industrial employment. I show, for instance, that the two school systems did not differ in terms of student attendance and school financial resources, further highlighting the key role of educational content for human capital accumulation. Importantly, the differences between secular and Catholic school curricula may not be confined to the subjects studied, but could also comprise broader attitudes that were (or were not) beneficial to the accumulation of "economically useful" human capital. Accordingly, my interpretation emphasizes a broad concept of the Catholic school curriculum, but one that is clearly distinct from what children learned in secular schools.

By analyzing the hindering role that religiosity can play for the diffusion of useful knowledge and economic development, this paper contributes to a growing literature studying when (and how) religious values hamper the spread of innovations and new ideas (Berman, 2000; Mokyr, 2011; Bénabou et al., 2015; Carvalho, 2013; Carvalho and Koyama, 2016; Carvalho, Koyama, and Sacks, 2017; Iyigun, Rubin, and Seror, 2018). For instance, Mokyr (2011) argues that traditional Judaism, incompatible with scientific and technological innovation, was responsible for the (almost complete) absence of Jewish inventors before 1850. In the Islamic context, Chaney (2015) documents a decline in scientific production in the 12th century and suggests that this was driven by institutional changes rewarding religious more than scientific knowledge. From a theoretical perspective, Berman (2000), Carvalho and Koyama (2016), and Carvalho et al. (2017) develop models that account for the resistance to modernization of some Jewish communities in the 19th century, for the rise of Ultra-Orthodoxy, and for the strong opposition to modern ideas and secular education. In a more general framework, Bénabou et al. (2015) analyze the interplay between religious beliefs and scientific-economic development. In their model, belief-eroding innovations reduce the stock of religious human capital. Whether or not these innovations will be blocked depends on political conflicts and coalition formation along religious and income dimensions. While most of the articles adopt historical and/or theoretical viewpoints, this paper is, to my knowledge, the first to provide micro-level evidence on how conservative religious values can hinder the spreading of useful knowledge and affect economic development.

This article also relates to a broader literature analyzing the role of religion for economic progress.[6] In particular, it relates to those studies examining the relationship between religion and accumulation of human capital. For instance, Becker and Woessmann (2009) and Botticini and Eckstein (2012) examine Protestantism and Judaism, respectively. In both cases, the authors argue that the better economic outcomes achieved by Protestants and Jews, compared to those of Catholics, were due to

[6]For an overview of the literature on the economics of religion, see Iannaccone (1998) and Iyer (2016).

investment in human capital; specifically, to investment in literacy.[7] I contribute to this literature in two main respects. First, rather than analyzing the spread of religion as such and comparing different religious affiliations, I exploit variation in the *intensity* of religion. Second, while most studies point to literacy (i.e., quantity of education) as the mechanism through which religion affects human capital formation and, in turn, economic progress, I show that religiosity can also affect educational content.

Finally, this paper contributes to the literature examining the interaction between culture and economic development, through channels such as trust, generalized morality, family ties, and long-term relatedness between populations (Guiso, Sapienza, and Zingales, 2006; Tabellini, 2008, 2010; Alesina and Giuliano, 2010; Spolaore and Wacziarg, 2012). I add to this literature by focusing on one dimension of culture—religion—and by suggesting accumulation of human capital as the channel explaining the relationship between cultural and economic factors.[8]

The remainder of the article is organized as follows: Section 2 illustrates the historical background. Section 3 describes the data. Section 4 presents the empirical results. Section 5 concludes.

2 Historical Background

2.1 The Second Industrial Revolution in France: Technology and the Role of Human Capital

French economic growth began to accelerate in the mid-18th century, and by the mid-19th century, France was "a centre of invention and diffusion for modern technologies" (Crouzet, 2003, p. 234). The Second Industrial Revolution—usually dated from 1870 to 1914 (Mokyr, 1999)—differed from the earlier phase of industrialization in two main respects. First, the localized progress of the First Industrial Revolution spread to many more sectors and products, and pathbreaking inventions were introduced (Mokyr, 1999). Some—such as pharmaceutical products, synthetic materials, and the electricity network—were completely new. Others were advances in existing technology: railroads, for instance, were expanded and improved, and new sources of power (the diesel engine and electric locomotives) started to be used. Overall, the entire population (including the working classes) started to be exposed to technological and scientific progress.

Second, the role of human capital changed. During the First Industrial Revolution, the upper tail of the skill distribution was crucial for the industrial takeoff, fostering the invention and adoption of new technologies. On the other hand, worker skills played a limited role in the production process; they were mostly "tacit skills," largely transmitted via the master-apprentice relationship (Mitch, 1993;

[7] Even if the main objective of literacy was religious, it could still have positive spillovers on economic activities by allowing correspondence, written contracts, computations, and book-keeping (Mokyr, 2016). Interestingly, Cantoni (2015) finds no effects of Protestantism on economic growth, and Boppart, Falkinger, Grossmann, Woitek, and Wthrich (2013) show that the beneficial effects of Protestantism over Catholicism on educational output hold only in conservative milieus.

[8] Many studies have analyzed the role of culture vs. institutions and tried to disentangle the two. I follow Alesina and Giuliano (2015) in referring to culture as a set of beliefs and values, and to institutions as formal institutions only.

Mokyr, 2005; Squicciarini and Voigtländer, 2015). By the last third of the 19th century, however, the many advances in sciences and technology had given rise to more sophisticated industrial machinery, turning "the [...] technological system from an exception to a commonplace" (Mokyr, 1999, p. 2). The role of ordinary workers' human capital grew steadily, hand in hand with the increasing complexity of the industrial technology (Galor and Moav, 2006; Bessen, 2012).[9] Workers were not trained anymore in the (now decayed) apprenticeship system, and formal knowledge began to matter. This pushed the French government (along with many other governments throughout Europe) to invest in the universalization and professionalization of primary education (Galor and Moav, 2006). While much still had to be learned on the factory floor, knowing basics of material science, geometry, and the metric system, as well as their practical applications to objects and tools, could help workers perform their tasks (Chatoney, 2006). Thus, in the years of the Second Industrial Revolution, "education reforms were designed primarily to satisfy the increasing skill requirements in the process of industrialization" (Galor and Moav, 2006, p. 88).

2.2 Catholicism and Science

The French Revolution (1789) marked a turning point in the relationship between Catholicism and science. In previous decades, the Catholic Church had a complex but generally positive attitude toward scientific and technological progress, which was seen as part of God's harmonious plan for the human race. Several clergymen were eminent members of the Enlightenment: the Abbé Jean-Antoine Nollet, who was involved in the earliest public experiments with electricity, also mentored famous scientists, such as Lavoisier and Monge; similarly, François Rozier, "a clergyman whose vocation was the Enlightenment," was the publisher of *Observations sur la Physique, sur l'Histoire Naturelle, et sur les Arts* (Mokyr, 2005).[10] In these same years, Popes Benedict XIV (1740–1758) and Clement XIV (1769–1774) were known as "friends of science" (Minois, 1991).

Shortly after the French Revolution (and the anticonservative program promoted by the revolutionary government), a culture war broke out between supporters of the traditional order, embodied in the Catholic Church, and supporters of the new order, who espoused secular and scientific thinking. This was exacerbated by the French invasion of Italy (carried out under the flag of the Enlightenment) and by the complex relationship between Napoleon and Pope Pius VII. The reaction of the Church was brutal.

[9] The technology-skill complementarity became particularly relevant when, in the 1880s, the dynamo entered manufacturing production and fostered the subsequent electrification of industry. This was accompanied by the introduction of new instruments, such as conveyors, traveling cranes, and other handling devices that increasingly relied on mechanical skills to be operated. Also, the installation and maintenance of the machines became more complex: machinists and technicians needed to read and understand instructions, and to know the basics of algebra, geometry, and mechanical drawing (Goldin and Katz, 1998; Caselli, 1999).

[10] More generally, the Society of Jesus was largely involved in science (Ashworth, 1986) and has been defined as "the most important contributor to ... experimental physics in the seventeenth century" (Heilbron, 1979, p.2).

In the 1820s, Rome embraced an extremely antimodern and antiscientific attitude: all French laws and norms were abolished, and science became the scapegoat for the revolutionary events and was accused of being false and misleading. The conservative program of the Church in Rome quickly spread to all Catholic regions in Europe, especially in France. During the Bourbon Restoration (1815–1830), its effects were felt in many aspects of people's lives. For example, though medicine had progressed substantially, local clergymen opposed any modern medical advice or intervention, rejected the efforts of public authorities who tried to introduce vaccinations, and rebuffed doctors who recommended birth control. Religious texts replaced the scientific instruction that many clergy members had acquired in the pre-revolutionary period: the study of science was banned from seminaries, and production of religious books rose sharply (from 300 to 600 per year) (Minois, 1991; Jacob, 2014).

This antiscientific attitude of the Church continued until the First World War and the years between 1880 and 1914 were the most complex ones. In France, the newspaper *L'Ami du Clergé* (founded in 1878) would advise local clergy on which technologies could be used in churches and by the population, if Rome had not yet expressed clear guidance on this.[11] The Catholic battle against science and modernity also took on political connotations: as progressive parties came into power (e.g., during the Third Republic, 1870–1914), the Church confronted the French government on major societal issues, especially concerning education. Since the Church's program was promoted at the central level, it is unlikely that local differences in religious institutions explain the differential resistance to useful knowledge and economic development within France (as in the cases analyzed by Davids (2013) and Rubin (2017)). Variation in the intensity of Catholicism is likely to capture variation in the intensity of religious beliefs, which, in turn, determined the degree to which the Catholic antiscientific agenda was observed at the local level.[12]

2.3 Schooling in 19th-century France

Here, I describe the key 19th-century French schooling reforms and highlight how religiosity may have shaped their implementation at the local level. Figure A.3 in the Appendix provides a timeline.

During the Bourbon period (1815–1830), education represented the most thorny issue in the ongoing battle between religion and science. The Church saw schooling, and especially primary education, as a way "to rebuild the moral fibre of the lower classes, leaving behind them the accident [of the Revolution]" (Furet and Ozouf, 1977, p. 121). In these decades, the clergy had recovered its hegemony over primary schooling and promoted an education system where morality, "religion and love of the

[11] The bicycle was considered a "dangerous instrument of female emancipation" and electric lamps could be placed only in specific parts of the church (not on the altar) and only if they caused no "theatrical effects." Similarly, *L'Ami du Clergé* defined birth control practices as "abominable," the result of a "selfish and materialist civilization" (Minois, 1991).

[12] Other authors study the interaction between religious beliefs and institutional change. For instance, Belloc, Drago, and Galbiati (2016) show that, in Medieval Italy, shocks to religious beliefs retarded institutional transition to self-government in cities where political and religious powers were the same people.

King" had to be properly inculcated in the population (Jacob, 2014).

