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► **To cite this version:**

Guillaume Blanc. Modernization Before Industrialization: Cultural Roots of the Demographic Transition in France. 2019. hal-02318180v2

**HAL Id: hal-02318180**

**<https://hal.science/hal-02318180v2>**

Preprint submitted on 13 Nov 2019 (v2), last revised 3 Feb 2024 (v11)

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# Modernization Before Industrialization: Cultural Roots of the Demographic Transition in France

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October 2019 (latest version)

## Abstract

*This research identifies the origins of the early demographic transition in France, before the French Revolution and more than a century before the rest of Europe. We provide strong empirical evidence suggesting that secularization accounts for the bulk of the decline in fertility and document large, significant, and robust results across specifications, datasets, and estimation methods. We draw on a novel individual-level historical dataset crowdsourced from publicly available genealogies to establish a causal interpretation. This dataset allows to control for time-varying unobservables, to study the effect of secularization before and after demographic change, and to exploit the choice of migrants in the aftermath of the decline in religiosity. Finally, we discuss the roots of the rapid and early process of secularization and suggest that the strength of the Counter Reformation following the demise of Protestantism in France played an important part. Our findings demonstrate that cultural change and the transition to modernity and away from tradition can shape development.*

**JEL codes:** N33, O10, Z12

**Keywords:** fertility, modernization, development, secularization

*God blessed Noah and his sons and said to them, “Be fertile, increase in number, and fill the earth”*  
—Genesis 9:1

*And the race of man cannot, by any efforts of reason, escape from it*  
—Thomas Malthus, *An Essay on the Principle of Population* (1798)

## 1 INTRODUCTION

Over the past three hundred years, the transition from stagnation to growth has triggered dramatic upheavals with enduring consequences. As many regions of the

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world experienced unprecedented growth, an evolution towards modernity and away from tradition also took place. Most accounts place industrialization and development first, followed by unwavering modernization in social norms, political organization, and demographic behaviors. However, the sequencing is intricate because most of these changes took place simultaneously.

This paper advances the hypothesis and demonstrate that secularization, not development, brought about the demographic transition in France: modernization materialized before industrialization. The demographic transition plays a major part in the process of development, the transition from a regime of high fertility and low growth to a regime of low fertility and high growth.<sup>1</sup> Yet, while the rest of Europe experienced a sustained decline in the rate of fertility at the very earliest in 1870's, and in 1892 for England and Wales (Coale and Watkins, 1986), the transition started in France before the French Revolution. There is some uncertainty on the timing due to the lack of available data before the Revolution, but the onset of the decline in fertility has been estimated to occur between 1755 and 1776 (Blanc, 2019; Cummins, 2012).

Why the demographic transition started first in France, more than a century before the rest of the world, has been a long standing puzzle.<sup>2</sup> In many ways, France was a developing country in the eighteenth century. In 1750, literacy in France was half that of England and Wales. France attained the GDP per capita of 1750 England and Wales, the cradle of the Industrial Revolution, in the aftermath of World War I, and it took France more than a century to achieve the rate of urbanization of 1750 England: only in 1950 did urban population outnumbered rural population.

In the mid-eighteenth France underwent, also before any other country, a major and rapid process of secularization and decline in religiosity (Chartier, 1991; Van Kley, 1996). Historical and anecdotal evidence suggests that a rapid and sharp weakening of Roman Catholic Christian values affected all layers of society as soon as in the 1740's and 1750's. According to Tackett (1986), "*a spirit of irreligion was sweeping over the kingdom (...) in a veritable flood*" (p. 252). Desacralization, characterized by Weber (1904/1905) as "disenchantment", *Entzauberung*, contributed to a broader process of modernization and move away from the weigh of tradition, documented by McCloskey (2006, 2010, 2016) and Mokyr (2016).

We establish that the spread of modern norms of limited fertility in eighteenth century France was an outcome of secularization. We do so using a variety of empirical methods, novel historical measures to capture secularization, as well as a novel individual-level dataset that allows to control for unobservables and to study fertility

<sup>1</sup>"*We all agree that the escape from the Malthusian trap is the most important event in world history*" (McCloskey, 2010, Chapter 23).

<sup>2</sup>See Coale and Watkins (1986); Cummins (2012); Henry (1972a,b, 1978); Henry and Houdaille (1973); Knodel and van de Walle (1979); Murphy (2015); Weir (1994); Wrigley (1985a,b), among others.

decisions in the eighteenth century (in a time without administrative data), before and after the transition.

In our analysis, we exploit variation in the extent of the decline in religiosity by looking at the effect of religiosity in the late eighteenth century conditional on pre-secularization religiosity proxies. Our main independent variable is *Religiosity (late 18th c.)* and is measured at the *département* and at the district levels. This is the outcome of the process of secularization that took place in the 1750's. We use the share of refractory clergy (nonjurors) in 1791, before the policies of dechristianization and major anti-Church events of the French Revolution. The 1790 Civil Constitution of the Clergy required clergymen to take an oath of allegiance to the State. The oath had to be taken “*on a Sunday at the conclusion of the mass*” (Decree on the clerical oath, 1790), and Franck and Johnson (2016); Squicciarini (2017); Tackett (1986) argue that it reflected the religiosity of the population at the start of the French Revolution.

In order to capture the decline in religiosity and not preexisting differences, we control for pre-secularization religiosity measures in most of our regressions. Importantly, in France, as opposed to the rest of the world, secularization was a rural phenomenon. Since historical times, rural areas have placed more value on tradition and less on technological change and human capital accumulation. We therefore expect our estimates throughout the paper to be downwards biased, towards zero.

We evaluate the cross-sectional determinants of marital fertility at the *département* level from 1841 to 1901. We find that *Religiosity (late 18th c.)* explains both fertility levels and dates of transition. We estimate remarkably strong, significant, and robust coefficients across specifications. Decreasing late eighteenth century religiosity from the 75th to the 25th percentile of the distribution predicts a decrease in fertility of about one standard deviation.

We provide different strategies to suggest a causal effect, by accounting for spatial correlation and omitted variables. First, we explore issues related to spatial clustering. Since *Religiosity (late 18th c.)* and marital fertility have similar spatial dependence structures, we may falsely identify a correlation that is spurious in nature. As suggested by Kelly (2019), we report Moran statistics and noise simulations at different weighing schemes to address this. Using fixed-effects takes away all the spatial dependence. Second, we evaluate the role of omitted variables that could drive both secularization and fertility following Oster (2016). We conclude that omitted variables do bias our estimates downwards.

Finally, we use district-level variation in religiosity in the late eighteenth century by exploiting a novel individual-level crowdsourced historical dataset spanning several centuries (Blanc, 2019; Kaplanis et al., 2018). This data contains all publicly available genealogies on geni.com and is a representative sample for France from 1700 to 1900. The raw data consists in individual-level informations (such as dates and places of

birth and death) and intergenerational links.

We reach plausibly causal estimates by accounting for time varying *département*-level unobservables with fixed effects. Again, we find strong, significant, and robust effects of *Religiosity (late 18th c.)* on fertility, between districts and within *départements*. We also find that, while treatment (religiosity in the late eighteenth century) was positively associated with fertility after secularization, it had a negative and insignificant effect before, suggesting that we merely capture secularization and not pre-existing differences that are unobservables. Last but not least we study individuals who migrated during childhood, before the change in norms, but were exposed to secularization in their district of settlement, to strengthen our causal interpretation and to separate the effect of cultural change from that of intergenerationally transmitted persistent traits. We compare individuals born in the same district and observe that they adopt the cultural traits of their migration destination at the time of the process of secularization.

Last but not least, we address the roots of secularization and show that it was driven by the unchecked spread of the Counter Reformation following the demise of Protestantism. The austere morality imposed by Jansenists, rigorous followers of a theological movement that primarily spread in France and disappeared in the first half of the eighteenth century, could have played a role. While there was religious competition between Protestants and Catholics in other European countries, such competition did not take place in France where the Counter Reformation had an especially strong and unrivalled monopoly after the 1685 Revocation of the Edict of Nantes which abolished all rights and religious freedom of Protestants. The monopoly of the Catholic Church on the market for salvation essentially set a price that was too high to pay for most.

This paper has numerous contributions. First, we are the first to both advance the hypothesis and demonstrate that the sudden mid-eighteenth century decline in religiosity precipitated the demographic transition in France. We offer a solution to a major unsolved puzzle and we substantiate the view that cultural change caused it (Braudel, 1986b; Sauvy, 1960). Second, we contribute to a vibrant literature that has documented the persistence of culture over the very long run (Giuliano and Nunn, 2016; Spolaore and Wacziarg, 2013; Voigtländer and Voth, 2012). However, we empirically establish that cultural *change* and not persistence can cause long run development. By looking at the determinants of change, we also contribute to literatures on the economic consequences of the Reformation and Counter-Reformation in Europe (Becker and Woessmann, 2009; Becker, Pfaff and Rubin, 2016) and on the cultural roots of the Industrial Revolution (Mokyr, 2016; Squicciarini, 2017; Squicciarini and Voigtländer, 2015). This is also the first paper to examine the determinants of rapid secularization in eighteenth century France. Finally, this is the first research to use

eighteenth century individual-level data on fertility.

## 2 HISTORICAL BACKGROUND AND LITERATURE ON DEMOGRAPHIC CHANGE, DEVELOPMENT, AND SECULARIZATION

### 2.1 DEMOGRAPHIC TRANSITION AND DEVELOPMENT

In every respect, eighteenth century France lagged one to two hundreds years behind England, the cradle of the Industrial Revolution. France attained the GDP per capita of 1750 England and Wales in the 1920's (Bolt and van Zanden, 2014; Lévy-Leboyer and Bourguignon, 1985), the rate of urbanization of 1750 England in 1950 (Bairoch, Batou and Chèvre, 1988), and the rate of literacy of 1650 England in 1850 (Buringh and van Zanden, 2009). Weber (1976) depicts Frenchmen as “*peasants*” and “*savages*”. Crouzet (2003) notes that “*France remained fundamentally a peasant-based rural economy. Only in 1911 did employment in industry overtake that in agriculture.*” (p. 236), while Lévy-Leboyer (1968) discusses “*the absence of a take-off in France*”.

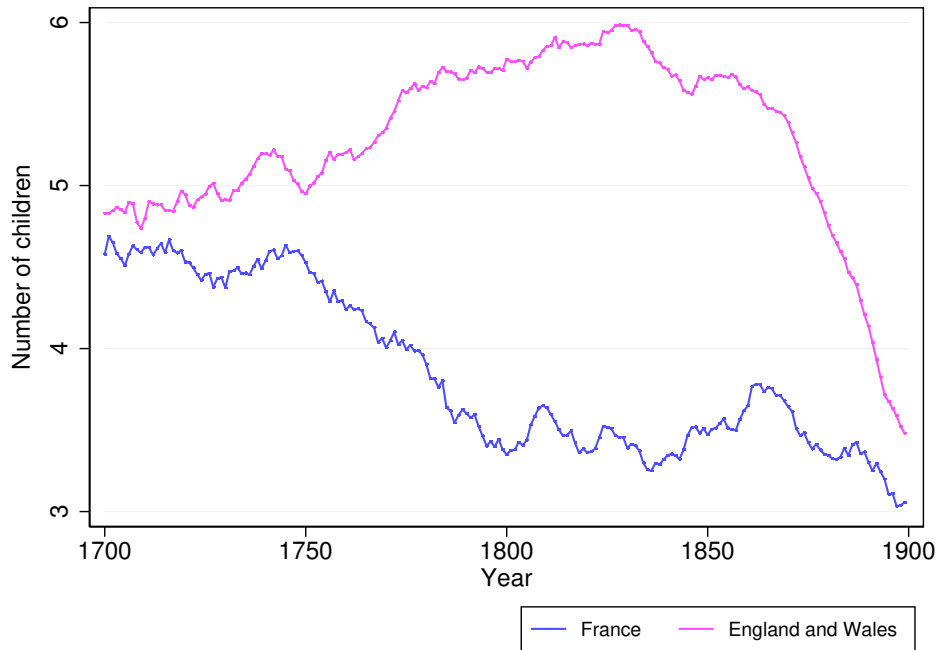
Despite the absence of industrialization in France, France and England did not grow at different rates in per capita terms after 1750 and throughout the 19th century (Bolt and van Zanden, 2014) since the rate of population growth in England largely exceeded that in France. In the two centuries following 1750, the population of England increased from 5,5 to 40 millions inhabitants, while the population of France increased from 24,5 to the same figure in 1950, 40 millions inhabitants. Changing rates of fertility were already noticed by contemporary observers, and attributed to changing moral standard and preferences: “*it is the same love of ease and convenience that is filling France with bachelors...men who vanish from the world with all their posterity*” (Goudar, 1756, p.271).

The early transition, a century before the rest of Europe, in an epoch of stagnation, and before the French Revolution, has generated numerous contributions in the past 50 years (Henry, 1972*a,b*, 1978; Henry and Houdaille, 1973; Knodel and van de Walle, 1979; Weir, 1994; Wrigley, 1985*a,b*). Figure 1 displays the rate of gross fertility for France and England and Wales between 1700 and 1900. In the 1750's and throughout the second half of the eighteenth century, the average rate of fertility in France significantly declined, while it slowly increased in England until 1880. Uncovering the deep roots has been hampered by data availability due to the early nature of the fertility decline. In particular, demographer Louis Henry used parish records to reconstruct village-level series of fertility in the eighteenth century while Coale and Watkins (1986) tried to assess the importance of economic and cultural factors in Europe using census data after 1831. There is widespread agreement that cultural forces caused the transition in France, yet the ultimate cause for the decline remains

one of the most important unsolved puzzle in the history, demography, and growth literatures.

**Figure 1:** Demographic transition in France and England

*Note:* This figure displays the gross rate of fertility for France and England and Wales over time. Source: Blanc (2019)



While modern methods of contraception became available well after the onset of the fertility decline, means of contraception were known at the time. Some innovations did take place in that epoch, such as the spread of early condoms (known as “redinguote d’Angleterre”, English riding coat (Spolaore and Wacziarg, 2019; van de Walle, 2005)), but these were expensive and not widely used. On the contrary, natural methods to achieve parity-specific control, such as *coitus interruptus* (withdrawal) or *implexus restrictus* (non-ejaculation), have been known since biblical times (Spolaore and Wacziarg, 2019), the former originating from the Middle East (van de Walle, 2005). According to van de Walle (2005) withdrawal “was frequently alluded to in libertine literature” (p. 2), which was particularly widespread in eighteenth century France (Darnton, 1991) with books such as *Venus in the Cloister or The Nun in her Smock* or Diderot’s *Indiscreet Jewels*. Other methods of contraception, less relevant here, include chastity, late marriage, sodomy, abortion, or infanticide (Braudel, 1986b).

According to standard economic theory, development is the best contraceptive (Hansen and Prescott, 2002; Kremer, 1993). In the course of history, as technolog-

ical progress accelerates the return to human capital rises and fertility decisions are altered, triggering the onset of the transition. While in the Malthusian trap, income per capita fluctuates around a subsistence level because of the positive relationship between income and fertility. As quality is favored to quantity, the relationship is reversed and the economy enters the modern growth era, where human capital is the main driver of progress (Galor, 2011; Galor and Weil, 2000). The set of endogenous growth models developed by Galor (2011); Galor and Weil (2000); Galor and Moav (2002) generates fascinating dynamics and interactions at work in the long run between human capital accumulation, fertility, and technological progress, but fails to explain the French demographic transition.

In recent years a number of empirical studies have tried to assess the forces driving the demographic transition in France, especially by weighing the relative importance of economic versus cultural forces broadly (de la Croix and Perrin, 2018; Murphy, 2015).<sup>3</sup> More related to our analysis of the cultural origins of the transition, Daudin, Franck and Rapoport (2018) demonstrate that norms of limited fertility diffused within France and Spolaore and Wacziarg (2019) show that the reduction in the rate of fertility in 19th century Europe was driven by a process of diffusion of norms originating from France.<sup>4</sup> While these studies highlight processes of diffusion, so far none has empirically established the cause of the decline in fertility in France.

## 2.2 RELIGION, COUNTER REFORMATION, AND SECULARIZATION IN FRANCE

Since medieval times, France has been known as the “*the eldest daughter of the Roman Catholic Church*”, French kings as “*Rex Christianissimus*”, “most Christian king”, and the French as “*God’s chosen people*” (Burleigh, 2005, p. 23). This section briefly summarizes the chain of events that brought about a radical change in beliefs and religiosity in the mid-eighteenth century.

Throughout history, France was a major Roman Catholic country that even hosted seven successive popes in the XIVth century. During the French Renaissance, and particularly after the reign of Francis I, Protestantism marginally spread to France with an estimated 10% of Protestants in the mid-sixteenth century (most of these Huguenots). The second half of the sixteenth century was a period of violent Religious Wars and political unrest, whose apex was the massacre of thousands of Protestants on

<sup>3</sup>Murphy (2015) proposes that the French Revolution may have been one of many causes of the decline. He examines the cross-sectional determinants of fertility in France and devotes two paragraphs to the effect of the oath on fertility at the *département* level in 1831. We hope to demonstrate with more systematic and rigorous analysis that secularization, not the French Revolution (1789), caused the demographic transition in France.

<sup>4</sup>The existence of deep-rooted barriers to the adoption of innovation has been documented in Spolaore and Wacziarg (2009). See also Delventhal, Fernández-Villaverde and Guner (2019) for the diffusion of the fertility transition between countries, or Blanc and Wacziarg (2019) for an account of modernization at the microeconomic level.



Saint Bartholomew's Day in 1572. In 1593, after four years fighting a war of succession against the Holy League to gain access to the throne which he should have inherited in 1589, Henry IV of France renounced Protestantism and, for the second time since Saint Bartholomew's Day, was forced to convert to Catholicism. The promulgation of the Edict of Nantes in 1598 finally put an end to the French Wars of Religion by granting Huguenots substantial rights and freedom of religion.

In the 17th century France remained predominantly Catholic and in 1685, Louis XIV revoked the Edict of Nantes which effectively ended this short period of religious toleration and led to the emigration of thousands of Protestants.<sup>5</sup> This period coincided with a Catholic resurgence and the rise, diffusion and consolidation of Counter Reformation theological movements in France: the Jesuits and the Jansenists. Importantly, religious competition was primarily between these two movements, and much less so with Protestants.

Jansenism spread to France from Louvain (Van Kley, 1996, p. 58) after the posthumous publication in 1640 of *Augustinus* by Cornelius Jansen, “*a Catholic Lutheran*” (Burleigh, 2005, p. 34). Jansenists advocated a rigorist view of Catholicism, with an emphasis on predestination of the elect to salvation, the limitation of sacraments and the need for penitence: “*Jansenism accentuated humankind's pristine perfection and original innocence, the better to underscore the catastrophe of the original sin of disobedient pride and the ensuing fall.*” (Van Kley, 1996, p. 60); “*an austere, rigorous creed, that stressed individual study of the scripture in the vernacular, the need for sincere contrition rather than mere fear of eternal damnation, the infrequency of communion, and the remoteness of God from a concupiscent humanity.*” (Burleigh, 2005, p. 34).

They also strongly opposed the elitism of Jesuits: “*this set Jansenism on a collision course with baroquely lax Catholicism in which the Jesuits could allegedly finesse everything this way or that.*” (Burleigh, 2005, p. 34). Van Kley (1996) writes that “*against the Jesuits' preference for Latin and elites, Port-Royal's director Le Maitre de Sacy began to translate the Bible into French, and Pascal appealed to literate opinion*”, referring to the Council of Trent's interdiction against vernacular Bible translation and the support of famous scientists such as Blaise Pascal. As a result, Jansenism spread to rural places, while elites remained acquainted to the Jesuits.

The first half of the eighteenth century in France was characterized by major religious turmoil and controversies between the two groups, eventually leading to the decline and demise of Jansenism. In 1709, Louis XIV decreed that the Abbey of Port Royal des Champs, the center of Jansenism in France, be demolished. In 1713, the *Unigenitus* papal bull, supported by the Jesuits, set a number of fierce religious fights into motion. The bull was an apostolic constitution condemning 101 Jansenist views

<sup>5</sup>See Hornung (2014) for the long run effects of the forced migration of Huguenots to Prussia.

described by theologian Pasquier Quesnel.

In the following years, the bull generated major controversies (Van Kley, 1996). The Convulsionnaires of Saint-Médard, a group of Jansenists, would gather in cemeteries and holy places to convulse and declare miraculous healings. From the 1720's and until the 1740's, Jesuits bishops and clergy would deny sacraments and burial in consecrated ground to the faithful unless they could provide a proof of acceptance of *Unigenitus* such as *billets de confession*, papers that affirmed submission to the bull and had to be signed by the archbishop of Paris. The *billets* were very much denounced by Catholics in news articles all across France (Perez, 1999).

Around 1750 however, a sudden, rapid, and widespread process of secularization took place in France. de Tocqueville (1856) writes that “*irreligion was able to become a general and dominant passion in eighteenth-century France*” (Book 3, Chapter 2). The Counter Reformation has been advanced as a plausible explanation but no ultimate cause has yet been uncovered.<sup>6</sup> Norberg (1985) notes that “*Historians have been too preoccupied establishing the meaning, chronology, and social composition of this phenomenon to speculate on its deeper causes*” (p. 302).

The austere morality slowly and forcibly imposed by the Counter Reformation in France, the rigorism of Jansenists, or religious controversies and competition with Jesuits are believed to have precipitated the decline in religiosity and social unrest (Tackett, 1986; Van Kley, 1996).<sup>7</sup> Hoffman (1984) argues that “*the Counter Reformation's austere morality was imposed in full force (...) not surprisingly, it was rejected by people who saw nothing wrong in combining devotion and gaiety*” (p. 138).<sup>8</sup>

Thereby, many regions of France experienced a widespread process of secularization as soon as in the late 1740's. There was substantial heterogeneity in the extent of the religiosity decline and, in particular, it has been documented in the regions of Provence and Auvergne-Rhône-Alpes (in the dioceses of Grenoble and Lyon) by Hoffman (1984); Norberg (1985); Vovelle (1973).<sup>9</sup> In regions such as Brittany, there is much more limited evidence that such change occurred (Tingle, 2012), while Paris stayed rather religious with substantial variance (Chaunu, 1978).

Finally, Chartier (1991) describes how regions such as Savoy experienced a radically different evolution from that on the other side of the border: “*habits thus seem to have been quite different on different sides of the frontier, which suggests the singularity of dechristianization in France.*” (p. 97).

<sup>6</sup>We provide an empirical evaluation of the causes of the decline in religiosity in Section 6.

<sup>7</sup>See Cantoni, Dittmar and Yuchtman (2018) on the role of religious competition between Protestants and Catholics on secularization.

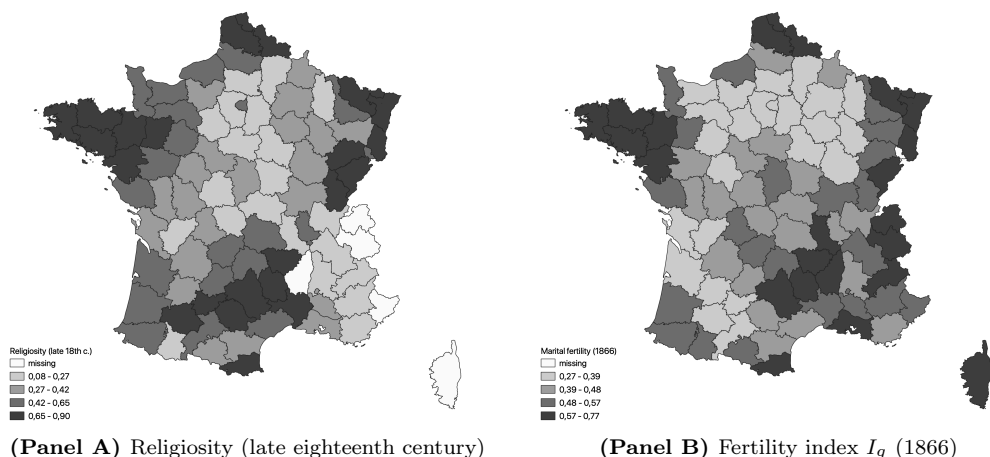
<sup>8</sup>Tackett (1986) evokes “*epic struggles with the Jesuits*” (p. 6) and argues that “*a whole series of affaires and causes célèbres, from the repression of the convulsionnaires in the 1730's through the billets de confessions in the 1750's and the expulsion the Jesuits in the 1760's, had contributed in broadly publicizing and intensifying grievances toward the clergy.*” (p. 257).

<sup>9</sup>This change was reflected by a decline in legacies for perpetual masses and offerings to the church, a decline in the request for burials in holy places, and a decline in the number of invocations of the Virgin Mary.

Figure 2, displays the spatial distribution of *Religiosity (late 18th c.)* and marital fertility in 1866 (details on the main variables are provided in Section 3). Some regions, particularly Brittany, Paris, and Occitanie, remained very religious while other regions such as Provence and Auvergne-Rhône-Alpes were much less religious in the late eighteenth century, in line with existing historical and anecdotal evidence on the decline (Chaunu, 1978; Hoffman, 1984; Norberg, 1985; Tingle, 2012; Vovelle, 1973). We also notice that the two maps superimpose almost perfectly (with a correlation coefficient of  $\rho = .6$ ), while Savoy has a high level of marital fertility consistent with the anecdotal evidence presented by Chartier (1991) on its religiosity level.