Throughout the July Monarchy (1830–1848), the state took an active role in expanding and improving primary education. This was addressed to children aged 6 to 13, with the objective of having seven years of schooling. But because some students started early, some started late, and some dropped out and returned, the 5–15 cohort better reflects the ages at which children effectively attended (Grew and Harrigan, 1991). The 1833 Guizot Law introduced a national curriculum for primary school students. Meanwhile, all teachers were required to have a *brevet de capacité* (i.e., a certificate awarded after passing a qualification exam), and every department had to maintain an *école normale* to "form teachers capable of applying innovations made in curriculum and methods ... [and able to] fashion more and more enlightened, and harder working, men" (Furet and Ozouf, 1977, p. 142-143).

Enacted during the Second Republic (1848–1852), the Falloux Law of 1851 encouraged Catholic public schools. There were four types of schools (secular public, Catholic public, secular private, Catholic private), and the expansion of Catholic public schools was seen as a way to increase enrollment and build a national education system (Grew and Harrigan, 1991; Franck and Johnson, 2016). The differences between Catholic and secular schools emerged over these decades and, even if the Falloux Law weakened secular education in terms of useful knowledge (compared to the 1833 Guizot Law), religious education was in worse straits. Secular and Catholic teachers now faced different qualifications. The former still had to obtain a *brevet de capacité*, and many of them were professionally trained in the *écoles normales*.[13] Meanwhile, the clergy were exempted from the *brevet*; a simple *lettre d'obédience* from a religious order was sufficient to qualify as a teacher. Nuns and priests (including those without any training) proliferated in primary schools. In general, Catholic schools had better physical facilities, more classrooms, and higher summer attendance. However, "the intellectual level of French priesthood was mediocre ... and they often [turned] their backs on the modern world. In education, this was expressed in the denunciation of science as materialist, and the maintenance of the old idea of a classical-Christian utopia for the consumption of schoolchildren" (Anderson, 1975, p. 116).[14] "The preference for clerical teachers was, first of all, a religious one" (Grew and Harrigan, 1991, p. 221): as argued by the Ministry of Education in 1858, "[Catholic] families were particularly interested in the development of moral and religious values by schools and believed that only religious schools could provide those values" (Harrigan, 2001, p. 60). During this time, all schools charged

[13]Some "economically useful" subjects became optional in the *écoles normales* curriculum, but the training in these schools still guaranteed professional standards (Grew and Harrigan, 1991).

[14]Student curriculum in secular schools changed in the same fashion as teacher training in *écoles normales*, and some "technical" subjects (such as practical applications of arithmetic, elements of physics, and natural history) were made optional (Art. 23, *Loi relative à l'enseignement du 15 mars 1850*). However, besides religious instruction, it included French (reading and writing), calculus, and the metric system. Catholic education, on the other hand, was typically centered around the Bible and other religious texts, and little emphasis was placed on counting (Grew and Harrigan, 1991).

tuition fees; only the poorest families were exempted.

The Falloux Law helped spread Catholic education also during the Second Empire (1852–1870), but, once the country was closing in on the goal of universal education,[15] the government's next objective was to increase the *quality* of the education system (Grew and Harrigan, 1991). Already in 1863, the arrival of Victor Duruy at the education ministry opened a new period for reforms, and the divergence between Catholic and secular schools increased. Teacher training in the *écoles normales* improved, and the standards for the *brevet* became more stringent.[16] Conversely, Catholic primary schools were still largely run by local priests and nuns, who were endowed with only a *lettre d'obédiance*.

The late 1860s had set the stage for the Republican government's schooling reforms (1873–1902), aimed at creating higher, more uniform standards. These affected both teaching corps training and the student curriculum, and were accompanied by a definitive shift in educational financing from the communal/departmental level to the state level (Grew and Harrigan, 1991). By 1890, two-thirds of secular teachers had obtained not only the traditional *brevet* but also the *brevet supérieur*, with a whole year of their studies devoted to teaching practice. Despite this further professionalization of the secular teaching corps, Catholic education remained largely unaffected.[17] The exemplary moment in this process of reforms is represented by the 1881–1882 Jules Ferry laws, which made primary education mandatory, made public schools free and secular, and introduced crucial changes to the student curriculum. In particular, religion instruction was replaced by moral and civic instruction, and the curriculum now included elements of natural sciences, physics, and mathematics; their applications to agriculture, hygiene, and industry; handwork and the use of tools dedicated to the main manual professions; and elements of drawing (Art. 1, *Loi sur l'enseignement primaire obligatoire du 28 mars 1882*). Primary education needed to be "intuitive," i.e., based on the sense of evidence and demonstration, and "practical," i.e., focusing on the concrete applications (Ferry Jules, 1882). Of course, the hours spent at schools studying "economically useful" knowledge did not turn children into skilled workers. Much still had to be learned on the factory floor, but the purpose was to "provide agility aptitudes, which are particularly necessary for the primary school children who will be mainly dedicated to manual professions" (Chatoney, 2006, p. 146).

All educational policies were adopted nationwide and enforced by a strong administrative system, but when there was scope for flexibility, religiosity played a key role in their local implementation (Grew and Harrigan, 1991). In particular, the professionalization and secularization of primary

[15] In 1876, more than 75% of children aged 5 to 15 were attending a primary school.

[16] The distinction between obligatory and optional subjects was abolished. Teacher training included geometry, physics, chemistry, natural history, basics of agriculture and industry (with visits to factories), bookkeeping, and gymnastics.

[17] A law declared that all teachers must obtain a *brevet* by 1884, but most Catholic teachers had no training and often refused to obtain it. This was either because they ideologically opposed it or because they feared they would not pass.

education, which had began with Victor Duruy in the late 1860s, became an ideological battle that triggered the Catholic reaction. As Figure 2 shows, the number of Catholic schools remained stable throughout these decades, even if, after 1882, religious schools were being laicized. How could this happen? Because the state implemented its reforms only in public schools, without interfering with private education—to satisfy the local demand for religious schooling—new private Catholic schools started to be established as their public counterparts were laicized (Figure 2).[18] The choice of Catholic parents for a religious education for their children seems to become particularly important when the differences between the two education systems increased—as shown in Figure 3 (right panel), plotting the per-period coefficients of the share of Catholic schools on religiosity. The Jules Ferry laws provide striking evidence for this: the rise of private Catholic education occurred despite greater public spending on and the gratuitousness of secular education—while families often had to pay fees to send their children to religious schools where, however, they could "preserve" their Catholic identity.

Thus, in the second half of the 19th century, while secular education was becoming increasingly modern and professional, Catholic schools remained "the clearest measure of resistance to secularization" and represented the "bastions of a Catholic subculture" (Grew and Harrigan, 1991, p. 107, 221). This dual system persisted until the 1901–1904 *Lois Anti-Congreganistes* (which prohibited all members of religious orders from teaching also in private schools[19]), and it strongly affected the differential diffusion of knowledge among the population. In about fifty years, the French education system achieved several aims: universal education, professionalization of the teaching corps, administrative and financial centralization, and the introduction of a secular, modern school curriculum (that remained in place, without major revisions, until the Second World War). On the other hand, the pace at which this process took place was very heterogenous within the country, and it cannot be explained without discussing the confrontation between science and religion, and the resistance that national laws encountered at the local level.

3 Data

I assembled a rich dataset from several primary and secondary sources. In this section, I briefly describe the geographical units at which the empirical analysis is conducted, and give an overview of the outcome variables and of the main variables of interest. Appendix C provides a detailed description of all data, including sources.

[18] In 1881, right before the Jules Ferry laws were enacted, Catholic schools made up 26% of all schools, and 58% of them were public. As public education became secularized, Catholic schools managed to survive in the private realm. In 1901, they still comprised 21% of all schools—but now only a few of them (less than 4% of the total) were public. On the other hand, secular education was overwhelmingly public: in 1881, 92% of secular schools were public, increasing to more than 96% in 1901. Figure A.5 reproduces Figure 2, using the share of Catholic and secular schools (rather than their number); the patterns are similar.

[19] Secular education had triumphed: by 1906, religious schools represented just 0.2% of French schools.

During the Revolution, France was divided into departments, districts, and cantons. Since French territorial borders changed over time, with some departments being annexed and others being lost, my analysis focuses on the 83 departments that were part of France during the whole period of study. Districts were administrative units between departments and cantons. They were in place for approximately five years (1790–1795). My main indicator of religiosity, the share of refractory clergy, is measured at the district level. There were 523 districts in the 83 departments of the analysis—each department comprised at least 3 (e.g., the departments of Ariege and Loire) and up to 10 districts (the Vosges department). Finally, cantons are akin to metropolitan areas; typically, they were composed of a main city and a few smaller towns or villages. In 1876, the 83 departments of this study were subdivided into 2,770 cantons.

The empirical analysis is composed of two main parts. In the first part, I study the relationship between religiosity and economic progress during the First and Second Industrial Revolutions. I start with a cross-sectional analysis at the department and canton levels, and then turn to a difference-in-differences approach. In the second part, I investigate the mechanism behind the negative relationship between religiosity and industrial-economic development. First, I study the relationship between religiosity and the type of primary education, using cross-sectional data at the department and canton levels. Then, in a panel framework, I estimate the effect of religious education on industrial development. Finally, using data by sector and worker cohort, I analyze the relationship between the type of primary education and employment in skill-intensive sectors.

3.1 Data on Religiosity

Christianity began to spread in France in the 2nd century A.D. As in other parts of Europe, Protestantism reached the French territory in the early 16th century. However, the Huguenots—the French Protestants—were severely persecuted and confined to a small minority of the population. In 1872, 98% of the French population was Catholic (*Recensement Général*), making it unlikely that religious heterogeneity confounds the results. At the same time, there was large variation in the intensity of Catholicism, which I exploit in the empirical analysis.

The main indicator of religiosity is the share of refractory clergy in 1791 (Tackett, 1986). Among the several reforms voted on by the National Assembly, the 1790 *Civil Constitution of the Clergy* was one of the most controversial. This was an attempt to deeply restructure the French Church, both financially and organizationally; it included abolishing tithes, and nationalizing Church lands, as well as reducing the number of religious corps, and having citizens elect bishops and priests. Given the strong opposition and the delays in its implementation, the National Assembly required the clergy to take an oath of allegiance to the *Constitution*. This was not simply a clergyman's personal decision, but rather a community-level choice: "Almost everywhere laypeople exerted pressure on the clergy to

accept or reject the oath, with the oath ceremony providing the occasion for a de facto referendum on the general religious and secular policies of the Revolution" (Tackett, 1986, p. 546). Consequently, the French clergy split into *jurors* (constitutional) and *nonjurors* (refractory). I use the share of refractory clergy—those who did not swear the oath but did remain loyal to the Church—as the main indicator of religiosity at the local level.[20] These data are available for all 83 departments and for 475 districts in these departments. On average, 42% of French clergy stayed loyal to the Church, with the highest percentage in the Morbihan department, in Brittany (about 88%), and the lowest in the Var department, in the Provence-Alpes-Côte d'Azur region (about 4%). Section 4.1 uses other measures of religiosity and provides evidence of a stable spatial distribution of Catholic intensity over time.