**Figure 2:** Religiosity and fertility

*Note:* This figure displays the spatial distribution of late eighteenth century religiosity and of the fertility index  $I_g$  in 1866. *Religiosity (late 18th c.)* is defined as the share of refractory clergy (non-jurors) in 1791. Section 3 details these measures. Appendix Figure 3.2.1 provides other maps



### 3 DATA

This section present our main data sources and variables. We introduce our main explanatory variable in Section 3.1. In 3.2 and 3.3 we present the dependent variables and controls at the *département* and at the individual and district levels, with corresponding summary statistics in Tables 3.2.1 and 3.3.1.

There are 90 *départements* and 513 districts in 19th century France.<sup>10</sup> *Départements* are the main administrative units in France since 1790, all of nearly equal size (about 6,000 miles) and designed to ensure that travel distance by horse from any location within the department to the main administrative center would not exceed one day. Districts are lower units, with close to no administrative purpose, created in 1790 such

<sup>10</sup>For regions, we use the 2016 division of 13 regions. We generate district boundaries with Thiessen polygons.

that there could not be more than 9 or less than 3 districts per *département* (which was practically their sole feature). They were replaced by and merged into (larger) *arrondissements* in 1795.

### 3.1 RELIGIOSITY

***Religiosity (late 18th c.)*** Our main explanatory variable throughout the paper is *Religiosity (late eighteenth century)*. This is a measure of the outcome of the sudden process of secularization. We construct this measure of post-secularization religiosity from the share of refractory clergy in 1791. In July 1790, during the French Revolution, the National Constituent Assembly passed the Civil Constitution of the Clergy which required all clergymen to swear an oath of loyalty to the State. We use the share of clergymen that did not take the oath (“refractory clergy”, or “non-jurors”) to proxy for late eighteenth century religiosity.

According to Tackett (1986), “*the regional reactions of clergymen in 1791 can be revealing of the attitudes and religious options of the lay population with which the clergymen lived*” (p. xvi). There is evidence that the oath generated passionate debates and reactions from the population: “*the issue of the oath soon became a veritable obsession, unleashing emotional reactions and factional strife in parishes everywhere*” (Tackett, 1986, p. 4).

This measure has been commonly used in the literature as a proxy to religiosity in late eighteenth century France (Franck and Johnson, 2016; Squicciarini, 2017). According to Tackett (1986), “*the map of clerical reactions in 1791 was remarkably similar to the map of religious practice in the middle of the twentieth century*” (p. xv). Indeed, the presence of refractory clergy is highly correlated with religious practices and attitudes in the 19th and 20th century, with a correlation coefficient of  $\rho = .7$  in the 1950’s (Tackett, 1986, p. xvi) and similarly for the number of priests and church attendance in the 19th and well into the 20th century (Squicciarini, 2017). This is remarkable to the extent that it suggests that the early and rapid secularization was followed by centuries of persistence.

Importantly the share of refractory clergy is measured before the August 1792 decree that ordered all non-jurors to leave the country and before the establishment of anti-clerical cults (the Cult of Reason and the Cult of the Supreme Being among others), the War in Vendée, the Paris Commune, and the Reign of Terror. Hence, it does not capture the effect of main Revolutionary events and policies of dechristianization but rather religious attitudes before the French Revolution, that is the outcome of the 1750 secularization process.

The data is available at the *département*, diocese, and district levels and is constructed from the choice of more than 50,000 parish clergymen, that is more than

90% of all *curés* and *vicaires* holding posts in 1791 France (Tackett, 1986, p. 39).<sup>11</sup> At the district level, the share of non-oath taking priests is seemingly uniformly distributed from 0 to 1, while it varies from .8 to .91 at the *département* level, with an average of 48%.

***Religiosity (pre-secularization) controls*** We supplement this with data on pre-secularization religiosity in order to capture the extent of the religiosity *decline* and not pre-existing differences. At the *département* level, our set of pre-secularization religiosity controls include the number of clergymen per capita, the average tithe in 1750, the number of abbeys in 1756, centuries of jesuit presence until 1763, and finally the share of Protestants after the 1685 revocation of the edict of Nantes.<sup>12</sup> The first three measures aim at capturing religiosity in the pre-1750 era (note the particularly high number of clergymen, in average 1 for each 500 inhabitants in France), while the following two are standard measures used capture the presence of specific religious groups that may especially matter for upper tail human capital.<sup>13</sup> At the district level, we use the number of abbeys and the centuries of jesuit presence.

***Correlates of secularization*** Table 3.1.1 presents the correlation matrix of religiosity in the late 18th c., pre-secularization religiosity, and various measures of development (urbanization), human capital (literacy), and “culture” (Encyclopedie subscriptions) at the *département* level. Religiosity in the late eighteenth century is not significantly correlated to any of the pre-secularization religiosity proxies. However, importantly, it is positively correlated with urbanization ( $\rho = .261$ , significant at the 5% level). The sign is the opposite as that of the correlation before secularization ( $\rho = -.206$ , significant at the 10% level), which indicates that the decline in religiosity happened mostly in rural areas. This is a rather surprising fact to the extent that urbanization (development) and religiosity are usually believed to be negatively correlated (Barro and McCleary, 2003). This French idiosyncrasy, if anything, would downward bias our estimates of the effect of secularization (the effect of *Religiosity*

<sup>11</sup>At the *département* level, *Religiosity (late eighteenth century)* is constructed as a district population-weighted average of the district-level share of refractory clergy. In doing so, we ensure that rural districts, which may have more clergymen per capita, do not bias the average *département*-level value.

<sup>12</sup>Clergymen per capita is measured in 1791, at the same time as the share of refractory clergymen is measured. However this is a stock while the share of refractory clergy measures the intensity of the religiosity decline. It is unlikely that the total number of clergymen would have immediately declined following the decline in religiosity (and if it did, it would drive the coefficient on the share of refractory clergy to zero). From 1791 to 1995, the number of clergymen in France only decreased from 50,000 to 30,000 ([source](#)). Our point estimates are larger in most regressions if we do not add this control. The share of Protestants is measured in 1815. We do not include the 1670 measure (the only other available year) because we want to capture the effect of the revocation of the edict of Nantes in 1685. Including the 1670 share of Protestants instead does not change our point estimates but increases standard errors due to a lower number of observation.

<sup>13</sup>To the best of our knowledge, this is the first research to empirically control for pre-1750 religious attitudes in France. The number of clergymen per capita and the average tithe (tax rate) seem like natural candidates to proxy for religiosity, while there is evidence that abbeys and monasteries played a significant role in local religious life (Heldring, Robinson and Vollmer, 2017).

(late 18th c.) controlling for pre-secularization religiosity) since urban places are also centers of innovation and human capital accumulation.

### 3.2 DÉPARTEMENT LEVEL

**Marital fertility** The main dependent variable at the *département level* is the index of marital fertility  $I_g$ . The index has been constructed by Coale and Watkins (1986) as part of the Princeton European Fertility Project (PEFP), and is available for about 80 *départements*. The PEFP provides data at the sub-national level for all countries in Europe, at the *département* level for France.<sup>14</sup>

The index  $I_g$  measures the fertility of a population relative to the maximum that might be attained, that is “*how closely the married population approaches the maximum fertility it might experience*” (Coale and Watkins, 1986, p. 161). It is constructed from the counts of the French census. It equals the total number of children born to married women divided by the number of children that would be born from these women should they not practice any form of limitation, using data from the Hutterites, an Anabaptist sect that does not practice any fertility control:

$$(I_g)_i = \frac{B_i^m}{\sum_j M_{ij}G_j}$$

with  $B_i^m$  the total number of children born from married women in society  $i$ ,  $M_{ij}$  the number of married women in age cohort  $j$ , and  $G_j$  the rate of fertility of Hutterites for age cohort  $j$ . We focus on marital fertility rather than overall fertility because it is the standard measure in the literature to detect the presence of fertility control achieved through parity-specific means (Coale and Watkins, 1986).

In Table 3.2.1, Panel A, we present summary statistics for the index of marital fertility. The index is available for 19 years from 1831 to 1961, and decreases from .56 to .33. Throughout Section 4, we report cross-sectional regressions for 1866 in the text (the earliest time a region other than France, Latvia, experienced a sustained decline in fertility) and the regressions for four selected years (1841, 1861, 1881, and 1901) in the appendix. Alternatively, in some specifications, we also use the first year of transition below a marital fertility index of .5 (estimated between 1831 and 1961).

**Controls** We supplement this data with a set of controls used in the *département-level* regressions in Section 4. We present this set in Table 3.2.2, while Figure 3.2.1 displays the spatial distribution of some variables of interest.

As mentioned in 3.1, we primarily control for pre-secularization religiosity. We

<sup>14</sup>A number of minor issues have been identified with the data from the PEFP, mainly with respect to the identification of the presence of fertility controls, see Brown and Guinnane (2007); Guinnane (2011). These issues are less relevant in our context since we study fertility levels after the transition already took place.

also control for broadly defined cultural and institutional factors with a dummy that measures the presence of a printing press in 1500, the number of books printed in 1500, Encyclopedie Subscriptions per capita in 1776-1779 (as a proxy to the diffusion of the Enlightenment), dummies for Pays status (fiscal regions in *Ancien Régime* France, which may capture cultural differences or state capacity), and a dummy for the presence of a University before 1750. We further control for education using the rate of literacy of conscripts in the year of observation. Finally, we control for pre-industrial development with *département* population (a standard proxy in the pre-industrial era) and average soldier height from 1716 to 1749, and contemporary development with the log of the rate of urbanization in the year of observation (urbanization being defined as the share of the population living in towns of more than 5,000 inhabitants).

### 3.3 INDIVIDUAL AND DISTRICT LEVEL

We supplement the *département* level data with a new crowdsourced historical individual level dataset from Blanc (2019), who reconstructs rates of fertility at the individual level from publicly available genealogies posted on geni.com and scrapped by Kaplanis et al. (2018). Lineage reconstruction from crowdsourced genealogies relies on the work of descendants reconstituting their family tree today using their own family history and searching through the same parish records as the ones used by demographers.<sup>15</sup>

Importantly, parish records are available online with unrestricted access in all French departments from the mid-17th century onwards. The resulting dataset contains thousands of individuals and is nationally representative of France from 1700 to 1900, with observables in the dataset highly correlated ( $\rho > .9$ ) with all available measures for France (see Blanc (2019) for a detailed discussion).

An important caveat is that a significant number of observations in the sample may not have a recorded horizontal lineage as individuals reconstituting their family tree today have a greater incentives recording their direct ancestors (the vertical lineage) rather than the horizontal branches. As a consequence, we could have incomplete fertility series. Following Blanc (2019), we deal with this issue by defining the *fertility sample*, the sample of individuals for which at least one parent in any of the four generations preceding the individual observation is recorded as having a fertility rate strictly greater than one.<sup>16</sup> In our analysis, we either restrict the sample to the *fertility sample* or include a *fertility sample* dummy that allows to gain some power while controlling for this bias.<sup>17</sup>

<sup>15</sup>It is assumed that they do so with a greater efficacy due to their knowledge of family history and past migrations, and own personal incentives.

<sup>16</sup>We discard the rate of fertility of individual  $i$  in assessing this.

<sup>17</sup>Finally, since the dataset does not always contain both spouses, we cluster all regressions at the couple



The rate of fertility at the individual level is simply the total number of children ever born. While the *département* level data is only available after 1831, the individual-level data contains individuals observed between 1700 to 1900.<sup>18</sup> All observations contain geo-coded places of birth, marriage, and death, which allows to match individuals with *Religiosity (late 18th c.)* at the district level.

In Figure 3.3.1, Panel A, we display the towns of birth included in the main sample and in the fertility sample, while Panel B displays district-level variation in *Religiosity (late eighteenth century)* along with district and *département* boundaries. In our preferred specifications, we include *département* by period fixed effects and thus exploit within *département*, between districts, variation in late 18th religiosity (accounting for time-varying *département*-level unobservables). We present summary statistics for observations in the fertility sample in Table 3.3.1. There are 18,663 observations. In average, individuals in the sample have 3.85 children while their parents have 4.65. At the district of birth level, the average *Religiosity (late 18th c.)* is .59.

## 4 MAIN EMPIRICAL FINDINGS AT THE DÉPARTEMENT LEVEL

### 4.1 BASELINE RESULTS

**Determinants of  $I_g$**  We explore the cross-sectional determinants of  $I_g$  from 1831 to 1901 and estimate Equation (1) separately for each year  $t$  using OLS. Our main variable of interest is *Religiosity<sub>i,late 18th c.</sub>*. We expect  $\hat{\beta}_t$  to be strictly positive and, as discussed in Section 3, to be downwards biased.

$$(1) \quad (I_g)_{i,t} = \beta_t \times \textit{Religiosity}_{i,\textit{late 18th c.}} + \mathbf{X}'_{i,t}\delta_t + \varepsilon_{i,t}$$

Table 1 reports the results for 1866, along with robust standard errors. We estimate that an increase in *Religiosity (late 18th c.)* of 1 percentage point is associated with an increase in the fertility index of about .35 pp. This is a remarkably large effect since the average marital fertility index in France was .49 in that year, about half the Hutterites standard. We also report standardized coefficients: throughout specifications, increasing *Religiosity (late 18th c.)* from the 25th to the 75th percentile of the distribution is predicted to increase  $I_g$  of about .13 points, exactly one standard deviation.