3.2 Data on Primary Education

When studying the mechanism through which religiosity affects economic development, I focus on the role of primary education. I start by using department-level schooling data for the 1851–1901 period (*Statistiques de l'Enseignement Primaire*). These are generally reported every five years. The main schooling outcomes are the share of Catholic schools and the growth in the share of Catholic schools. In robustness checks, I use the share of Catholic students and the growth in the share of Catholic students.[21] Enrollment rate, the number of students per school, and the total number of schools are included as controls. These refer to both types of schools (Catholic and secular together), thus capturing differences in other educational dimensions (beyond the type of primary education).

In addition, I digitized schooling data for more than 2,000 cantons in 1873 and in 1894 (French *Archives Nationales*). Consistent with the department-level analysis, the main schooling outcomes are the share of Catholic schools and the growth in the share of Catholic schools. The archival data also yield information on the quality of school buildings, which could be good (*bonne*), adequate (*passable*), or bad (*mauvaise*). For each canton, I compute the share of school buildings in bad condition as a proxy for schools' lack of resources at the local level.

3.3 Data on Industrial and Economic Progress

3.3.1 Cross-sectional Analysis

In the cross-sectional analysis at the department level, I use two main outcome variables to study the interaction between religiosity and economic development during the Second Industrial Revolution:

[20] Clergymen not taking the oath had to be replaced and could not hold religious services. This was not a particularly strong punishment, especially considering Revolution-era events. Then, the Law of Toleration (May 1791) allowed them to again hold services, as long as they did not speak against the *Constitution*. Only during the Reign of Terror (1792–1793), which promoted the complete dechristianization of the country, were stronger punishments imposed. These were not anticipated, and were addressed first to the refractory clergy, then also to the constitutional clergy.

[21] I prefer using data on schools, because information on Catholic vs. secular students is not available for 1871. Also, for 1856, data by type of education (i.e., Catholic vs. secular) are not available for schools or for students.

the share of workers employed in industry in 1901 (*Recensement Général*) and the number of industrial machines per capita in 1891 (*Annuaire Statistique de la France*). As placebos, for the First Industrial Revolution, I use the share of workers in industry in 1866 (*Recensement Général*) and the number of steam engines per capita in 1839–1847 (Chanut, Heffer, Mairesse, and Postel-Vinay, 2000).[22] Then, I perform a within-department analysis and use canton-level data on household expenditure in 1901 as a proxy for household income (*Salaire et cout de la vie*).[23] For the pre-1870 period, I use data on the number of firms in three key sectors of the First Industrial Revolution: cotton spinning, metallurgy, and paper milling (Juhász, Squicciarini, and Voigtländer, 2019).

3.3.2 Panel Analysis and Cohort Analysis

In the panel analysis, the outcome variable is the share of industrial employment (*Recensement Général*). This is reported every five years from 1871 to 1911.[24] Next, using data by sector and worker cohort (*Enquête industrielle*, 1896), I compute the share of workers employed in skill-intensive sectors and perform a cohort-level analysis.[25]

4 Empirical Results

I first provide evidence of a persistent spatial distribution of religiosity over time. Then, employing different empirical strategies to deal with endogeneity concerns, I show that more religious locations started to lag behind after 1870. Finally, I shed light on the mechanism and suggest that the type of education was key: I find that the share of Catholic schools was negatively associated with industrial development about a decade later and that "religiously educated" cohorts were less likely to be employed in skill-intensive sectors.

4.1 Local Persistence of Religiosity

Table 1 uses alternative indicators of religiosity to show that departments with a higher share of refractory clergy in 1791 were already more religious before the French Revolution and continued to be so until the 20th century. First, it uses data from the 1789 *cahiers de doléances* (Hyslop, 1934). On the eve of the Revolution, Louis XVI, confronted with general discontent among the population, decided to call the Estates General, i.e., the French representative assembly. The representatives of each Estate (clergy, nobility, and third estate) in every *baillage* (electoral district) endorsed a *cahier*. This was a list

[22] Since, in this period, economic growth was largely driven by advances in the industrial sector, these measures of industrial development can also be considered proxies for economic development.

[23] During the industrialization period, households spent a huge proportion of their income, thus household expenditure would largely reflect household income. Using data on 19th-century Britain, Horrell (1996) shows that, on average, about 85% of household income was spent on necessities only, and 75% of this was spent on food.

[24] Data on the share of industrial employment are also reported for 1866, but due to lack of information on the share of Catholic schools/students in 1856, my baseline specifications focus on the 1871–1911 period.

[25] Transformation and transport are considered "modern"; fishing, agriculture, and mining "traditional."

of grievances and suggestions about French social, economic, and political life, "embody[ing] the will of the community that endorsed it" (Shapiro, Tackett, Dawson, and Markoff, 1998, p. 105). Hyslop (1934) grouped the *cahiers'* contents into 49 categories. I identified four categories reflecting "antireligious" attitudes and use the share of antireligious categories over all topics covered in the *cahiers* as a measure of pre-1789 (anti-)religiosity.[26] Columns 1-2 show a negative and significant relationship between the share of antireligious categories in the 1789 *cahiers* and the share of refractory clergy in 1791, suggesting that departments that were more religious before the French Revolution were also more religious during it.[27] Then, columns 3-6 focus on later indicators of religiosity. I first use data on the share of readers of *La Croix*, the Catholic newspaper *par excellence*, in 1893 (Cholvy and Hilaire, 2000). Godfrin and Godfrin (1965) argue that the title and the crucifix on the front page served to gather the whole Catholic community, and that its habitual readers were people supporting the Church unconditionally. Next, I look at Church attendance in the 1950s, measured as the share of people attending Sunday Mass (Isambert and Terrenoire, 1980). Both post-1791 indicators are positively and significantly associated with the share of refractory clergy, providing evidence of a stable spatial distribution of intensity of Catholicism until the 20th century—in line with the extensive literature on persistence of cultural traits (e.g., Putnam, 1993). The maps in Figure 1 depict the spatial distribution of religiosity; they show that departments with higher religiosity in 1791 had higher Church attendance still into the 1950s. These findings further suggest that the share of refractory clergy reflects religiosity at the local level, since it is positively associated with other dimensions of Catholicism (not related to any political episode).[28]

4.2 Cross-sectional Evidence: Religiosity and Economic Development during the First and Second Industrial Revolutions

This section investigates the relationship between religiosity and economic development before and during the Second Industrial Revolution. I estimate equations of the form:

$$y_i = \beta \cdot R_i + \gamma \mathbf{X}_i + \varepsilon_i \ , \tag{1}$$

where y_i are proxies for economic development, R_i represents religiosity in location i, $\mathbf{X_i}$ is a vector of control variables, and ε_i is the error term. Following my discussion in Section 2, I expect religiosity

[26] The categories are: (1) "*cahiers* demanding the democratization of the clergy," (2) "*cahiers* expressly hostile to Papal influence in the French Church," (3) "*cahiers* showing secularism," and (4) "*cahiers* showing pronounced *etatisme* as regards the Church." I focus on the *cahiers* of the third estate, since they represented 98% of the French population.

[27] Eight departments that reported data on the share of refractory clergy have no information in the *cahiers de doléances*. I end up with 75 observations in column 1. Since information on enrollment rates is available only for the 19th century, I control for 1786–1790 literacy in column 2—including this variable yields 70 observations.

[28] I prefer using the share of refractory clergy as my main indicator of religiosity since it is measured before my outcome variables, in both the pre-1870 and the post-1870 periods, and because it provides within-department information.

to hamper the diffusion of technical and scientific knowledge, and therefore economic development, during the Second Industrial Revolution. I thus expect $\beta < 0$ after 1870, but not before.[29]

4.2.1 Department-level Analysis

Table 2 uses department-level data and shows the OLS results for the Second Industrial Revolution (columns 1-2) and, as a placebo, for the First Industrial Revolution (columns 3-4). The share of refractory clergy is negatively and significantly correlated with the share of workers in industry in 1901 (column 1) and with the number of industrial machines per capita in 1891 (column 2). On the other hand, it is not significantly associated with the share of industrial workers in 1866 (column 3) or with the number of steam engines per capita in the 1840s (column 4).[30] Table 2 also reports the standardized beta coefficients, showing that a one standard deviation increase in religiosity is associated with a 0.193 standard deviations decrease in the share of industrial employment and with a 0.248 standard deviations decrease in the number of industrial machines per capita. For instance, "moving" from the 10th to the 90th percentile of the religiosity distribution leads to a 9 percentage-points decrease in the share of industrial employment in 1901.

One worry is that the spatial distribution of religiosity may be related to other factors also affecting economic development during the Second Industrial Revolution (but not before). I now account for a large set of confounding characteristics, starting with a series of baseline controls (Table 3) and then turning to additional confounding factors measured at the eve of or during the Second Industrial Revolution (Table A.3).[31]

Table 3 (columns 1-2) includes total department population and a series of geographic characteristics (such as average temperature, average precipitation, and wheat suitability) that could be related to religiosity and make agricultural production more attractive than industry, as well as the number of early industrial activities as a measure for an initial advantage for the subsequent industrialization.[32] Among them, the coefficient on average precipitation is negative and significant, suggesting that departments that receive more precipitation are generally less industrialized—probably because of higher agricultural productivity. Then, as one would expect, the number of early industrial activities is pos-

[29] I chose 1870 as the cutoff year based on extensive historical literature (Mokyr, 1999). However, as one can imagine, changes to the industrial sector happened gradually. This is not an issue in this case, since the outcome variables are measured in 1891 and 1901, by which time the Second Industrial Revolution was well underway.

[30] Data on steam engines per capita in the 1840s are not available for the departments of Alpes-Maritimes and Corse.

[31] Table A.1 in the Appendix regresses the share of refractory clergy on all baseline and additional controls (one by one) to check whether these are correlated with religiosity. It shows that only a few department-level characteristics vary systematically with religiosity. My results are robust to the inclusion of both the baseline and the additional controls.

[32] Finley, Franck, and Johnson (2017) find that regions where more Church land was redistributed during the French Revolution experienced higher agricultural productivity in the mid 19th century. This could potentially confound my results by making agricultural production more profitable than industrial activities. However, they also show that the positive effects of land redistribution on agricultural productivity declined over the course of the 19th century.

itively and significantly associated with industrialization during the Second Industrial Revolution.[33] Columns 3-4 account for differences in the influence of central institutions. France was a centralized state, and, contrary to cross-country studies, my results are unlikely to be confounded by institutional heterogeneity. However, to proxy for local differences in the reach of the central government, I control for distance from Paris and include a dummy for departments located in *pays d'élection*, i.e., regions where the king, before 1789, had exerted particularly strong power in fiscal and financial matters. Both variables are negatively (and significantly in columns 4, 6, 8) associated with the economic and industrial outcomes. Columns 5-6 account for preexisting differences in average and upper-tail human capital, and control for enrollment rate and for the presence of knowledge elites, proxied by the subscribers to the *Encyclopédie* of Diderot and d'Alembert. These are positively (and in general significantly) associated with the outcome variables. Finally, columns 7-8 weight regressions by population, accounting for the concern that the results are confounded by low-population departments. In all specifications, the coefficient on the share of refractory clergy remains significant and similar in magnitude, showing that the findings are robust to the inclusion of all baseline controls. Table A.2 in the Appendix adds the same set of baseline controls (included in Table 3) in the pre-1870 regressions and shows that religiosity is not significantly associated with industrialization before the Second Industrial Revolution.

4.2.2 Alternative Explanations

Section A.1 in the Appendix performs (and discusses in more detail) a number of robustness checks. First, Table A.3 includes, in the post-1870 regressions, a set of additional controls, measured at the eve of or during the Second Industrial Revolution. I account for the presence of specific population groups that could have been engaged in industrial activities and located in low-religiosity departments. In particular, I control for the share of individuals with secondary education, for the share of students in "modern" secondary schools,[34] as well as for the share of Huguenots, who—though just 1.8% of the French population—had historically been involved in industry, trade, and finance (Scoville, 1953). Then, I use data on average farm size. One concern could be that large landowners hindered industrial development and used religion to keep the population obedient while opposing schooling reforms (see, for instance, Galor, Moav, and Vollrath, 2009).[35] To further account for the potentially confounding

[33] Data on average temperature and precipitation are not available for one department (Tarn-et-Garonne), while data on wheat suitability are not available for four departments (Alpes-Maritimes, Corse, Loire, and Tarn-et-Garonne). This explains why the number of observations is reduced from 83 (Table 2) to 79.

[34] Besides enrollment rate in secondary schools, the type of secondary education could play an important role for economic development—as shown by Semrad (2015) for the case of Bavaria. In France, we can distinguish between "modern" secondary education (*enseignement special* or *moderne*) and "traditional" secondary education (*enseignement classique*).

[35] However, this does not seem to have been the case in 19th-century France, since, after the 1789 Revolution, landholding took on a small-scale character and landowners had little influence on the rural community (Forster, 1967; Jones, 2012).

role of agricultural productivity, I control for the value of per capita agricultural production in 1892. Finally, as a proxy for economic and cultural integration, I include the density of the railway system in 1879. In all specifications, the results on religiosity hold.

Another key concern could be that Catholicism's antiscientific approach is capturing a broader conservative *état d'esprit*. I now use data from the *cahiers de doléances* and identify seven categories reflecting "conservative" contents; I construct the share of conservative contents over all topics covered in the *cahiers* and use it as proxy for conservatism at the local level.[36] Table A.4 shows a negative and significant relationship between the share of antireligious and the share of conservative contents in the *cahiers*, suggesting that more religious departments were also more conservative. In Table A.6, I regress the two industrial outcomes on both religiosity and conservatism. The coefficient of religiosity is still negative and significant in all specifications, while the measure of conservatism is not significantly associated with industrialization. This likely suggests that the antiscientific dimension of Catholicism (and not a conservative attitude as such) is explaining the negative relationship between religiosity and economic development after 1870.

Then, while I already account for differences in the reach of central institutions, Table A.7 further deals with the concern that remoteness and distance (also in terms of linguistic and cultural background) are confounding the results. The focus is on Brittany and on those departments that had traditionally spoken a language other than French. Excluding these areas from the analysis provides similar results to those in Table 3. To check whether the department-level findings are driven by regional differences, Table A.8 controls for region fixed effects. Table A.9 accounts for spatial autocorrelation and Table A.10 excludes Paris (Seine department). The results on religiosity hold in all specifications. This sensitivity analysis suggests that any remaining omitted-variable bias due to unobservables should also be modest. This is confirmed when I analyze the role of unobservables using the Altonji, Elder, and Taber (2005) methodology and the Oster's (2017) correction of the Altonji et al. (2005) method. Table A.11 shows that selection on unobservables would have to be at least 4.1 times stronger than selection on observables to explain away the relationship between the share of refractory clergy and the outcome variables, making it unlikely that unobserved factors are confounding the results.

4.2.3 Within-department Analysis

The department-level results are robust to the inclusion of several observable characteristics, and the Altonji et al. (2005) method suggests that selection on unobservables would have to be substantially

[36] The categories are: (1) "*cahiers* appealing to French tradition," (2) "*cahiers* making reservation on the renunciation of privileges," (3) "*cahiers* concerned for a regeneration of the *moeurs*," (4) "*cahiers* asking for restriction of the press," (5) "*cahiers* in favor of maintaining the gilds," (6) "*cahiers* in favor of maintaining feudal justice gilds," and (7) "*cahiers* showing conservative nationalism." The share of conservative contents is computed analogously to the share of antireligious contents (Section 4.1). Section A.1 also analyzes other dimensions of conservatism related to the political sphere.

stronger than selection on observables for my findings to be overturned. To further rule out that unobserved department factors are confounding the results, Table 4 uses canton-level data and exploits within-department variation. The outcome variable is (log) household expenditure in 1901, and the main variable of interest is the share of refractory clergy. These data are available for 1,113 French cantons.[37] Since (log) household expenditure is measured at the canton level, while religiosity is measured at the district level, I cluster standard errors at the district level.

The baseline controls that are also available at the canton or district level are included. These are population, wheat suitability, distance from Paris, and the presence of knowledge elites. Column 1 first shows results with no fixed effects. Columns 2-5 add department fixed effects and include, one by one, the geographic, institutional, and human capital controls. Column 6 weights the regression by canton-level population. In all specifications, the coefficient on the share of refractory clergy is negatively and significantly associated with the outcome variable. At the bottom of the Table, I report the standardized beta coefficients, showing that a one standard deviation increase in religiosity is associated with a 0.14 standard deviations decrease in (log) household expenditure (column 5).

Table A.12 in the Appendix shows that the results on religiosity hold when household expenditure is measured at the district level—computed as the (canton) population-weighted average of household expenditure. Table A.13, by contrast, focuses on the pre-1870 period. It uses as outcome variable district-level data on the number of firms in three fast-growing sectors of the First Industrial Revolution: cotton spinning, metallurgy, and paper milling. The regression results show that the coefficient on the share of refractory clergy is not significantly associated with industrialization in the pre-1870 period.

4.2.4 Exogenous Variation in Religiosity

The canton-level analysis supports the department-level evidence, showing the robustness of the results to varying aggregation levels and further suggesting that religiosity played a negative role on economic development during the Second Industrial Revolution. But one could still wonder why some places were more religious than others and whether there is a source of exogenous variation in religiosity. Section B in the Appendix uses plague outbreaks during a narrow period, i.e., the Protestant Reformation in France, as an instrumental variable, similar to the approach of Dittmar and Meisenzahl (2019).

The Reformation—starting with the circulation of Martin Luther's theses in 1517—undermined the monopoly of Catholicism. This represented a "global shock" throughout central Europe, and it created an alternative to the Catholic ideology (Robert E. Ekelund, Robert F. Hébert, Robert D. Tollison, Gary M. Anderson, and Audrey B. Davison, 1996; Iyigun, 2008). Importantly, the new religious competition interacted with shocks at the local level. Focusing on German cities, Dittmar and Meisen-

[37] The 1,113 cantons are located in 410 districts and 75 departments.

zahl (2019) show that, once the new doctrine created an opening for change, the occurrence of plagues discredited the incumbent elites, increased religious and political competition at the local level, and fostered the adoption of public goods institutions.

In France too, the Reformation provided an alternative to Catholicism. The preceding decades were characterized by widespread "eschatological anxiety" (Crouzet and Good, 2001): pamphlets predicting calamities circulated and natural disasters were considered God's vengeance upon a sinful society. In this context, the Catholic Church had established itself as a monopolistic "provider of salvation," often pushing people to confess their sins and to organize daily processions of expiation. The Protestant ideology was immediately welcomed in France, and the years leading up to the 1598 Edict of Nantes (when Henry IV granted rights to Protestants) saw the strongest religious competition in the country. Where plagues occurred, the prophetic approach of Catholicism was further scrutinized: "The Reformation in France heightened attitudes about the forces of good and bad [...] and plagues became a battle hammering out Church positions" (Cohn, 2018, p. 155).

My hypothesis is that, in the years of strongest religious competition, the occurrence of plagues discredited the Catholic doctrine and shifted religious views toward Protestantism.[38] To test this hypothesis, I use information on outbreaks in France from 1347 to 1786 (Biraben, 1975). Since outbreaks could reflect other factors and be endogenous to economic development, I study plagues in the 1517–1598 period, conditional on long-run variation in plagues. Table B.1 presents the results of the IV regressions: the first stage shows that the share of plagues in the 1517-1598 period is a strong predictor of religiosity in 1791, and the second stage shows a negative and significant coefficient of the share of refractory clergy. Table B.2 shows no significant relationship between religiosity and outbreaks in placebo periods, pre-1517 and post-1598. This suggests that the interaction between religious competition and local plague shocks (rather than plagues as such) triggered dissensus about the Catholic Church and decreased Catholic religiosity.[39] Finally, Table B.3 performs a series of falsification tests. If plagues affected economic development through other channels, e.g., their demographic consequences, outbreaks before and after the period of high religious competition should also have had a positive impact on economic development. I examine the reduced-form relationship between economic development and plagues in the 1517–1598 period and in the placebo periods. While a strong and positive relationship exists between my outcome variable and outbreaks in the 1517–1798 period,

[38] In France, contrary to the German context, higher local religious competition created tension with the Catholic Church, but it was not conducive to institutional change. This was likely due to the uncertain status of Protestantism in the country.

[39] Using detailed data on the list of French Protestant refugees in Geneva from the *Livre des habitants de Genève* (Geissendort, 1957), I construct a measure for the presence of early Protestant groups. I find a positive relationship between outbreaks in the period of religious competition and the emergence of Protestantism. However, as Table A.1 shows, given the forceful persecutions of the Huguenots, Protestantism in the 19th century is not associated with Catholic religiosity. Appendix B discusses in detail why my results are unlikely to be confounded by the presence of Protestantism.

I estimate a statistically insignificant relationship in the pre-1517 and post-1598 periods. Thus, the instrumental variable strategy provides further support for a causal interpretation of the relationship between religiosity and economic development.

4.3 Difference-in-Differences: Religiosity and Economic Development during the First and Second Industrial Revolutions

Here, I use panel data on the share of industrial employment to analyze the relationship between religiosity and economic development in a difference-in-differences framework. Data on industrial employment are available for every five years from 1866 to 1911; I consider 1866 and 1871 as the pretreatment period and estimate equation of the form:

$$y_{i,t} = \alpha_i + \alpha_t + \beta R_i \cdot Post1871_t + \varepsilon_{it}. \tag{2}$$

Table 5 shows the results. Column 1 contains no fixed effects; column 2 adds year fixed effects only; column 3 includes also department fixed effects; and column 4 controls for changes in department-level population. In all specifications, the coefficient on the interaction between the share of refractory clergy and the *Post1871* indicator is negative and significant, suggesting that more religious departments started to lag behind during the Second Industrial Revolution. In other words, preexisting variation in religiosity began to matter significantly more when skill-intensive technologies were introduced.