Our estimates are stable and significant at the 1% level across all specifications. In column (2), we control for proxies to *Ancien Régime*, pre-secularization religiosity in order to capture secularization. Especially, we control for the number of clergymen

level and use a male dummy accounting for possible gender differences. Since we also cluster standard errors at the district level (*Religiosity (late 18th c.)* is measured at the district level), we implement two-way clustered standard errors using Stata command `vce2way` (Yoo, 2019).

<sup>18</sup>We proxy marriage, the year of observation, with the year of birth of the first child.



per capita, the number of abbeys, and the average rate of the tithe collected by the church. Column (3) adds regions fixed effects to account for unobserved cultural or economic factors that may confound the effect of late eighteenth century religiosity (for example, shared identity or language could have an effect on broadly defined modernization (Weber, 1976)). In (4), we further control for observed cultural and institutional factors. In particular we control for fiscal status (Pays d'élection, d'Etat, or d'imposition) in the *Ancien Régime*. Indeed, it could be that state capacity and state history had an impact on both secularization and fertility, especially in a time when the State and the Church shared many privileges. Also we worry that, since our measure is an oath of allegiance to the State, we only capture the effect of state authority. We also control for Encyclopedie subscriptions in order to capture the diffusion of the Enlightenment and the presence of local knowledge elites, who may have an impact on cultural change and the modernization of society as a whole. In column (5), we control for literacy and education to account for the quantity-quality trade-off. Finally we account for pre-industrial and contemporary development in (6) and (7), and our results remain virtually unchanged.

Appendix Table 4.1.1 reports results on the determinants of marital fertility for eight selected years, while we display the scatterplots of marital fertility against late eighteenth century religiosity, with and without controls, in Figures 4.1.1 and 4.1.2.

**Table 1:** Determinants of  $I_g$  (1866)

*Note:* This table displays the results of the cross-sectional regression of the marital fertility index  $I_g$  in 1866 on late eighteenth century religiosity. *Religiosity (late 18th c.)* is defined as the share of refractory clergy (non-jurors) in 1791. Controls are described in Appendix Table 3.2.2. All observations are weighed by *département* population in the year of observation. We report robust standard errors. Appendix Table 4.1.1 displays the results of the same regression at different points in time.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	<i>dep var:</i> Fertility index $I_g$ 1866						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Religiosity (late 18th c.)</i>	0.352*** (0.055)	0.363*** (0.057)	0.377*** (0.065)	0.343*** (0.062)	0.340*** (0.063)	0.338*** (0.068)	0.332*** (0.072)
Religiosity (pre-secularization)		Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects			Yes	Yes	Yes	Yes	Yes
Cultural and institutional factors				Yes	Yes	Yes	Yes
Education and schooling					Yes	Yes	Yes
Pre-industrial development						Yes	Yes
Contemporary development							Yes
Mean of $I_g$ (1866)	.49	.48	.48	.48	.48	.48	.48
Standard deviation of $I_g$ (1866)	.12	.12	.12	.12	.12	.12	.12
Perc. 25-75 <i>Religiosity (late 18th c.)</i>	.13	.13	.14	.13	.13	.13	.12
Observations	84	80	80	80	80	80	80
R-squared	0.36	0.41	0.65	0.79	0.80	0.80	0.81

***Determinants of dates of transition*** We turn to the determinants of transition year and estimate Equation 2, where the dependent variable is the year in which

$I_g$  first declined below .5.

$$(2) \quad (\text{First year with } I_g < .5)_i = \beta \times \text{Religiosity}_{i,\text{late 18th c.}} + \mathbf{X}'_{i,1831} \delta + \varepsilon_i$$

Table 2 reports our results. We estimate that an increase in *Religiosity (late 18th c.)* from 0% to 100% is associated with a delay in the year of transition of almost 120 years.<sup>19</sup> Again, we estimate stable and robust coefficients, all significant at the 1% level. In the absence of the decline in religiosity, with *Religiosity (late 18th c.)* set to 1 everywhere, the average Frenchman would have first had a marital fertility index below .5 in about 1920 instead of 1862, which is comparable to the timing of the decline observed in the rest of Europe.

**Table 2:** Determinants of transition date ( $I_g < .5$ )

Note: This table displays the results of the same regression as in Table 1, using the first year with  $I_g < .5$  as a dependent variable.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	<i>dep var:</i> First year with fertility index $I_g$ lower than .5						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Religiosity (late 18th c.)</i>	98.112*** (13.241)	99.647*** (13.323)	120.262*** (18.957)	111.710*** (18.507)	112.670*** (18.117)	117.506*** (18.884)	118.735*** (19.632)
Religiosity (pre-secularization)		Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects			Yes	Yes	Yes	Yes	Yes
Cultural and institutional factors				Yes	Yes	Yes	Yes
Education and schooling					Yes	Yes	Yes
Pre-industrial development						Yes	Yes
Contemporary development							Yes
Mean of dep var	1863	1862	1862	1862	1862	1862	1861
Standard deviation of dep var	34	34	34	34	34	34	33
Perc. 25-75 <i>Religiosity (late 18th c.)</i>	36	37	44	41	41	43	44
Observations	85	80	80	80	80	80	78
R-squared	0.40	0.45	0.62	0.74	0.75	0.76	0.76

## 4.2 ACCOUNTING FOR SPATIAL DEPENDENCE

We have so far found large and highly significant results. Yet, the spatial distribution of *Religiosity (late 18th c.)* and marital fertility is geographically clustered, which may lead us to mistakenly interpret results as strong and robust although spurious in nature (Kelly, 2019). Indeed, intuitively, if both the dependent and the independent variable are spatially correlated, the standard error of the coefficient will not be adjusted for the fact that close observations are naturally more likely to possess the same attributes, hence resulting in inflated t-stats.

The degree of spatial correlation could most certainly be explained by the fact that

<sup>19</sup>Because of non-random measurement error (some *départements* already had a fertility level lower than 50% that of the Hutterites in 1831, and these are likely to have lower religiosity), we arguably under-estimate the true effect of *Religiosity (late 18th c.)* on the date of transition.

religiosity is a cultural attribute. Nonetheless, we remain agnostic on what causes it as we deal with this issue. An important portion of the growth and deep roots literature has dealt with the problem of spatial dependence by reporting adjusted standard errors (Conley, 1999). However, Kelly (2019) demonstrates that Conley standard errors are often misleadingly small due to unrealistically set low cutoff values (the distance after which it is assumed that spatial correlation vanishes), while the degree of spatial dependence is not rigorously assessed or tested for.

Kelly (2019) proposes the following solutions, which we implement for two assumed correlation ranges of 250 and 500 kilometers (to the best of our knowledge, this is the first paper in the growth literature to do so), on top of computing Conley-adjusted standard errors. First, reporting the p-value of Moran’s test for spatial dependence of OLS residuals. Second, reporting the results of simulations where the dependent and the independent variables are alternatively replaced by spatial noise. We run 1,000 independent simulations and report the fraction of regressions significant at the .1% level.

Our results are displayed in Table 3. In Panel A, we provide the outcome of the aforementioned tests for spatial correlation. In Assumption 1 (2), we assume a correlation range of 250 (500) kilometers. Moran’s statistics is significant (with  $p < .01$ ) in the first two specifications and for both ranges, suggesting a high degree of spatial correlation. Moreover, in these specifications, spatial noise significantly explains marital fertility at the .1% in about 10% of simulations (and similarly for the fraction of simulations where religiosity in the late eighteenth century explains noise), for both correlation ranges. Panel B displays the estimated coefficient on *Religiosity (late 18th c.)* (as in Table 1) as well as spatial correlation-adjusted standard errors. Correspondingly, in the first specification, the Conley standard error increase from .052 (un-adjusted, non-robust) to .080 and .093 as the correlation range increases. However, our results remain highly significant.

In column (3), we add region fixed effects in order to capture unobserved regional characteristics such as unobserved economic development or cultural traits (shared identity or language). Column (4) adds, among other things, pays status dummies in order to capture the effect of state capacity and state history. By looking at within-region and within-pays variation, we hope to reduce the extent of spatial dependence (Case, 1991). After the inclusion of these fixed effects, the p-value of Moran’s test significantly increases and we fail to reject the null that errors are randomly distributed across the landscape. Furthermore, the fraction of significant simulations approaches zero and Conley standard errors become smaller than non-adjusted standard errors. In Appendix Table 4.2.1 and 4.2.2, we display our results at different points in time and for the determinants of transition year. We conclude that accounting for spatial dependence with fixed effects significantly improves the precision of our estimations.

This suggests that our results are not spurious and cannot be explained by simply fitting spatial noise.

**Table 3:** Accounting for spatial dependance in the determinants of  $I_g$  (1866)

*Note:* This table displays the results of the cross-sectional regression of the marital fertility index  $I_g$  in 1866 on late eighteenth century religiosity, and various tests to assess the extent of spatial dependence. *Religiosity (late 18th c.)* is defined as the share of refractory clergy (non-jurors) in 1791. Controls are described in Appendix Table 3.2.2. All observations are weighed by *département* population in the year of observation. Assumption 1 (2) assumes a correlation range of 250 (500) kilometers. Results under Assumption 2 are displayed in parenthesis. Moran statistics are computed using an inverse distance spatial weighing matrix. Conley standard errors are computed using the Stata code provided by Hsiang (2010), and assuming a linearly declining spatial weighing kernel. Appendix Tables 4.2.1 and 4.2.2 display the same set of results at different points in time, and for the determinants of transition year.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	dep var: Fertility index $I_g$ 1866						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Panel A: Testing spatial correlation on OLS residuals</b>							
<b>Assumption 1:</b> 250 kilometers correlation range ; <b>2:</b> 500 kms (in parenthesis)							
p-val of Moran's test for spatial dependence ( $H_0$ : error is iid)	.00 (.00)	.00 (.00)	.57 (.93)	.81 (.87)	.78 (.93)	.84 (.81)	.93 (.76)
Fraction of simulations with significant (p=.001) spatial noise	12% (10%)	12% (13%)	8% (5%)	1% (0%)	1% (0%)	1% (0%)	1% (0%)
Fraction of simulations where independent variable explains (p=.001) noise	9% (11%)	8% (12%)	5% (2%)	3% (2%)	3% (2%)	3% (2%)	2% (2%)
<b>Panel B: Spatial correlation-adjusted standard errors</b>							
<i>Religiosity (late 18th c.)</i>	0.352	0.363	0.377	0.343	0.340	0.338	0.332
Non-adjusted standard errors	(0.052)***	(0.055)***	(0.065)***	(0.056)***	(0.057)***	(0.057)***	(0.059)***
Conley standard errors (Assumption 1)	(0.080)***	(0.074)***	(0.075)***	(0.052)***	(0.051)***	(0.055)***	(0.059)***
Conley standard errors (Assumption 2)	[0.092]***	[0.084]***	[0.070]***	[0.040]***	[0.041]***	[0.047]***	[0.047]***
Religiosity (pre-secularization)		Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects			Yes	Yes	Yes	Yes	Yes
Cultural and institutional factors				Yes	Yes	Yes	Yes
Education and schooling					Yes	Yes	Yes
Pre-industrial development						Yes	Yes
Contemporary development							Yes

### 4.3 ACCOUNTING FOR OMITTED VARIABLES

While reverse causality is practically not an issue and we have ruled out the possibility of spatial dependence and spurious correlation driving our results, omitted variables may result in bias. This section addresses the issue of unobservables. We rely on Altonji, Elder and Taber (2005); Oster (2016) to construct bounds to the true effect while accounting for unobservables. We remain agnostic about the drivers of selection or the direction of the bias, and conclude that OLS results are downwards biased.

It is easy to imagine that religious areas would place more emphasis on tradition broadly defined, and be less prone to innovation and change, which would bias our estimates upwards and be a threat to identification. Yet, the standard drivers of secularization (development broadly defined, see Barro and McCleary (2003)) do not apply to 1750 France. Religiosity was positively correlated to urbanization in late eighteenth century France, after the process of secularization took place, while it was negatively

correlated before (see Section 3). Since urban centers have historically been centers of innovation (both technological and societal) and human capital accumulation, we would therefore expect our estimates to be downwards biased, towards zero.

Oster (2016) shows that both coefficient stability and movements in the R-squared are informative of the bias resulting from unobservable selection. She suggests a procedure that results in the estimation of a  $\beta^*(R_{max}^2, \delta)$  statistics, which converges in probability to the true  $\beta$  (with  $\delta$  the degree of proportionality between unobservable and observable selection and  $R_{max}^2$  the maximum possible R-squared given measurement error). Altonji, Elder and Taber (2005); Oster (2016) suggest to use  $\delta = 1$  as an upper bound, implying equal selection, that is that unobservables and observables are equally related to the treatment. Oster shows that if 0 does not lie in the interval between the the OLS coefficient and  $\beta^*(R_{max}^2, 1)$  (Oster’s beta), then we can reject the null that the coefficient of interest is exclusively driven by unobservables. Throughout this section, we alternatively make the two following assumptions on selection on unobservables:

**Assumption A.** *Unobservable selection is exactly proportional to selection on observables.*

**Assumption B.** *Unobservable selection is exactly proportional to selection on the diffusion of the Age of Enlightenment (as proxied by  $\log 1 +$  Encyclopedie subscriptions per capita in 1777 – 1779) conditional on other observables.*

The first assumption is fairly standard, while Assumption B relies on the idea that we can learn about unobservables explaining marital fertility from unobservable determinants of Encyclopedie subscriptions per capita, a standard measure to proxy for the diffusion of the Age of Enlightenment (Darnton, 1973; Squicciarini and Voigtländer, 2015). Using this proxy of a different dimension of cultural change allows us to sensibly model unobservables that may have affected marital fertility. Intuitively, although this is an over-simplification, we assume that the Age of Enlightenment affected marital fertility through unobserved factors (e.g. libertinage, emphasis on change as opposed to tradition, industrial mindset) that are also correlated with secularization. To the best of our knowledge, this is the first paper to rely on such an assumption within the framework provided by Oster.

In both cases we assume that the degree of proportionality is one, but we also report the  $\delta$  statistics, which reflects how strong selection on unobservables should be to explain away the estimated effect of *Religiosity (late 18th c.)*.<sup>20</sup> Following Oster (2016), we set  $R_{max}^2 = \min\{1.3R^2, .9\}$ . However, we assume that measurement error due to the historical nature of the data bounds the maximum  $R^2$  at .9.

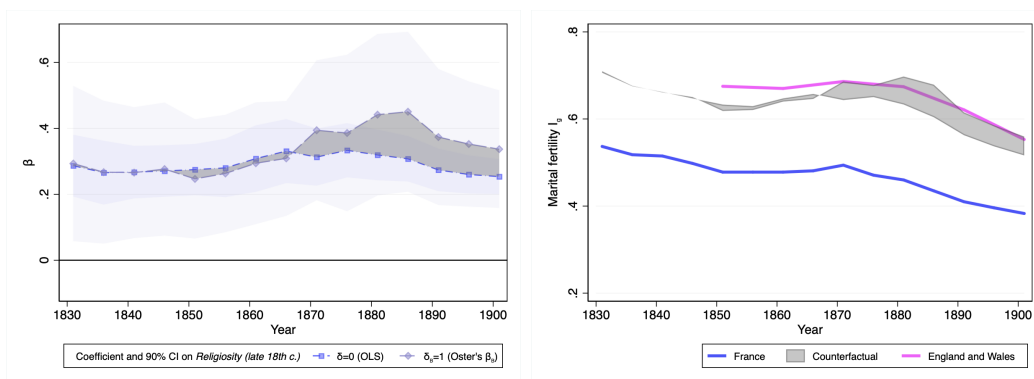
<sup>20</sup>Formally, Oster defines  $\delta$  such that  $\delta\sigma_{1X}/\sigma_1^2 = \sigma_{2X}/\sigma_2^2$ , with  $\sigma$  denoting covariance,  $X$  denoting *Religiosity (late 18th c.)*, and indexes 1 and 2 denoting, respectively, observables and unobservables.

Appendix Tables 4.3.1 and 4.3.2 report the results of the regression on the determinants of  $I_g$  in 1866 and for eight selected years accounting for unobservable selection.<sup>21</sup> Panel A relies on Assumption A and Panel B on Assumption B, which is our main assumption. We report bootstrapped standard errors over 1,000 replications. Our results are virtually unaffected by unobservable selection. Across specifications we consistently estimate larger coefficient than OLS under the equal selection assumption.

In order to assess the degree of selection that would be needed to explain away our results, we rely on the  $\delta$  statistics and conclude that, in most specifications, selection on unobservables would have to be twice as strong as selection on observables to drive our estimates to zero. In Panel B, we even estimate in some specifications that selection on unobservables would have to be of a different sign than that of the selection on Encyclopedie subscriptions to explain away our results.

**Figure 3:** Determinants of  $I_g$  and counterfactual accounting for unobservables (1831-1901)

*Note:* This figure displays the estimated impact of *Religiosity (late 18th c.)* on marital fertility over time. *Religiosity (late 18th c.)* is defined as the share of refractory clergy (non-jurors) in 1791. Panel A displays the estimated coefficients accounting for the full set of controls under no selection (OLS) and equal selection ( $\beta_B$ ), where Oster's beta is computed under Assumption B. The grey area represents Oster's bounds to the true effect. We report Conley standard errors for OLS and bootstrapped standard errors for  $\beta_B$ . Panel B displays the marital fertility index for France and England and Wales over time, along with a counterfactual index for France.



(Panel A) Omitted variables-adjusted coefficient

(Panel B) Counterfactual fertility

We plot the effect of *Religiosity (late 18th c.)* over time in Figure 3. Panel A displays the estimated coefficients (OLS and omitted variable-adjusted coefficient) for *Religiosity (late 18th c.)* as well as Oster's bounds from 1831 to 1901. The bias arising from unobservable selection is practically null until 1870, and that it becomes negative afterwards. The former is consistent with the observation that *Religiosity (late 18th c.)* is uncorrelated to most proxies of development in the late eighteenth century. The latter can be explained by the fact that unobserved factors such as a

<sup>21</sup>Appendix Table 4.3.3 display similar results on the determinants of transition year.

lower emphasis on tradition, a scientific and industrial mindset, were likely to play an observable role in the latter phases of development as income per capita took off and the second phase of the demographic transition started. Panel B displays the marital fertility index for France and England and Wales over time, along with a counterfactual index for France, which is inputted by setting *Religiosity (late 18th c.)* to 100% under the coefficient bounds suggested by Oster while keeping everything else constant (especially pre-secularization religiosity). This would be the level of fertility in France if no clergymen took the oath of allegiance to the secular state. Again, secularization accounts for the vast majority of the cross-sectional difference between France and England and Wales.

#### 4.4 MECHANISMS AND ALTERNATIVE EXPLANATIONS

We turn to alternative explanations and mechanisms that could have played a role in mitigating or permitting the effect of *Religiosity (late 18th c.)* on marital fertility. Especially we explore the role played by development and the Enlightenment, which we describe below in more details.

Table 4 presents our results on the determinants of marital fertility in 1866, with the full set of controls in each specification.<sup>22</sup> The first dimension, in Panel A, is development broadly defined. We do not expect it to have played a significant role alone in the large decline in the rate of fertility in the 1750's since there was no major change to development levels at the time, but we wish to test two hypotheses. The first, advanced by Braudel (1986a,b), is that France was overpopulated. In other words the malthusian constraint was binding, resulting in a permanent escape from the malthusian trap. This is an attractive theory especially since France was indeed 5 times as populated as England in 1750. In column (1), we look at the effect of population density (measured as the number of inhabitants per squared km) on marital fertility. We find a negative coefficient: densely populated areas had lower fertility in 1866. Yet, the effect is small and economically insignificant since the average *département* had 60 inhabitants per sq km in 1793. The estimated coefficient becomes statistically insignificant in column (2), after controlling for *Religiosity (late 18th c.)*.

The second hypothesis relates to the interaction between cultural and economic factors. Spolaore and Wacziarg (2019) show that, in a model of social distance and fertility decisions, a reduction in the intrinsic benefits of fertility relative to its costs is not a sufficient condition for fertility to decline, unless it is accompanied by a change in social norms preventing birth control. The inverse also holds true, that a change in social norms is merely not sufficient since economic factors need to allow the change in

<sup>22</sup>In Table 4.4.1 and 4.4.2 we provide the same set of results for selected years and the determinants of transition date.

preference to translate into lower fertility. We proxy for development with the log rate of urbanization. In column (3) we include this variable alone and find a statistically insignificant positive association. The positive sign could be explained by the fact that the coefficient is likely confounded by religiosity in the late eighteenth century, since religiosity was higher in urban places. After including *Religiosity (late 18th c.)*, the coefficient on urbanization becomes negative, but is still statistically insignificant. In column (5), we add an interaction term between *Religiosity (late 18th c.)* and urbanization. The coefficient on the interaction term is positive, which substantiate the intuition that a change in social norms is not a sufficient condition. However, it is statistically insignificant.

**Table 4:** Mechanisms and alternative explanations (1866)

*Note:* This table displays the results of the cross-sectional regression of the marital fertility index  $I_g$  in 1866 on late eighteenth century religiosity, and various tests to assess mechanisms (especially on the role of the Enlightenment and development). *Religiosity (late 18th c.)* is defined as the share of refractory clergy (non-jurors) in 1791. Each specification relies on the full set of controls described in Appendix Table 3.2.2. Specification (7) is therefore identical to the last specification in Table 1. All observations are weighed by *département* population. We report robust standard errors. Appendix Table 4.4.1 displays the results of the same regression at different points in time, and for the determinants of transition year.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	dep var: Fertility index $I_g$ 1866								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Religiosity (late 18th c.)</i>		0.318*** (0.073)		0.341*** (0.079)	0.303 (0.322)		0.338*** (0.068)	0.411*** (0.078)	0.312*** (0.075)
<b>Panel A: Development</b>									
Population density (1866)	-0.000* (0.000)	-0.000 (0.000)							-0.000 (0.000)
log Urbanization (1866)			0.013 (0.034)	-0.013 (0.029)	-0.018 (0.057)				0.005 (0.033)
_____ × <i>Religiosity (late 18th c.)</i>					0.013 (0.112)				
<b>Panel B: Enlightenment</b>									
log 1 + <i>SubEnc</i> (1777-1779)						-0.052** (0.023)	-0.049*** (0.015)	0.003 (0.042)	-0.052*** (0.018)
_____ × <i>Religiosity (late 18th c.)</i>								-0.097 (0.077)	
Full set of controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	81	80	81	80	80	81	80	80	80
R-squared	0.66	0.77	0.64	0.77	0.77	0.68	0.80	0.81	0.81

Finally, we explore the effect of the Age of Enlightenment on marital fertility. Column (6) displays the coefficient on Encyclopedie subscriptions per capita alone. We find a negative, large and statistically and economically significant effect, even after accounting for late eighteenth century religiosity in (7). However, the diffusion of the Enlightenment alone is unlikely to explain the fertility decline, since France was by no means an outlier in Europe (Mokyr, 2016; Roche, 2000). The Republic of Letters and Age of Enlightenment spread all over the continent and especially in England and Scotland (Buringh and van Zanden, 2009), where the demographic transition started in the late 19th century. In column (8), we include an interaction term between *Religiosity (late 18th c.)* and log 1 + *SubEnc* to test whether secularization had a stronger



effect on marital fertility in places that were exposed to the Enlightenment. We expect the coefficient on the interaction term to be positive if our hypothesis holds true. However it is negative and statistically insignificant. Finally, in the last column, we include all regressors at the same time. Urbanization and Encyclopedie subscriptions remain negative and significant, but the coefficient on *Religiosity (late 18th c.)* is virtually unchanged.

## 5 INDIVIDUAL-LEVEL RESULTS

In this section, we turn to individual-level analysis in order to achieve suggested causal estimates and to evaluate the determinants of the fertility decline at the time of the decline. We explore the cross-sectional determinants of the rate of fertility of individuals observed throughout the 18th and 19th century. This is the first research to use country-wide (individual-level) data on fertility dating back to 1700.

**Baseline results** We estimate Equation 3, where  $\log fert_{i,t}$  is the log of the total number of children ever born to individual  $i$ , observed in period  $t$ .<sup>23</sup> Each individual is assigned the level of *Religiosity (late 18th c.)* of its district of birth  $d(i)$ , and we report clustered standard errors at the district level. We also account for time fixed effects  $\lambda_t$  in order to only capture cross-sectional variation. In our preferred specification, we hope to reach causal estimates by exploiting within *département*, between districts, variation as we control for *département* of birth by period fixed effects with  $\lambda_{dep(i)}$  and  $\lambda_{dep(i),t}$ . This allows to suppress the effect of time-varying *département*-level unobservables.