The difference-in-differences analysis examines the average effect of religiosity on the share of industrial employment during the Second Industrial Revolution. Next, I use a more flexible estimating equation that, rather than interacting the share of refractory clergy with the *Post1871* indicator, interacts the religiosity measure with each of the time-period dummies, using 1866 as the baseline time-period. The results can be intuitively seen in Figure A.2, plotting the per-period coefficients on the interaction terms over time. The figure shows that the negative relationship between religiosity and the outcome variable increases in magnitude during the Second Industrial Revolution, becoming noticeably large in the late 1890s and early 1900s. Finally, one could be concerned that other department characteristics (especially those associated with religiosity) also started to matter after 1870. Table A.14 in the Appendix uses specification (2) and performs a difference-in-differences analysis, using (one by one) the baseline controls rather than the share of refractory clergy. Among them, only (log) population and the *Pays d'Elections* dummy were significantly associated with the intensity of Catholicism (Table A.1). In the difference-in-differences specification, the interaction between these variables and the $Post1871$ indicator is not significantly associated with the share of industrial employment. Among the other controls, the interaction between enrollment rate in 1851 and $Post1871$

has a positive and significant coefficient, probably capturing the important role of early human capital for economic development during the Second Industrial Revolution.[40]

4.4 Mechanism: Religiosity, Catholic Education, and Economic Development

So far, I have used different empirical strategies to study the relationship between religiosity and economic development. Altogether, the cross-sectional analysis at the department and canton levels, the instrumental variable evidence, and the difference-in-differences results have pointed to a causal interpretation of my findings. The next question is: What is the mechanism explaining the negative relationship between religiosity and industrial-economic development during the Second Industrial Revolution? This section suggests that primary education played a central role. It shows that (1) the more religious departments and cantons had a higher share of Catholic schools, especially when the two education systems (Catholic and secular) started to diverge; (2) locations with higher shares of Catholic schools had less industrial development about a decade later; and (3) "religiously educated" cohorts were less likely to be employed in innovative sectors.

4.4.1 Preference for Catholic Education in More Religious Areas

As explained in Section 2, the 1851 Falloux Law helped all clergymen qualify to be teachers. Differences between secular and religious education emerged in these years, becoming more pronounced in the late 1860s. Using data on primary education from 1851 to 1901, Table 6 studies the relationship between religiosity and the type of schools (Catholic vs. secular) in the two subperiods of educational reforms (1851–1866 and 1866–1901). All specifications account for department-level differences in other educational dimensions, such as enrollment rate, the number of students per school, and the total number of schools. In columns 1-3, the dependent variable is the share of Catholic schools in 1851, 1866, and 1901. They report a positive coefficient on the share of refractory clergy, which becomes larger in magnitude and significant at the end of the period, i.e., in 1901, when the preference for religious education became a clear expression of a strong Catholic identity (Grew and Harrigan, 1991). Then, columns 4-7 use as dependent variable the growth in the share of Catholic schools in the two distinct subperiods. As one would expect, more religious departments experienced higher growth in the share of Catholic schools, especially between 1866 and 1901 (columns 5-7). These results are robust to the inclusion of the baseline controls and when weighting regressions by department population. The standardized beta coefficients suggest that with a one standard deviation increase in the share of refractory clergy, the share of Catholic schools in 1901 increases of 0.327 standard deviations (column 3), and the growth in the share of Catholic schools (in the 1866–1901 period) increases of 0.429 standard deviations (column 5).

[40] Primary education became mandatory in 1882, which led to small differences in enrollment rate during the Second Industrial Revolution. In both the cross-sectional and the panel analyses, I control for enrollment rate.

Then, I perform a within-department analysis, using data on religiosity and education for about 2,000 cantons in 1873 and 1894. Figure 3 (left panel) plots the share of refractory clergy against the share of Catholic schools in 1873 and shows a strong positive relationship between the two variables. Then, Table 7 shows the regression results for the share of Catholic schools in 1873 (columns 1-2), in 1894 (columns 3-4), and for the growth in the share of Catholic schools from 1873 to 1894 (columns 5-8). Even if the canton-level data do not allow me to analyze the growth in Catholic schools in the two subperiods of educational reforms, the key advantage of this disaggregated information is that I can exploit within-department variation in religiosity. The canton-level analysis supports the findings of Table 6: the coefficient on religiosity is positive and significant in all specifications, even when including department fixed effects (columns 2, 4, 6, 7, 8) and when weighting regressions by canton-level population (column 8). In addition, both the department-level results and the canton-level results hold when using the share of Catholic students as outcome variable (Tables A.15, A.16, and A.17).

Thus, despite strong state intervention and investments in secular education, the share of Catholic schools changed little in the country, from about 26% in 1866 to about 22% in 1901 (see Figure A.5). This argument is supported by Franck and Johnson (2016), who find that the massive increase in state spending on secular education did not affect overall enrollment in Catholic schools. Table A.18 also provides evidence for this; it shows that the share of Catholic schools is not correlated with state investment on education. At the same time, department-level variation was substantial, from an increase in the share of Catholic schools of 80% (in the Lozère department) to a decrease of 70% (in the Hautes-Alpes department).[41] This is also evident in Figure 3 (right panel), which plots the per-period coefficients of the share of Catholic schools on religiosity. These findings, in line with the historical record, suggest a strong preference by religious parents for Catholic education for their children, especially when the secular education system became more modern and professional, representing a threat to students' Catholic ideology. They also contribute empirical evidence to the extensive theoretical literature on cultural transmission and backlash of cultural identities (see, for instance, Berman, 2000; Bisin and Verdier, 2001; Bénabou and Tirole, 2006; Carvalho, 2013; Carvalho et al., 2017; Iyigun et al., 2018; Fouka, 2019; Sakalli, 2019).[42]

Finally, Table A.19 shows the relationship between religiosity and the type (columns 1-2) and quantity (columns 3-4) of primary education. The dependent variables are the share of students in Catholic schools and the enrollment rate in primary schools. The share of refractory clergy is significantly

[41] Lozère and Hautes-Alpes are, respectively, in the 95th and 5th percentiles of the religiosity distribution.

[42] Berman (2000) uses a form of social interaction models, the club good approach, to razionalize why, in the 19th century, part of the Jewish population did not assimilate to the new ideas and markets, isolating themselves from the rest of the community and giving rise to Ultra-Orthodoxy. To my knowledge, Fouka (2019) and Sakalli (2019) are the only other empirical studies showing a backlash of identity in response to assimilation policies. Fouka (2019) focuses on German immigration in 20th-century United States and Sakalli (2019) on secularization of education in Turkey.

associated only with the type of primary education.

4.4.2 Catholic Education Negatively Associated to Economic Development about a Decade Later

I now use data on schooling and industrialization to study the relationship between Catholic education and economic development over time. Specifically, I estimate equations of the form:

$$y_{i,t} = \alpha_i + \alpha_t + \beta CS_{i,t-10} + \gamma \mathbf{X}_{i,t-10} + \varepsilon_{it}, \tag{3}$$

where y_{it} is the share of employment in industry, and α_i and α_t denote, respectively, department and time fixed effects, thus accounting for unobserved time-invariant department characteristics and nationwide common trends. The main explanatory variables, $CS_{i,t-10}$, are the share of Catholic schools/ students in $t-10$. The vector $\mathbf{X}_{i,t-10}$ includes enrollment rate in primary schools, the (log) number of students per school, the (log) number of total schools in $t-10$, and department-level population in t. I use ten years of lagged schooling variables, since children in primary schools, aged 5 to 15, entered the labor force about ten years later (when they were between 15 and 25).

Table 8 reports the results for the share of industrial employment between 1871 and 1911. Columns 1-3 use the share of Catholic schools as the main explanatory variable. Column 1 includes only department and year fixed effects; column 2 controls for department-level population; column 3 adds enrollment rate, the (log) number of students per school, and the (log) number of total schools. In all specifications, the share of Catholic schools is strongly and negatively associated with industrial employment 10 years later. Since the share of secular schools is the "inverse" to the share of Catholic schools, the results also imply a positive relationship between secular education and industrialization. Among the schooling controls, the (log) number of students per school is negatively and significantly associated with the share of industrial employment. By contrast, changes in enrollment rate do not seem to play a role—likely because primary-school enrollment was already very high in the period of study. Columns 4-6 use the share of students in Catholic schools as the main explanatory variable. All results hold. The standardized beta coefficients are reported at the bottom of the table: they show that a one standard deviation increase in the share of Catholic schools is related to 0.199 standard deviations decrease in the share of industrial employment (column 3). To better gauge the corresponding magnitude, "moving" from the 10th to the 90th percentile of the share of Catholic schools distribution would decrease the share of industrial employment by 6.2 percentage points (relative to a mean of 28% with a standard deviation of 11%).

4.4.3 Additional specifications

Table 9 and Table 10 address concerns of potential omitted-variables bias and reverse causality, respectively. First, while department and year fixed effects control for omitted-variable bias from unobserved

time-invariant department characteristics and time-specific factors, there could still be bias from omitted variables, whose department-specific change over time is correlated with changes in the share of Catholic schools and in industrial employment. Table 9 controls for observable characteristics that would not be captured by department and year fixed effects. Columns 1-2 account for changes in fertility and vaccinations, respectively. These could both be important confounders if a higher quantity of children in more Catholic areas was associated with lower industrial employment—because of lower investment in quality of children, not related to the type of education.[43] Column 3 controls for the spread of phylloxera, a pest of grapevines, which represented one of the most devastating agricultural shocks in French history. It destroyed about one-third of French vineyards between 1875 and 1889, causing wine production to decline by about 70% (Meloni and Swinnen, 2014). If people migrated from the countryside to urban areas, the spread of phylloxera could have favored a switch from the agricultural to the industrial sector and a decrease in the share of Catholic schools. Column 4 controls for changes in agricultural yield and in the cultivated land area, focusing on the three main cereals produced in France at the time: wheat, rye, and oats.[44] Next, I account for the potentially confounding role of changes in migration and urbanization that could affect educational choices as well as industrial employment (columns 5 and 6). The results on the share of Catholic schools are robust to the inclusion of all these variables.[45] Finally, public budget considerations are likely the most relevant confounder in this setting. A challenge for my interpretation could be that increases in government investment (especially in secular-oriented departments) were the dominant factor fostering industrialization, while changes in the type of primary education were merely a sideshow without economic relevance. I analyze two types of government investments. First, I account for government subsidies per capita (column 7). While these are positively associated with the share of industrial employment, the results on the share of Catholic schools are still very strong. Second, in the decades marked by the massive expansion of the railway system, railroads could facilitate market access and industrial development. Column 8 controls for changes in travel costs via the rail network to any other department in France.[46] In all regressions, the coefficient on the share of Catholic schools is highly significant, and

[43]The tradeoff between quantity and quality of children is an important element explaining the transition to modern economic growth (see, for instance, Galor, 2005, 2011). Becker, Cinnirella, and Woessmann (2010) use an instrumental-variable approach to investigate both directions of causality and find evidence of mutual causation between fertility and education in 19th-century Prussia. In a recent paper, de la Croix and Perrin (2018), focusing on the French context, study the temporal and spatial variation in fertility and school enrollment using a structural estimation technique.

[44]Wheat, rye, and oats accounted for 83% of land devoted to cereal cultivation. Cereal yield is constructed as the principal component of the average yield (per hectare) of the three cereals. Table A.20 controls for average yield and total cultivated area, separately for wheat, rye, and oats. The results on education hold.

[45]The indicators of fertility and vaccinations are measured in $t-15$, i.e., when the cohort that was in schools in $t-10$ was born and potentially got vaccinated. The spread of phylloxera (computed as a dummy for the year when it first appeared in a department) is measured in $t-10$ (since it likely affected industrialization after some years).

[46]Table A.21 further deals with the potentially confounding role of travel costs; it accounts for changes in travel costs via railways to Paris, which could capture the exposure to new ideas spreading from the capital, as well as for the density of

similar in magnitude to the baseline results of Table 8.[47]

Finally, Table A.22 checks whether changes in Catholic education are correlated with changes in public spending; it shows that the share of Catholic schools does not systematically vary with any measures of government investment, supporting the argument that parents' religious preferences (rather than public budget considerations) are affecting changes in the type of primary schools.

While using lagged explanatory variables suggests that I capture the effect from the type of education on industrialization, in principle, economic development could also affect educational choices. Table 10 performs an exercise to mitigate concerns of reverse causality. Using the share of Catholic schools as dependent variable, it shows that lagged industrial employment does not predict the share of Catholic schools one decade later.[48] Finally, Table 11 further investigates the timing of the effect of Catholic education on industrialization. It uses different lags for the schooling variables and shows that the coefficient on the share of Catholic schools is quantitatively larger and more significant when the share of Catholic schools is measured in $t-10$, $t-15$, or avg($t-10$, $t-15$). The coefficient is smaller in magnitude and insignificant when the two variables of interest are measured at time t (column 1). These time patterns are in line with an effect of education on industrialization, supporting a causal interpretation of the findings.

4.4.4 Religiously educated cohorts less likely to work in innovative sectors

The panel analysis suggests that Catholic education played a key role in explaining the negative relationship between religiosity and economic development during the Second Industrial Revolution. But, what is the specific channel through which Catholic education may have hampered industrialization? The historical record highlights important differences between the curricula in Catholic and secular schools. Perhaps, though, the two types of primary education differed in other critical dimensions.

Tables A.23 and A.24 empirically deal with two potential confounders: student attendance and school resources. First, if student attendance during summer months (when more workers were needed in the fields) is lower in locations with a higher share of Catholic schools, differences in attendance (rather than in the curriculum) could differentially affect human capital accumulation in religious and secular schools. Table A.23 uses as dependent variable the share of students attending primary schools during summer months in 1876. The results show that Catholic education is not systematically associated with student attendance, even when including the schooling and the baseline controls (columns

and the expenditure for national roads, that—even if not so massively expanded as railways—could also facilitate market access. All results hold.

[47] Since some control variables are not available for the same years, I cannot run regressions where they are all included.

[48] Franck and Galor (2016) find a positive effect of industrialization on human capital formation. However, they look at quantity of human capital (such as enrollment rate, literacy, number of teachers) before the Second Industrial Revolution. Their findings do not contrast with mine, since I focus on a later period, when enrollment rates had already soared, and I analyze the effect of the type of education on industrialization.

2-3). Second, newly digitized data from the French *Archives Nationales* provide canton-level information on the quality of school buildings for about 2,100 cantons in 1873. Table A.24 uses the share of buildings in bad condition as a proxy for school financial resources. The negative (and significant in column 2) coefficient suggests that Catholic schools did not have fewer resources and, if anything, they had a smaller share of buildings in bad condition. This is in line with the historical record documenting that Catholic schools generally had better physical facilities, and it points to the role of curriculum as the key difference between the two types of primary education.

To further validate this argument, I use data from the 1896 *Enquête industrielle*, which contains detailed information on the number of workers by sector and worker cohort. If the curriculum—and the accumulation of "economically useful" knowledge—is the channel through which primary schooling affected industrialization, one would expect religious education to be negatively associated with employment in skill-intensive industries. For each cohort, I compute the share of workers in skill-intensive sectors, and I relate it to the share of Catholic schools at the time when that cohort was attending primary school. I estimate equations of the form:

$$y_{i,c} = \alpha_i + \alpha_c + \beta CS_{i,c} + \gamma \mathbf{X}_{i,c} + \varepsilon_{it}, \tag{4}$$

where y_{ic} is the share of workers from cohort c in skill-intensive sectors, and α_i and α_c denote, respectively, department and cohort fixed effects. The main explanatory variable is the share of Catholic schools, in a given department, when cohort c was attending primary school. The vector $\mathbf{X}_{i,c}$ includes the enrollment rate in primary schools, the (log) number of students per school, the (log) number of total schools, and department-level population.

Table 12 shows the results. The higher the share of Catholic schools when a cohort was in primary school, the lower the share of workers from that cohort employed in skill-intensive sectors (columns 1-2). In terms of magnitude, a one standard deviation increase in the share of Catholic schools is associated with a 0.28 standard deviations decrease in the share of workers in skill-intensive sectors. The results hold when I use the share of students in Catholic schools as the main explanatory variable (columns 3-4), suggesting that "religiously educated" cohorts were less likely to be employed in innovative sectors, probably because they lacked the "economically useful" knowledge to operate the modern, skill-intensive industrial technology.[49]

[49]This findings are in line with Yuchtman (2017), who shows that in early 20th-century China, the traditional and modern educational tracks produced different types of human capital and affected workers' labor market outcomes. In addition, while I am focusing on the role of Catholic vs. secular education for industrial development, other studies analyze the interaction between industrialization and different religious groups. For instance, in the context of Egypt, Saleh (2015) shows that the first wave of industrialization (based on the textile industry) was deskilling for Muslims and upskilling for Christians, while the second wave of industrialization (based on the transportation industry) was upskilling for both groups.

4.5 Discussion: Interpretation and Limitations of the Results

The empirical analysis, together with the extensive historical record, suggests two clear patterns: (1) religiosity is negatively associated with industrial and economic development during the Second Industrial Revolution, and (2) Catholic education (and its curriculum) represents a key mechanism explaining this relationship.

This does not mean that the type of primary education (Catholic vs. secular) is the *only* mechanism explaining the negative relationship between religiosity and industrial-economic progress during the Second Industrial Revolution. The antiscientific program of the Church was likely manifested in other aspects of people's lives: in my setting, for example, the opposition to vaccinations and birth control (affecting the quantity-quality of human capital through channels not related to education), as well as the proscription against electricity in churches. Table 13 provides some evidence for this, showing that more religious departments had lower vaccination rates and higher fertility.[50] However, after studying the role of these alternative mechanisms for industrialization, I concluded that they are unlikely to account for my results (see Table 9).

This interpretation is consistent with the timing of the effect of religiosity on economic development. This paper focuses on a period in which Catholicism had embraced a markedly antiscientific attitude (1789–1914): even within this period, religiosity is not associated with economic development during the First Industrial Revolution, when the upper tail of skill distribution was crucial for industrialization. More Catholic areas started to lag behind only during the Second Industrial Revolution, when religion became a barrier to the accumulation of "economically useful" human capital. To validate this argument, I also discussed a large set of potentially confounding factors: these have to be related to changes in education and industrialization but not captured by the department and year fixed effects. Among them, public spending could have been an additional important driver of development, especially if the government was differentially devoting resources to secular- vs. Catholic-oriented departments. However, the results show that state spending alone is unlikely to explain the adoption of skill-intensive technologies during the late 19th century. Thus, the empirical evidence, supported by a rich historical record, makes it hard to imagine that education was not a *key* mechanism explaining the negative relationship between religiosity and economic outcomes during the Second Industrial Revolution.[51]

In addition, I shed light on the role of the curriculum as the main difference between secular and

[50] Blanc (2019), studying the early demographic transition in France, suggests that religiosity can explain both within-country differences in levels of fertility, as well as the dates of transition.

[51] These results are also in line with a large theoretical literature (e.g., Acemoglu, 1998), arguing that when technology becomes strongly labor-complementary, the abundance/scarcity of skilled labor favors/discourages technological advances: an increase in skilled labor should lead to faster adoption of skill-complementary technologies and to faster industrialization.

religious education. While the subjects included in the secular school curriculum (stretching from elements of natural sciences and mathematics to more practical applications) were clearly important for accumulation of "economically useful" knowledge, I do not argue that the hours spent studying these topics turned schoolchildren into skilled workers. Children usually entered a profession after finishing primary school and they still needed to learn their exact tasks on the factory floor. However, the "economically useful" knowledge they acquired could have prepared them to better learn the extra knowledge needed in their specific profession. At the same time, it is not easy to assess whether religious schooling was harmful or simply useless, and the differences between Catholic and secular schools were likely not restricted to the subjects studied but comprised broader attitudes that were (or were not) beneficial to the accumulation of "economically useful" human capital. Accordingly, I emphasize a broad concept of the Catholic school curriculum, but one clearly distinct from what children learned in secular schools.

5 Conclusion

The interaction between religion and technological-scientific progress has been particularly complex throughout history and still is today in many regions around the globe. This paper uses a historical setting to study when religion can hinder the diffusion of knowledge and economic development, and through which mechanism. Focusing on 19th-century Catholicism, I analyze a crucial phase of modern economic growth, the Second Industrial Revolution (1870–1914) in France. In this period, technology became skill-intensive, leading to the introduction of technical education in primary schools. At the same time, the Catholic Church was promoting a particularly antiscientific program and opposed the adoption of this technical curriculum. Using data collected from primary and secondary sources, I exploit preexisting variation in the *intensity* of Catholicism (i.e., religiosity). I show that, despite a stable spatial distribution of religiosity over time, more religious locations had lower economic development *only* during the Second Industrial Revolution, but not before. I shed light on the mechanism, focusing on the role of Catholic vs. secular education. I find that more religious areas adopted the new curriculum more slowly, pushing instead for religious education. Religious education, in turn, was negatively associated with industrial development about a decade later, when school-age children entered the labor market, and this negative relationship was particularly pronounced in skill-intensive sectors.

These findings on 19th-century France—a pioneer in the process of secularization and still representing one of the most exemplary secular state—may have important implications for economic development today, especially for those developing countries where religion plays a primary role in the personal and public spheres and that are experiencing large-scale technological progress. Three main implications emerge. First, the relationship between religion and economic development be-

comes negative when religion hinders the adoption of "economically useful" knowledge. Second, the *intensity* of religion is key, in that it determines the importance given to religious norms, and the degree of resistance to new ideas and innovative activities, if these clash with religious values. Third, a key mechanism through which religion can affect economic development is by affecting the content of education, and thus accumulation of human capital among the population.