(3)

$$\log fert_{i,d(i),t} = \beta \times Religiosity_{d(i),\text{late 18th c.}} + \mathbf{X}'_{i,t}\delta + \lambda_{dep(i)} + \lambda_t + \lambda_{dep(i),t} + \varepsilon_{i,t}$$

Table 5 presents our baseline results at the individual level for individuals in the *fertility sample* (see Appendix Table 5.1.1 for the full sample). First, we explore the relationship between late eighteenth century religiosity and fertility after the onset of the decline in fertility, in 1755. In the first column, with only period fixed effects and the male dummy, we estimate a large coefficient of .211, significant at the 1% level. There are 9,991 couples in 434 districts (84% of all districts in France). In column (2), we add a quadratic in the age of marriage in order to capture parity-specific fertility controls and a quadratic in the log fertility of parents to control for

<sup>23</sup>Periods are defined as half-decades. Results are practically unchanged with year fixed effects instead, but due to the low number of observations *département* by year fixed effects would take away most of the variation in districts with only one observation in a given year.

broader family-level and ancestral characteristics. We control for district-level pre-secularization religiosity measures in (3), and for the urban status of the town of birth in the year of observation and Encyclopedie subscriptions per capita at the district level in (4). Results are practically unchanged.

In (5), we add *département* fixed effects in order to capture time-invariant *département*-level characteristics such as state capacity or a shared culture/language for which there is practically no variation within *département*. The coefficient on *Religiosity (late 18th c.)* increases substantially, to .298. Eventually, we add *département* by period fixed effects in order to control for time-varying *département*-level characteristics that may confound the effect of late eighteenth century religiosity. Figure 5.1.1, Panel A, displays the distribution of the independent variable before and after fixed effects in order to isolate relevant variation in the treatment (see Panel B for the full sample). We report our results in column (6) of Table 5 and find a larger coefficient, significant at the 1% level.

**Table 5:** Determinants of fertility at the individual level

*Note:* This table displays the results of the individual-level regression of the log total number of children ever born on late eighteenth century religiosity. *Religiosity (late 18th c.)* is defined as the share of refractory clergy (non-jurors) in 1791, at the district of birth level. Individual level controls include a quadratic in the age of marriage and in the log number of children of the individual's parents. Religiosity (pre-secularization) controls include the number of abbeys in 1756 and the duration of Jesuit presence until 1763 (both at the district of birth level). Development and Enlightenment controls include the urban status of the town of birth in the year of observation and the log of Encyclopedie subscriptions in 1777 – 1779 at the district level. All specifications include period fixed effects and a male dummy. We report two-way clustered standard errors (at the couple and district level). Table 5.1.1 reports the same regressions for the full sample. Figure 5.1.2 displays the binscatter of specification (6).  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	<i>dep var:</i> log Number of children						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Religiosity (late 18th c.)</i>	0.211*** (0.070)	0.191*** (0.058)	0.187*** (0.061)	0.191*** (0.062)	0.298*** (0.109)	0.340*** (0.127)	-0.030 (0.151)
_____ × After transition							0.367* (0.194)
<b>Sample</b>							
Observed after demographic transition	Yes	Yes	Yes	Yes	Yes	Yes	
Observed between 1700 and 1900							Yes
<b>Controls</b>							
Individual-level controls		Yes	Yes	Yes	Yes	Yes	Yes
Religiosity (pre-secularization)			Yes	Yes	Yes	Yes	Yes
Development and Enlightenment				Yes	Yes	Yes	Yes
Département of birth fixed effects					Yes	Yes	Yes
Département of birth by period fixed effects						Yes	Yes
Mean of log <i>fert</i>	.95	.95	.95	.95	.95	.95	1
Standard deviation of log <i>fert</i>	.82	.82	.82	.82	.82	.82	.84
Perc. 25-75 <i>Religiosity (late 18th c.)</i>	.10	.09	.09	.09	.14	.16	
Observations (couples)	9,991	9,857	9,857	9,792	9,792	9,792	12,908
Clusters (districts)	434	434	434	432	432	432	451
R-squared	0.02	0.21	0.21	0.21	0.23	0.37	0.38

Figure 5.1.2 displays a binscatter plot of the relationship estimated in (6). In both specifications -(5) and (6)- controlling for *département*-level unobservables substanti-

ate our initial insight and the results of the Oster exercise about the direction of the bias: unobservables bias our estimates downwards, to zero. In a nutshell, we estimate throughout that an increase in *Religiosity (late 18th c.)* is predicted to increase log fertility of .2 to .3, which amounts to an increase in the total number of children ranging from 1.2 to 1.4 additional child. This is a huge effect as the log fertility of the average individual was 0.95, about 2.6 children. Finally, we report standardized estimates and find, again, that secularization (religiosity in the late eighteenth century, controlling for pre-secularization religiosity and time-varying *département*-level unobservables) accounts for the vast majority of the fertility decline.

We have so far established a large effect of late eighteenth century religiosity after the onset of the transition, even after controlling for time-varying *département*-level unobservables. Controlling for pre-secularization religiosity measures and *département* by period fixed effects suggest that we did not capture the effect of pre-existing differences in religiosity, but rather the effect of secularization, and that our results are not driven by unobservables.

In column (7), we test for the sign and significance of the relationship between *Religiosity (late 18th c.)* and log of fertility before and after the transition. We extend the sample to all available years, from 1700 to 1955 and add an interaction term between *Religiosity (late 18th c.)* and  $After_t$ , a dummy that equals one if the individual was observed after the transition (Equation 4). This specification is essentially a difference in differences, where treatment is the level of religiosity in the late eighteenth century.<sup>24</sup> The coefficient on *Religiosity (late 18th c.)* alone,  $\beta_0$ , captures the effect of late eighteenth century religiosity on fertility before the onset of the transition, while the coefficient on the interaction terms,  $\beta_1$ , captures the additional effect after the transition. We expect to find that, after we control for *département*-level unobservables, religiosity in the late eighteenth century did not have an effect on fertility before the arrival of secularization/the demographic transition.

$$(4) \quad \log fert_{i,d(i),t} = \beta_0 Religiosity_{d(i),late\ 18th\ c.} + \beta_1 After_t Religiosity_{d(i),late\ 18th\ c.} \\ + After_t + \mathbf{X}'_{i,t} \delta + \lambda_{dep(i)} + \lambda_t + \lambda_{dep(i),t} + \varepsilon_{i,t}$$

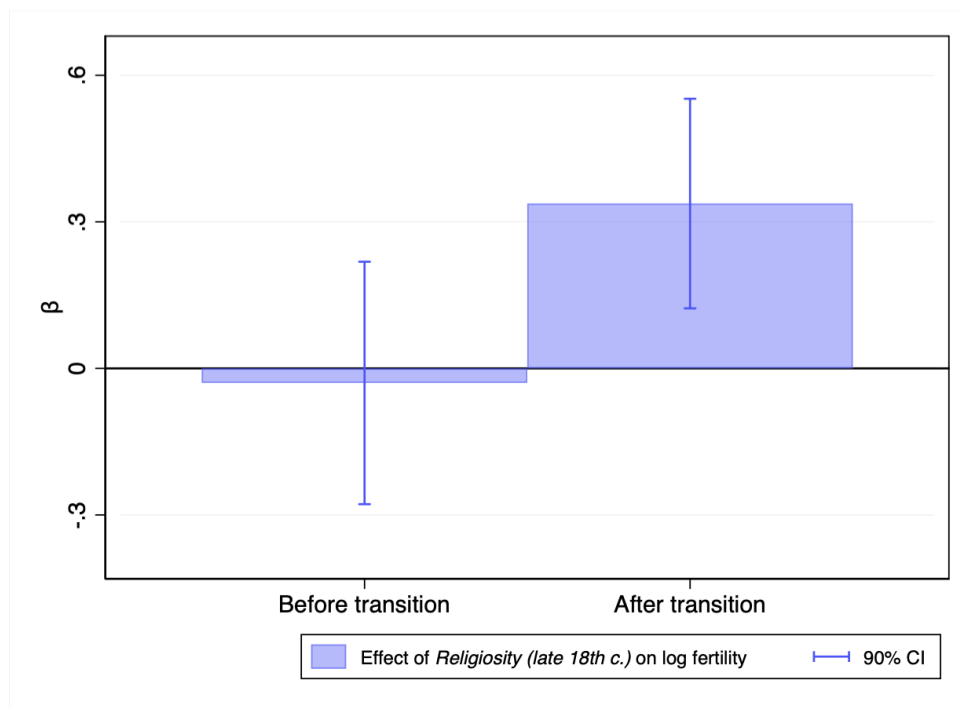
We find that, before the onset of the transition, *Religiosity (late 18th c.)* had a null (slightly negative) and statistically insignificant effect on log fertility, while it had a large, positive, and statistically significant effect in the aftermath of the decline

<sup>24</sup>In this context however, testing for pre-trends is complex due to data availability (we can only go back until 1700, and the number of observations is limited), but the fact that there is no effect in 1700 – 1755 is reassuring and indicates that there was likely no pre-trend. In order to test this, we interact *Religiosity (late 18th c.)* with linear time trends before and after the transition and find insignificant trends (with a coefficient close to 0 before 1755), which is suggestive that there was no different pre-trends in *départements* with high and with low religiosity in the late eighteenth century. Results available upon demand.

in fertility. We plot the estimated coefficients in Figure 4. This result is providing further indication that we do capture a causal effect of secularization, and that we are not merely capturing pre-existing differences.

**Figure 4:** Effect of *Religiosity (late 18th c.)* before and after transition

*Note:* This figure displays the estimated coefficients on *Religiosity (late 18th c.)* before and after the transition, from specification (7) of Table 5. Standard errors are two-way clustered at the couple and at the district level.



*Migrants and intergenerationally transmitted cultural traits* Last but not least, we provide an additional test to show that the coefficient on *Religiosity (late 18th c.)* does not capture pre-existing differences. We rely on a strategy that is reminiscent of the epidemiological approach to study the effect of cultural persistence on development. The epidemiological approach has been widely used to study the intergenerational transmission of cultural norms and beliefs. While papers using this approach (Algan and Cahuc, 2010; Fernández, 2011; Guiso, Sapienza and Zingales, 2004) have demonstrated a high degree of persistence in culture, we rather study cultural change.<sup>25</sup>

<sup>25</sup>Ideally, we would like to use the epidemiological approach to identify the effect of religiosity in the late eighteenth century on second generation migrants. But this would imply restricting the sample whose parents were born after 1755 and migrated to a different district. This would very significantly reduce the sample size, to less than 600 couples. Such procedure, with district of parental origin fixed effects, does return a positive coefficient .146 that is not statistically significant at standard levels of confidence due to a large standard error of .332.

In times of changing cultural norms and social unrest, we expect individuals to be more likely to change preferences and behaviors. Our approach therefore relies on first generation migrants, who migrated during childhood.<sup>26</sup> We would like to study individuals who migrated before the change in social norms, but were exposed to secularization in their district of settlement. That is, in our dataset, with a year of observation in the second half of the eighteenth century. This would allow us to identify the effect of cultural change (secularization) separated from pre-secularization inherited cultural traits (observables and unobservables), by using district of birth fixed effects.

Thereby, we study the effect of *Religiosity (late 18th c.)* of the district of marriage and abstract from observed and unobserved intergenerationally transmitted cultural traits with district of birth fixed effects. Formally, we estimate Equation 5, for migrant  $i$  who settled in district  $s(i)$  and originate from district  $o(i)$ .

$$(5) \quad \log fert_{i,s(i),t} = \beta \times Religiosity_{s(i),\text{late 18th c.}} + \mathbf{X}'_{i,s(i),t} \delta + \lambda_t + \lambda_{o(i)} + \varepsilon_{i,s(i),t}$$

While our main prediction entails looking only at individuals observed (the year of observation is the year of marriage) in the very immediate aftermath of the transition, the number of observations with such a restriction would be very limited. Hence, we estimate a slightly modified version of this model, with all individuals observed after 1755 and a time trend interacted with *Religiosity (late 18th c.)* of the district of marriage. We expect to find that *Religiosity (late 18th c.)* of the district of marriage had a positive and significant effect in the first years following 1755.

We present our results in Appendix Table 5.2.1.<sup>27</sup> First, we follow the main specification -(6)- of Table 5, with the independent variables measured at the district of marriage level instead of district of birth. We find a very similar, slightly higher, coefficient on *Religiosity (late 18th c.)* of the district of marriage as compared with that of the district of birth in Table 5. In Column (2), we replace the *département* of marriage fixed effects with district of birth fixed effects, which account for intergenerationally transmitted cultural traits (both observables and unobservables) such as religiosity before secularization. The coefficient on *Religiosity (late 18th c.)* of the district of marriage is divided by two, with inherited cultural traits capturing about half of the effect. However, the correlation between religiosity in the late 18th c. at the district of birth and at the district of marriage levels is high (.91), since most individuals did not migrate. Therefore, in the following specifications, we restrict the sample to those who migrated during childhood only. The sample is significantly re-

<sup>26</sup>An individual is said to have migrated during childhood if it has a place of marriage (proxied by place of birth of the first child) that is different from its place of birth.

<sup>27</sup>Table 5.2.2 for the full sample.

duced, down to 1,261 couples and 290 districts. First, in column (3), we estimate a roughly similar, slightly lower, coefficient on *Religiosity (late 18th c.)* of the district of marriage (without district of birth fixed effects). In (4), we add again district of birth fixed effects and find quantitatively similar but not statistically significant results.