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FIGURES AND TABLES

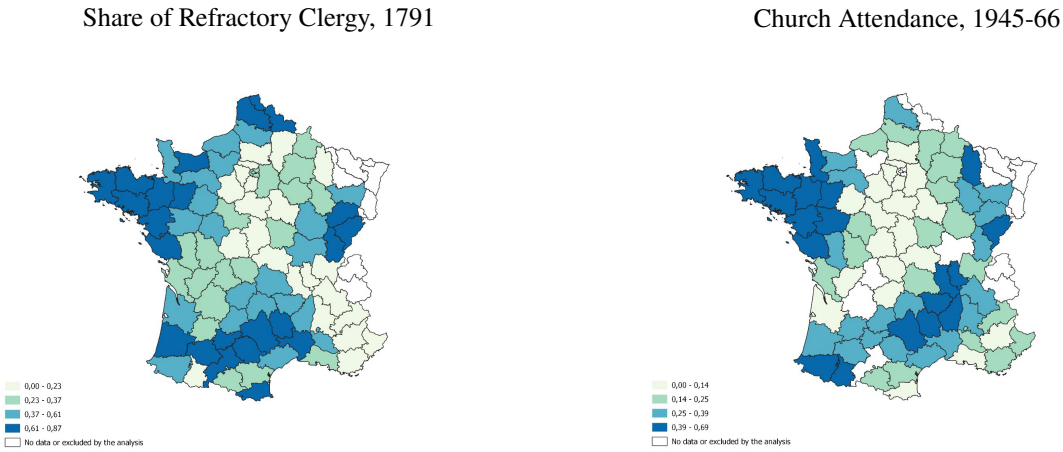

Figure 1: Religiosity in 1791 and in the mid-20th century

Notes: The left panel shows the spatial distribution of the share of refractory clergy in 1791. The right panel shows Church attendance in the 1945-66 period. The maps are obtained by using quartiles of the respective variables. Figure A.1 in the Appendix shows the spatial distribution of the share of refractory clergy at the district level.

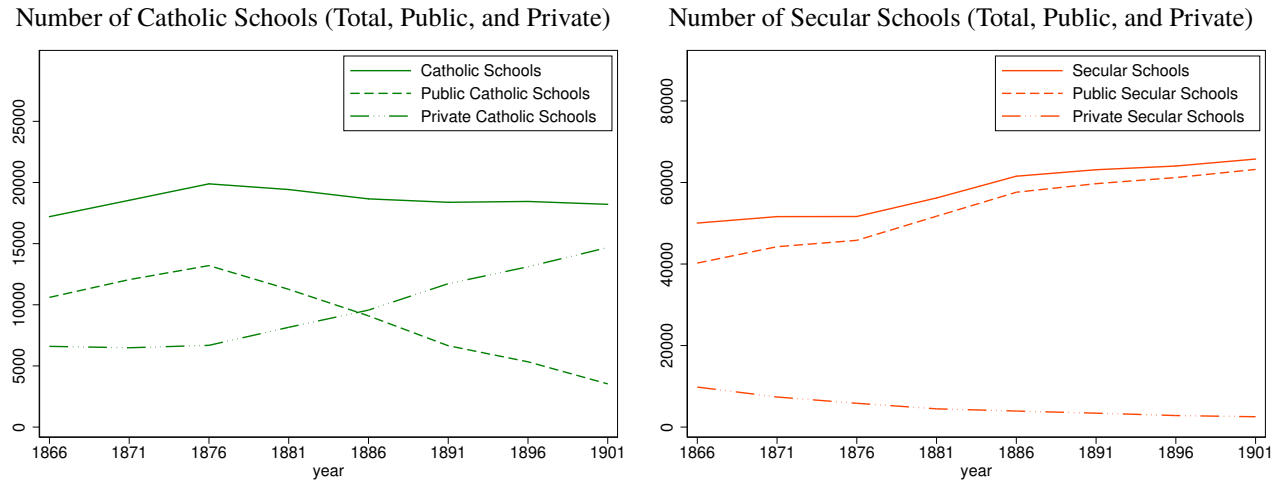

Figure 2: Catholic and secular schools in the public and private sector, 1866–1901

Notes: The left panel shows the number of total Catholic schools, public Catholic schools, and private Catholic schools. The right panel shows the number of total secular schools, public secular schools, and private secular schools.

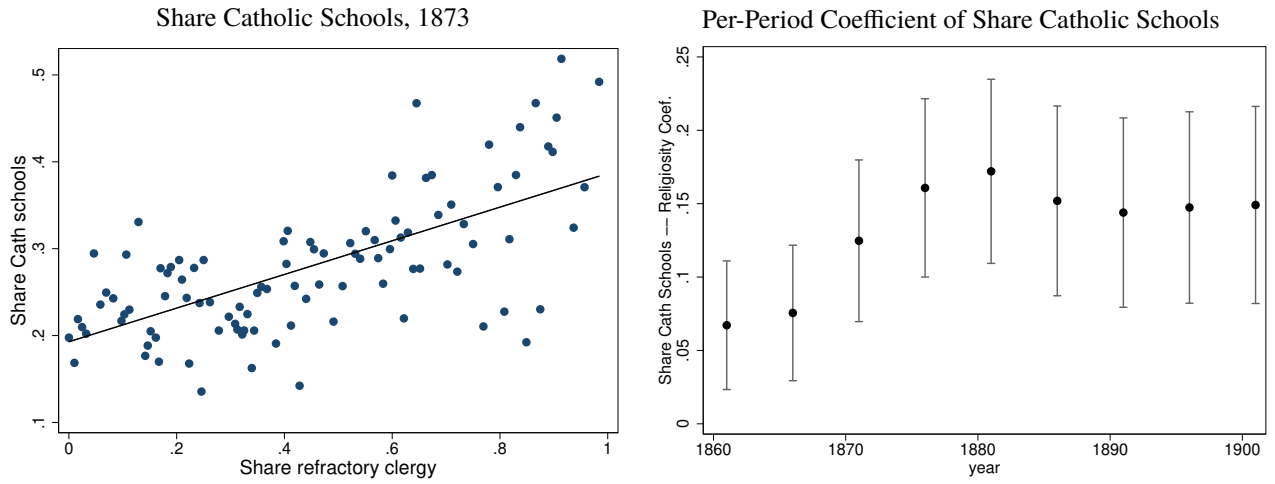

Figure 3: Religiosity and Catholic education

Notes: The left panel uses canton-level data and plots religiosity (measured as the share of refractory clergy) against the share of Catholic schools in 1873 (using a binned scatterplot with 100 equal-sized bins). The right panel uses department-level data and plots the per-period coefficient of the share of Catholic schools on religiosity. The baseline time-period is 1851. Data on the share of Catholic schools are not available for the year 1856. The bars represent 90 percent confidence intervals.

Table 1: Persistence of religiosity (1788–1950s)

Dependent Variable:	Share Refract. Clergy		Share *LaCroix* Readers 1893		Church Attendance 1945-66	
	(1)	(2)	(3)	(4)	(5)	(6)
Share Anti-Relig. *Cahiers*	-1.309***	-1.320**				
	(0.426)	(0.588)				
Share Refractory Clergy			1.315***	0.941*	0.428***	0.413***
			(0.471)	(0.476)	(0.066)	(0.073)
Controls		✓		✓		✓
R^2	0.09	0.28	0.08	0.26	0.39	0.55
Observations	75	70	83	79	76	72
Magnitude: Share Anti-Relig. *Cahiers* / Share Refractory Clergy						
stand. beta coeff.	-0.290	-0.286	0.289	0.209	0.625	0.594

Notes: All regressions are run at the department level. Controls are those listed in Table 3 (except for the use of literacy in 1786-90, rather than enrollment rate in the 19th century, in col. 2). Cols. 1-2 also control for the (log) number of topics covered in the *cahiers*. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. The last row reports the standardized beta coefficients.

Table 2: Negative relationship between religiosity and industrialization during the 2nd Industrial Revolution, but not before

Dependent Variable:	2nd Industrial Revolution		Pre-2nd IR	
	Share Ind. Workers, 1901	Machines pc, 1891	Share Ind. Workers, 1866	Steam Eng. pc, 1840s
	(1)	(2)	(3)	(4)
Share Refractory Clergy	-0.146*	-0.863**	-0.027	0.029
	(0.085)	(0.397)	(0.080)	(0.052)
R^2	0.04	0.06	0.00	0.01
Observations	83	83	83	81
Magnitude: Share Refractory Clergy				
stand. beta coeff.	-0.193	-0.248	-0.037	0.089

Notes: All regressions are run at the department level and do not include any controls. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. The last row reports the standardized beta coefficients.

Table 3: Negative relationship between religiosity and economic development during the 2nd Industrial Revolution

Dependent Variable:	Share Ind. Workers, 1901	Machines pc, 1891	Share Ind. Workers, 1901	Machines pc, 1891	Share Ind. Workers, 1901	Machines pc, 1891	Share Ind. Workers, 1901	Machines pc, 1891
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
							weighted by pop.	
Share Refractory Clergy	-0.187***	-1.382***	-0.173**	-1.277***	-0.149**	-1.133***	-0.209***	-1.440***
	(0.059)	(0.294)	(0.077)	(0.304)	(0.073)	(0.297)	(0.078)	(0.392)
Population	0.159***	0.612***	0.137***	0.331	0.131***	0.260	0.159***	0.392
	(0.025)	(0.145)	(0.036)	(0.209)	(0.041)	(0.228)	(0.035)	(0.242)
Mean Temperature	-0.030	0.252	-0.028	0.271	0.056	0.462	0.057	0.441
	(0.085)	(0.345)	(0.086)	(0.312)	(0.102)	(0.331)	(0.118)	(0.470)
Mean Precipitation	-0.151**	-0.786**	-0.128*	-0.542*	-0.142**	-0.541**	-0.143**	-0.705**
	(0.062)	(0.331)	(0.067)	(0.277)	(0.061)	(0.258)	(0.060)	(0.347)
Wheat Suitability	0.010	-0.168**	0.009	-0.191**	0.007	-0.205**	0.007	-0.285***
	(0.011)	(0.070)	(0.012)	(0.087)	(0.011)	(0.086)	(0.010)	(0.074)
Pre-Industrial Activities	0.098***	0.289**	0.100***	0.311**	0.086***	0.238*	0.098***	0.286*
	(0.023)	(0.141)	(0.022)	(0.129)	(0.021)	(0.123)	(0.022)	(0.152)
Distance from Paris			-0.021	-0.260**	-0.020	-0.291**	0.000	-0.140
			(0.018)	(0.129)	(0.019)	(0.131)	(0.018)	(0.098)
Pays d'Elections			-0.013	-0.243*	-0.017	-0.296**	-0.021	-0.407**
			(0.035)	(0.146)	(0.034)	(0.143)	(0.034)	(0.168)
Knowledge Elites					0.013	0.071**	0.009	0.062
					(0.009)	(0.033)	(0.009)	(0.041)
Enrollment Rate					0.381*	1.172*	0.469**	1.670**
					(0.211)	(0.636)	(0.220)	(0.809)
R^2	0.54	0.46	0.55	0.51	0.60	0.56	0.79	0.57
Observations	79	79	79	79	79	79	79	79
				Magnitude: Share Refractory Clergy				
stand. beta coeff.	-0.248	-0.395	-0.230	-0.364	-0.197	-0.323	-0.226	-0.408

Notes: All regressions are run at the department level. Controls: *Population* represents (log) total department population in the year indicated in the header. *Temperature* and *Precipitation* measure the (log) average precipitation and temperature in the 1700–1800 period. *Wheat Suitability* is wheat soil suitability. *Pre-Industrial Activities* is an index of pre-industrial activities in France that includes the number of mines, forges, iron trading locations, and textile manufactures before 1500. *Distance from Paris* measures the (log) distance from Paris (in km). *Pays d' Election* is a dummy for departments where the king, before 1789, exerted particularly strong power (especially in terms of fiscal and financial matters). *Knowledge Elites* reflects the (log) number of subscribers to the *Encyclopedie* in 1777–1780. *Enrollment Rate* represents the ratio of students to school-age population (5 to 15 years), measured 10 years before the outcome variables. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. The last row reports the standardized beta coefficients.