Finally, in (5), we test our main prediction by interacting *Religiosity (late 18th c.)* of the district of marriage with a time trend (the number of years elapsed since the onset of the transition in France). We find that, accounting for district of origin fixed effects, *Religiosity (late 18th c.)* of the district of marriage has a large and significant effect at the time of the transition. The effect is comparable in size to that estimated in our baseline results. The estimated effect decays over time, and becomes statistically insignificant in the 19th century. We display the estimated coefficient over time in Appendix Figure 5.2.1. As time passes and cultural change is replaced by persistence, intergenerational transmission takes over and the district of origin fixed effects likely capture internalized religious norms and beliefs. For individuals who migrated before secularization but were exposed to the change in norms in their place of destination, *Religiosity (late 18th c.)* of the district of marriage has a large and significant effect.

## 6 ROOTS OF SECULARIZATION

We now turn to a description of the roots of the decline in religiosity. If the rapid process of secularization in eighteenth century France is at the origins of the early demographic transition, what explains secularization? Although this is not the main focus of the paper, we provide some elements of answer in this section.

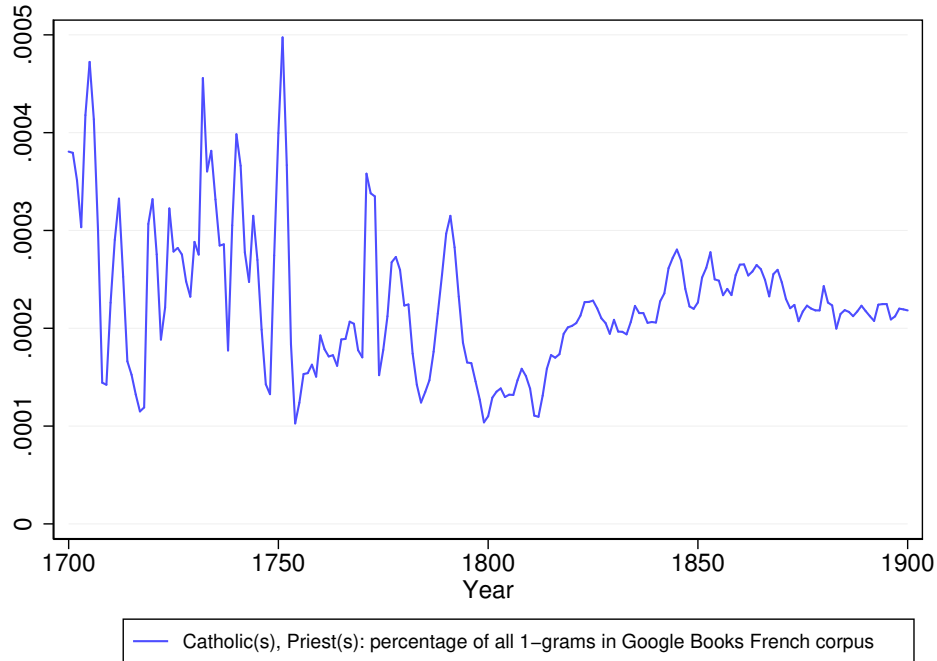
First, we provide a raw empirical evaluation of the extent of religious turmoil in early eighteenth century France (see Section 2 for a detailed discussion). In Figure 5, we plot the frequency, in percentage, of occurrence of the following 1-grams in the whole Google Books French corpus from 1700 to 1900: catholic(s) and priest(s). Given the scarcity of data on religious attitudes in eighteenth century France, this is the first time the extent of religious turmoil is assessed at the national level. The pattern emerging from that figure mirrors that at the local level described in Hoffman (1984); Norberg (1985); Vovelle (1973).<sup>28</sup>

As a result of religious turmoil and social unrest, “*a spirit of irreligion was sweeping over the kingdom (...) in a veritable flood*” (Tackett, 1986, p. 252). We already presented a host of historical anecdotes and narratives suggesting that the Counter Reformation played a major role in the decline: “*the Counter Reformation’s austere morality was imposed in full force (...) not surprisingly, it was rejected by people who saw nothing wrong in combining devotion and gaiety*” (Hoffman, 1984, p. 138).

<sup>28</sup>The same figure for the British English corpus leads a much lower and flatter curve, with less variance.

**Figure 5:** Religious turmoil in eighteenth century France

*Note:* This figure displays the frequency of occurrence of catholic(s) and priest(s) 1-grams in the Google Books French corpus from 1700 to 1900. Results are case-insensitive. We display moving averages over 3 years.



In the rest of Europe, Protestantism spread and secularization came as a gradual process. In Germany, this was the result of religious competition between Catholics and Protestants: as Protestants confronted the monopoly of the Catholic Church, their need to strike bargains with the secular elites affect the market for political legitimacy in favor of secular rulers (Cantoni, Dittmar and Yuchtman, 2018).

In France, this is a whole different story. In the late sixteenth century, the Edict of Nantes (1598) granted French (Calvinist) Protestants, the Huguenots, the right to practice their religion without persecution. However, the Edict of Fontainebleau ended this short period of religious toleration and freedom in 1685. The edict, issued by Louis XIV, deprived Protestants of all religious and civil liberties, and ordered the destruction of Huguenots churches. *Dragonnades*, French policies of legal persecution and forced conversion of Protestants ordered by Louis XIV, embodied the fight and terror against the Protestant Reformation. French dragoons, infantry soldiers, were billeted to Huguenots households in order to harass and intimidate them (Figure 6.0.1 displays a 1686 engraving representing the *dragonnades*). As a result most Protestants left France, which set the course for the unchecked diffusion of the Counter Reformation in France.

Especially while Jesuits had long been praised by the elites, Jansenism, a pious,

austere, and rigorist theological movement unique to France, spread (Chartier, 1991; Van Kley, 1996). Tackett (1986) writes that “*during the first half of the eighteenth century, one issue in diocesan politics dominated all others: the issue of Jansenism*” (p. 128). The austerity and rigorism of Jansenists is believed to have played a major role, but why? Our hypothesis is that the coercive monopoly of the Catholic Church on the market for salvation in France led the Counter Reformation, and especially Jansenists, to charge a price that excluded most faithful. Consistent with that, there is widespread evidence that Jansenist priests, or priests in Jansenist dioceses, widely supported the oath (Préclin, 1929).

In this section, we provide the first empirical evaluation of the hypothesis that the spread of the Counter Reformation in France resulted in a rapid process of secularization in the 1750’s and in the rise of strong anti-clerical beliefs. According to Braudel (1986b) “*The drama played out in the eighteenth century was a sort of revenge on the part of the Reformation. Having hesitated, two centuries earlier, between Rome and Luther, or rather between Rome and Calvin, France had chosen Rome, but the choice backfired.*” (p. 200). Therefore, we digitize diocese-level data on the spread of Jansenism and test the sign of the relationship with religiosity in the late eighteenth century (also measured at the diocese level). We expect places with more Jansenists to be less religious in the late eighteenth century, with social unrest developing as a result of jansenist rigorism and the dearth of alternative. Formally, we estimate Equation 6, at the diocese  $d$  level.

$$(6) \quad \text{Religiosity}_{d,\text{late 18th c.}} = \beta \times \log 1 + \text{Jansenists}_{d,1716-1725} + \mathbf{X}'_d \delta + \varepsilon_d$$

The number of Jansenists in a diocese is proxied by the number of *appelants* in 1716 to 1725 (from Préclin (1929)), clergy members who appealed to a general council to protest the Unigenitus papal bull, the 1713 apostolic constitution against Jansenism. We provide summary statistics in Table 6.0.1 and display maps of variables of interests in Figure 6.0.2.<sup>29</sup> The spatial distribution of Jansenism and of religiosity in the late eighteenth century exhibit surprisingly similar patterns, with a correlation coefficient of  $-.23$ . To emphasize this, Tackett (1986) writes that “*In the greater Parisian Basin, Jansenism would wield considerable influence over both the rural and the urban clergy. In Brittany, by contrast, it would seem to have been overwhelmingly concentrated in a few towns and to have been rapidly repressed*” (p. 132).

Table 6 reports our results. All observations are weighed by diocese population in order to capture the effect on the religiosity of the average Frenchman in the late

<sup>29</sup>There are 133 dioceses in France in 1791. We generate diocese boundaries with Thiessen polygons. Also, we use the log of the number of Jansenists because some places had more than 1,000 *appelants*.



eighteenth century. In column (1), without controls, we estimate that an increase in  $\log 1 + \textit{Jansenists}$  is associated with a decrease in *Religiosity (late 18th c.)* of 2.8 percentage points. The effect is statistically significant at the 5% level, and economically large. We report standardized statistics and find that moving from the 25th to the 75th percentile of the distribution of Jansenists is predicted to decrease religiosity in the late 18th c. of 10 percentage point, about 40% of a standard deviation. In column (2), we control for pre-secularization religiosity measures. Column (3) controls for region fixed effects to abstract from unobserved characteristics such as the use of a shared language or local culture. In column (4), we further control for Encyclopedie subscriptions at the diocese level and pays status dummies, to capture unobserved institutional characteristics in the *Ancien Régime*. Finally, in columns (5) and (6), we control for pre-industrial and contemporary development proxies with population and the rate of urbanization in 1793.

Our estimates are large, stable, and significant across specification. Moreover, since Jansenism spread mostly in the greater Parisian Basin and in the Rhone valley, we expect our coefficients to be confounded by development and therefore to be biased towards zero.<sup>30</sup> Indeed, we found that the magnitude of the coefficient increases in column (5) and (6), after the inclusion of development proxies.

**Table 6:** Counter-reformation and secularization

*Note:* This table displays the results of the cross-sectional regression of religiosity in the late eighteenth century on the presence of Jansenist clergymen, at the diocese level. *Religiosity (late 18th c.)* is defined as the share of refractory clergy (non-jurors) in 1791. Religiosity (pre-secularization) controls include the average exposure to *département*-level clergymen in 1791, the number of abbeys in 1756, and centuries of Jesuit presence before 1763. Cultural and institutional factors include Encyclopedie subscriptions per 10,000 inhabitants and pays dummies. Pre-industrial and contemporary development include, respectively, population and the log of urbanization in 1793. All observations are weighed by diocese population in 1793. We report robust standard errors.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	<i>dep var:</i> Religiosity (late 18th c.)					
	(1)	(2)	(3)	(4)	(5)	(6)
$\log 1 + \textit{Jansenists}$ (1716-1725)	-0.028** (0.011)	-0.030*** (0.011)	-0.028** (0.012)	-0.025** (0.011)	-0.026** (0.011)	-0.027** (0.011)
Religiosity (pre-secularization)		Yes	Yes	Yes	Yes	Yes
Region fixed effects			Yes	Yes	Yes	Yes
Cultural and institutional factors				Yes	Yes	Yes
Pre-industrial development					Yes	Yes
Contemporary development						Yes
Mean of <i>Religiosity (late 18th c.)</i>	.47	.47	.47	.47	.47	.47
Standard deviation of <i>Religiosity (late 18th c.)</i>	.26	.26	.26	.26	.26	.26
Perc. 25-75 $\log 1 + \textit{Jansenists}$	-1.0	-1.1	-1.0	-0.9	-0.9	-1.0
Observations	122	121	121	121	121	121
R-squared	0.05	0.15	0.41	0.44	0.44	0.46

Finally we test whether the presence of Jansenists had a larger effect on religiosity

<sup>30</sup>This spatial diffusion pattern probably is the result of the center of Jansenism in France being in the Abbey of Port Royal des Champs, 50 kilometers away from Paris.

in the late eighteenth century in places where they could compete with Jesuits. This hypothesis has been advanced in the history literature as a plausible explanation to the decline (Van Kley, 1996). We interact  $\log 1 + \textit{Jansenists}$  with the duration of Jesuit presence (in centuries) in a diocese. This way, we can test whether it was religious competition between Jansenists and Jesuits or rather the absence of religious competition with Protestants that is at the origins of secularization. Appendix Figure 6.0.3 reports marginal effects of  $\log 1 + \textit{Jansenists}$ , with and without region fixed effects. In both cases, due to large standard errors, we fail to reject the null that Jansenists did not lead to secularization in the absence of Jesuits. However, the coefficient is mostly flat, which indicates that Jansenists were a sufficient condition for religiosity to decline, and competition with Jesuits did not play a significant role contrary to what was believed by Tackett (1986); Van Kley (1996). It is likely that global competition with Jesuits played a role in driving Jansenists to propose a rigorist, pious, and austere alternative, but we are unable to support this.

Our estimates suggest that it seems to be the case that the coercive monopoly of the Catholic Church on the market for salvation in France led the Counter Reformation, and especially Jansenists, to charge a price that led to the exclusion of most faithful. This would explain the religious turmoil and decline in religious attitudes that affected France in the eighteenth century.