Table 4: Negative relationship between religiosity and economic development during the 2nd Industrial Revolution – within-department analysis

Dependent Variable:	(Log) Household Expenditure, 1901					
	(1)	(2)	(3)	(4)	(5)	(6)
						weighted
Share Refractory Clergy	-0.042***	-0.052**	-0.053**	-0.047**	-0.049**	-0.078***
	(0.014)	(0.021)	(0.022)	(0.022)	(0.022)	(0.028)
Population	0.042***	0.032***	0.032***	0.032***	0.027***	0.056***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.010)
Wheat Suitability			0.001	0.001	0.001	-0.002
			(0.004)	(0.004)	(0.004)	(0.004)
Distance from Paris				-0.047**	-0.046**	-0.041
				(0.022)	(0.022)	(0.028)
Knowledge Elites					0.007	-0.003
					(0.005)	(0.005)
Department FE		✓	✓	✓	✓	✓
R^2	0.07	0.37	0.36	0.37	0.37	0.55
Observations	1113	1113	1061	1061	1061	1061
Departments included	75	75	71	71	71	71
Magnitude: Share Refractory Clergy						
stand. beta coeff.	-0.119	-0.148	-0.150	-0.134	-0.139	-0.193

Notes: All regressions are run at the canton level. (Log) household expenditure is a proxy for (log) household income (see footnote 23). (Log) population is measured in 1894. Standard errors (clustered at the district level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. The last row reports the standardized beta coefficients.

Table 5: Dif-in-Dif: More religious departments have lower industrial employment during the 2nd IR

Dep. Variable: Share Industrial Employment, 1866–1911

	(1)	(2)	(3)	(4)
ShareRef*Post1871	-0.051***	-0.051***	-0.051**	-0.047***
	(0.018)	(0.019)	(0.020)	(0.018)
Share Refractory Clergy	0.002	0.002		
	(0.052)	(0.053)		
Population				0.124**
				(0.054)
Department FE			✓	✓
Year FE		✓	✓	✓
R^2	0.01	0.04	0.94	0.94
Observations	830	830	830	830

Notes: All regressions are run at the department level and control for the *Post1871* indicator. Standard errors (clustered at the department level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 6: Higher growth in share of Catholic schools in more religious departments

Dependent Variable:	Share Cath. Schools			Gr. Share Cath. Schools			
	1851	1866	1901	1851-1866	1866-1901		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
							weighted
Share Refractory Clergy	0.004	0.072	0.136***	0.297*	0.455***	0.378***	0.290**
	(0.052)	(0.052)	(0.042)	(0.177)	(0.124)	(0.139)	(0.111)
Schooling Controls	✓	✓	✓	✓	✓	✓	✓
Controls						✓	✓
R^2	0.17	0.32	0.38	0.34	0.40	0.57	0.56
Observations	82	82	82	82	82	79	79
Magnitude: Share Refractory Clergy							
stand. beta coeff.	0.010	0.145	0.327	0.154	0.429	0.352	0.336

Notes: All regressions are run at the department level. Schooling controls include enrollment rate, the (log) number of students per school, and the (log) number of total schools (measured in the initial period in cols. 4-7). In addition, cols. 1-3 include (log) department population and cols. 4-7 controls for population growth in the period indicated in the header. Cols. 4-7 also control for the initial share of Catholic schools. Controls are those listed in Table 3. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. The last row reports the standardized beta coefficients.

Table 7: Higher growth in share of Catholic schools in more religious cantons – within-department analysis

Dependent Variable:	Share Cath. Schools				Gr. Share Cath. Schools, 1873-94			
	1873		1894		1873-1894			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
								weighted
Share Refractory Clergy	0.132***	0.112***	0.130***	0.099***	0.272***	0.155**	0.142**	0.153**
	(0.023)	(0.023)	(0.018)	(0.017)	(0.052)	(0.065)	(0.067)	(0.076)
Schooling Controls	✓	✓	✓	✓	✓	✓	✓	✓
Controls (canton)							✓	✓
Department FE		✓		✓		✓	✓	✓
R^2	0.27	0.56	0.30	0.62	0.15	0.28	0.28	0.30
Observations	2065	2065	1891	1891	1684	1684	1613	1613
Departments included	78	78	75	75	73	73	69	69
Magnitude: Share Refractory Clergy								
stand. beta coeff.	0.210	0.178	0.268	0.204	0.160	0.091	0.083	0.090

Notes: All regressions are run at the canton level. Schooling controls include the (log) number of students per school, and the (log) number of total schools (measured in the initial period in cols. 5-8). Cols. 1-4 control for (log) canton population in the year indicated in the header. Cols. 5-8 control for population growth in the 1873–1894 period and for the share of Catholic schools in 1873. Controls are those listed in Table 3, when available at the canton/district level. Standard errors (clustered at the district level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. The last row reports the standardized beta coefficients.

Table 8: Catholic education negatively associated with industrial employment 10 years later

Dependent Variable: Share Industrial Employment, 1871–1911

	(1)	(2)	(3)	(4)	(5)	(6)
					students	
Share Cath. Schools/Students$_{t-10}$	-0.190***	-0.228***	-0.199***	-0.203***	-0.180***	-0.182***
	(0.070)	(0.062)	(0.067)	(0.073)	(0.061)	(0.061)
Population		0.140**	0.216***		0.125**	0.215***
		(0.062)	(0.078)		(0.057)	(0.071)
Enrollment Rate$_{t-10}$			0.025			0.017
			(0.042)			(0.040)
Students per School$_{t-10}$			-0.076**			-0.088**
			(0.036)			(0.035)
Total Schools$_{t-10}$			-0.043			-0.037
			(0.042)			(0.039)
Department FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
R^2	0.94	0.95	0.95	0.95	0.95	0.95
Observations	747	747	747	664	664	664
Magnitude: Share Catholic Schools /Students						
stand. beta coeff.	-0.189	-0.228	-0.199	-0.232	-0.206	-0.208

Notes: All regressions are run at the department level. Standard errors (clustered at the department level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. The last row reports the standardized beta coefficients.

Table 9: Catholic education negatively associated with industrial employment – confounding factors

Dependent Variable: Share Industrial Employment, 1871–1911

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Share Cath. Schools$_{t-10}$	-0.205***	-0.234**	-0.193***	-0.202**	-0.195***	-0.199***	-0.171**	-0.196***
	(0.071)	(0.105)	(0.069)	(0.080)	(0.069)	(0.068)	(0.072)	(0.073)
Fertility$_{t-15}$	-0.131							
	(0.094)							
Share Vaccinations$_{t-15}$		-0.008						
		(0.009)						
Phylloxera Dummy$_{t-10}$			0.000					
			(0.005)					
Agric. Yield (per hectar)				0.000				
				(0.002)				
Land Cultivated				-0.022**				
				(0.011)				
French Immigrants pc					0.003			
					(0.009)			
Share Urban Pop.						-0.006		
						(0.174)		
Governm. Subsidies pc							0.087*	
							(0.048)	
Avg. Travel costs via Railways								-0.058
								(0.066)
Schooling Controls	✓	✓	✓	✓	✓	✓	✓	✓
Department FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
R^2	0.96	0.98	0.95	0.95	0.95	0.95	0.95	0.95
Observations	664	276	729	495	664	747	664	415

Notes: All regressions are run at the department level and control for population in year t. Schooling controls include enrollment rate, the (log) number of students per school, and the (log) number of total schools in $t-10$. Standard errors (clustered at the department level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 10: Industrial employment does not predict the share of Catholic schools

Dependent Variable: Share Catholic Schools		
	(1)	(2)
Share Ind. Employment$_{t-10}$	0.048	0.091
	(0.122)	(0.126)
Schooling Controls		✓
Department FE	✓	✓
Year FE	✓	✓
R^2	0.91	0.92
Observations	581	581

Notes: All regressions are run at the department level. Schooling controls include enrollment rate, the (log) number of students per school, and the (log) number of total schools. In addition, col. 2 includes (log) department population. Standard errors (clustered at the department level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 11: Catholic education and industrial employment – different lags

Dependent Variable: Share Industrial Employment				
	(1)	(2)	(3)	(4)
measured at time	t	$t-5$	$t-15$	avg$(t-10, t-15)$
Share Cath. Schools	-0.070	-0.092**	-0.222***	-0.241***
	(0.050)	(0.045)	(0.058)	(0.065)
Department FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
R^2	0.94	0.94	0.96	0.96
Observations	747	830	664	664
Magnitude: Share Catholic schools				
stand. beta coeff.	-0.081	-0.104	-0.223	-0.240

Notes: All regressions are run at the department level and control for (log) department population in t. Standard errors (clustered at the department level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 12: "Religiously educated" cohorts less likely to be employed in innovative sectors

Dep. Var.: Share of Workers in Innovative Sectors, 1896				
	(1)	(2)	(3)	(4)
			students	
Share Cath. Schools	-0.384**	-0.381**		
	(0.150)	(0.154)		
Share Cath. Students			-0.206*	-0.239**
			(0.118)	(0.108)
Schooling Controls		✓		✓
Department FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓
R^2	0.97	0.97	0.97	0.97
Observations	249	249	249	249
Magnitude: Share Catholic Schools/Students				
stand. beta coeff.	-0.288	-0.285	-0.175	-0.203

Notes: All regressions are run at the department level and control for (log) department population. Schooling controls include enrollment rate, the (log) number of students per school, and the (log) number of total schools. Standard errors (clustered at the department level) in parentheses. * p<0.1, ** p<0.05, *** p<0.01. The last row reports the standardized beta coefficients.

Table 13: Lower vaccination rate and higher fertility in more religious departments

Dependent Variable:	Share		Fertility	
	vaccination, 1871		1871	
	(1)	(2)	(3)	(4)
Share Refractory Clergy	-0.248**	-0.260*	0.240***	0.197***
	(0.123)	(0.145)	(0.060)	(0.045)
Controls		✓		✓
R^2	0.06	0.20	0.20	0.66
Observations	66	62	83	79
Magnitude: Share Refractory Clergy				
stand. beta coeff.	-0.242	-0.244	0.451	0.370

Notes: All regressions are run at the department level. Controls are those listed in Table 3. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. The last row reports the standardized beta coefficients.