## 7 CONCLUDING REMARKS

This research is the first to both advance the hypothesis and establish that secularization brought about the demographic transition in France. Our analysis was motivated by the remarkably early timing of the decline in fertility in France, more than a hundred years before the rest of Europe and in a period of stagnation. However, this paper is not only about the causes of the demographic transition, but also and more importantly about, broadly, the role of ideas, preferences, and culture in shaping development. Our results suggest that cultural change and preferences matter in the process of development.<sup>31</sup> In particular, we establish that the transition from tradition to modernity played a role in the transition from stagnation to growth.

We have demonstrated that the important, early, and sudden process of secularization in mid-eighteenth century France brought about the decline in fertility and accounts for most of the demographic transition. Throughout the paper, we have estimated particularly large, robust, and significant results across specifications, datasets, and estimation methods. The features of the process of secularization in France suggest that we captured the causal effect of religiosity in the late eighteenth century.

<sup>31</sup>In a sense, this echoes the work of Becker, Murphy and Tamura (1990) on the role of luck and multiple equilibria and Galor and Moav (2002) on the role of preferences and human (cultural and/or genetic) evolution.

Moreover, with individual-level data in the eighteenth century we have been able to study, for the first time, the determinants of fertility in France at the time of and before the decline. Our results at the individual level suggest that secularization caused the demographic transition. Finally, we have provided some elements that can explain the idiosyncratic and early process of secularization in eighteenth century France. We have found suggestive evidence that the monopoly of the Roman Catholic Church and the spread of the Counter Reformation in France caused strong religious turmoil and declining religious beliefs.

In future research, it would be interesting to explore the short and long run consequences of the decline in religiosity on political outcomes and democratization. There is strong evidence that the process of secularization had wide ranging consequences and also brought about the French Revolution: “*If the Revolution could, with an astonishing facility, destroy the throne and the altar, it is because Jansenism, for more than a century, had destroyed the foundations of both.*” (Van Kley, 1996, p. 505).<sup>32</sup>

<sup>32</sup>Again, this is not a concern in our analysis because we use the share of refractory clergy in 1791 only, before the major events of the French Revolution.

## REFERENCES

- Algan, Yann, and Pierre Cahuc.** 2010. "Inherited Trust and Growth." *American Economic Review*, 100(5): 2060–2092.
- Altonji, Joseph G., Todd E. Elder, and Christopher R. Taber.** 2005. "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools." *Journal of Political Economy*, 113(1): 151–184.
- Bairoch, Paul, Jean Batou, and Pierre Chèvre.** 1988. *The Population of European Cities, 800-1850: Data Bank and Short Summary of Results*. Geneva:Librairie Droz.
- Barro, Robert J., and Rachel M. McCleary.** 2003. "Religion and Economic Growth across Countries." *American Sociological Review*, 68(5): 760–781.
- BDCassini.** 2017. *Geohistoricaldata*. Paris:LaDéHiS, CRH, EHESS.
- Becker, Gary S., Kevin M. Murphy, and Robert Tamura.** 1990. "Human Capital, Fertility, and Economic Growth." *Journal of Political Economy*, 98(5, Part 2): S12–S37.
- Becker, Sascha O., and Ludger Woessmann.** 2009. "Was Weber Wrong? A Human Capital Theory of Protestant Economic History." *The Quarterly Journal of Economics*, 124(2): 531–596.
- Becker, Sascha O., Steven Pfaff, and Jared Rubin.** 2016. "Causes and consequences of the Protestant Reformation." *Explorations in Economic History*, 62: 1–25.
- Blanc, Guillaume.** 2019. "Demographic Change and Development: 400 years of Crowdsourced Historical Data in Europe." Working paper.
- Blanc, Guillaume, and Romain Wacziarg.** 2019. "Change and Persistence in the Age of Modernization: Saint-Germain-d'Anxure 1730-1895." National Bureau of Economic Research Working Paper 25490.
- Bolt, Jutta, and Jan Luiten van Zanden.** 2014. "The Maddison Project: collaborative research on historical national accounts." *The Economic History Review*, 67(3): 627–651.
- Braudel, Fernand.** 1986a. *The identity of France: History and environment ; translated from the French by Sian Reynolds*. Vol. 1. 1990 ed., London:Collins.
- Braudel, Fernand.** 1986b. *The identity of France: People and production ; translated from the French by Sian Reynolds*. Vol. 2. 1990 ed., London:Collins.

- Brown, John C., and Timothy W. Guinnane.** 2007. "Regions and time in the European fertility transition: problems in the Princeton Project's statistical methodology." *The Economic History Review*, 60(3): 574–595.
- Buringh, Eltjo, and Jan Luiten van Zanden.** 2009. "Charting the "Rise of the West": Manuscripts and Printed Books in Europe, a Long-Term Perspective from the Sixth through Eighteenth Centuries." *The Journal of Economic History*, 69(2): 409–445.
- Burleigh, Michael.** 2005. *Earthly Powers: The Clash of Religion and Politics in Europe, from the French Revolution to the Great War*. New York City:HarperCollins.
- Cantoni, Davide, Jeremiah Dittmar, and Noam Yuchtman.** 2018. "Religious Competition and Reallocation: the Political Economy of Secularization in the Protestant Reformation." *The Quarterly Journal of Economics*, 133(4): 2037–2096.
- Case, Anne C.** 1991. "Spatial Patterns in Household Demand." *Econometrica*, 59(4): 953–965.
- Cattaneo, Matias D., Richard K. Crump, Max H. Farrell, and Yingjie Feng.** 2019. "On Binscatter." Working paper.
- Chartier, Roger.** 1991. *The Cultural Origins of the French Revolution*. Duke University Press.
- Chaunu, Pierre.** 1978. *La mort à Paris, XVIe, XVIIe et XVIIIe siècles*. Paris:Fayard.
- Clair, C.** 1976. *A History of European Printing*. London:Academic.
- Coale, Ansley J., and Susan C. Watkins.** 1986. *The Decline of Fertility in Europe*. Princeton:Princeton University Press.
- Conley, Timothy G.** 1999. "GMM estimation with cross sectional dependence." *Journal of Econometrics*, 92(1): 1–45.
- Crouzet, François.** 2003. "The Historiography of French Economic Growth in the Nineteenth Century." *The Economic History Review*, 56(2): 215–242.
- Cummins, Neil.** 2012. "Marital Fertility and Wealth During the Fertility Transition: Rural France, 1750-1850." *The Economic History Review*, 66(2): 449–476.
- Darby, H.C., and H. Fullard.** 1970. *The New Cambridge Modern History, vol. 14. The New Cambridge Modern History*, Cambridge:Cambridge University Press.
- Darnton, Robert.** 1973. "The Encyclopédie Wars of Prerevolutionary France." *The American Historical Review*, 78(5): 1331–1352.

- Darnton, Robert.** 1991. *Edition et sédition. L'univers de la littérature clandestine au XVIIIe siècle.* Paris:Gallimard.
- Daudin, Guillaume, Raphaël Franck, and Hillel Rapoport.** 2018. "Can Internal Migration Foster the Convergence in Regional Fertility Rates? Evidence from Nineteenth Century France." *The Economic Journal*.
- de la Croix, David, and Faustine Perrin.** 2018. "How far can economic incentives explain the French fertility and education transition?" *European Economic Review*, 108: 221–245.
- Delventhal, Matthew J., Jesús Fernández-Villaverde, and Nezhir Guner.** 2019. "Demographic Transitions Across Time and Space." Working paper.
- de Tocqueville, Alexis.** 1856. *The Ancien Régime and the French Revolution (2011, edited by Jon Elster, translated by Arthur Goldhammer).* Cambridge:Cambridge University Press.
- Febvre, Lucien, and Henri-Jean Martin.** 1958. *L'apparition du livre.* Paris:Albin Michel.
- Fernández, Raquel.** 2011. "Does Culture Matter?" In *Handbook of Social Economics*. Vol. 1 of *Handbook of Social Economics*, ed. Jess Benhabib, Alberto Bisin and Matthew O. Jackson, Chapter 11, 481–510. North-Holland.
- Franck, Raphaël, and Noel Johnson.** 2016. "Can public policies lower religiosity? Evidence from school choice in France, 1878–1902." *The Economic History Review*, 69(3): 915–944.
- Franck, Raphaël, and Stelios Michalopoulos.** 2017. "Emigration during the French Revolution: Consequences in the Short and Longue Durée." National Bureau of Economic Research Working Paper 23936.
- Galor, Oded.** 2011. *Unified Growth Theory.* Princeton:Princeton University Press.
- Galor, Oded, and David Weil.** 2000. "Population, Technology, and Growth: From the Malthusian Regime to the Demographic Transition and Beyond." *American Economic Review*, 90(4): 806–828.
- Galor, Oded, and Omer Moav.** 2002. "Natural Selection and the Origin of Economic Growth." *The Quarterly Journal of Economics*, 117(4): 1133–1191.
- Giuliano, Paola, and Nathan Nunn.** 2016. "Understanding Cultural Persistence and Change." Working paper.

- Goudar, Ange.** 1756. *Les interêts de la France mal entendus, dans les branches de l'agriculture, de la population, des finances, du commerce, de la marine, et de l'industrie. Par un citoyen.* Vol. 1, Coeur.
- Grendler, Paul F.** 2017. *The Jesuits and Italian Universities, 1548-1773.* Washington:Catholic University of America Press.
- Guinnane, Timothy W.** 2011. "The Historical Fertility Transition: A Guide for Economists." *Journal of Economic Literature*, 49(3): 589–614.
- Guiso, Luigi, Paola Sapienza, and Luigi Zingales.** 2004. "The Role of Social Capital in Financial Development." *American Economic Review*, 94(3): 526–556.
- Hansen, Gary D., and Edward C. Prescott.** 2002. "Malthus to Solow." *American Economic Review*, 92(4): 1205–1217.
- Heldring, Leander, James A. Robinson, and Sebastian Vollmer.** 2017. "The Long-Run Impact of the Dissolution of the English Monasteries." Working paper.
- Henry, Louis.** 1972a. "Fécondité des Mariages dans le Quart Sud-Ouest de la France de 1720 à 1829 (I)." *Annales*, 27(3): 612–640.
- Henry, Louis.** 1972b. "Fécondité des Mariages dans le Quart Sud-Ouest de la France de 1720 à 1829 (suite)." *Annales*, 27(4): 977–1023.
- Henry, Louis.** 1978. "Fécondité des Mariages dans le Quart Sud-Est de la France de 1670 à 1829." *Population*, 33(4): 855–883.
- Henry, Louis, and Jacques Houdaille.** 1973. "Fécondité des Mariages dans le Quart Nord-Ouest de la France de 1670 à 1829." *Population*, 28(4): 873–924.
- Hoffman, Philip T.** 1984. *Church and Community in the Diocese of Lyon 1500-1789.* New Haven and London:Yale University Press.
- Hornung, Erik.** 2014. "Immigration and the Diffusion of Technology: The Huguenot Diaspora in Prussia." *American Economic Review*, 104(1): 84–122.
- Hsiang, Solomon M.** 2010. "Temperatures and cyclones strongly associated with economic production in the Caribbean and Central America." *Proceedings of the National Academy of Sciences*, 107(35): 15367–15372.
- ISTC.** 2008. *Incunabula Short-Title Catalogue.* London:British Library.
- Jedin, H., K. S. Latourette, and J. Martin.** 1970. *Atlas Zur Kirchengeschichte.* Freiburg:Herder.

- Kaplanis, Joanna, Assaf Gordon, Tal Shor, Omer Weissbrod, Dan Geiger, Mary Wahl, Michael Gershovits, Barak Markus, Mona Sheikh, Melissa Gymrek, Gaurav Bhatia, Daniel G. MacArthur, Alkes L. Price, and Yaniv Erlich.** 2018. “Quantitative Analysis of Population-Scale Family Trees With Millions of Relatives.” *Science*, 360(6385): 171–175.
- Kelly, Morgan.** 2019. “The Standard Errors of Persistence.” Working paper.
- Knodel, John, and Etienne van de Walle.** 1979. “Lessons from the Past: Policy Implications of Historical Fertility Studies.” *Population and Development Review*, 5(2): 217–245.
- Komlos, John.** 2006. “Height of French Soldiers, 1716-1784.” *ICPSR*, 4363.
- Kremer, Michael.** 1993. “Population Growth and Technological Change: One Million B.C. to 1990.” *The Quarterly Journal of Economics*, 108(3): 681–716.
- Lévy-Leboyer, Maurice.** 1968. “La croissance économique en France au XIXe siècle. Résultats préliminaires.” *Annales*, 23(4): 788–807.
- Lévy-Leboyer, Maurice, and François Bourguignon.** 1985. *L'économie Française au XIXe siècle. Analyse Macro-économique*. Paris:Economica.
- Marion, Henri.** 1912. *La dîme ecclésiastique en France au XVIIIe siècle et sa suppression. Étude d'histoire du droit suivie d'un aperçu sur les dîmes inféodées à la même époque*. Bordeaux:Imprimerie de l'Université.
- McCloskey, Deirdre N.** 2006. *The Bourgeois Virtues: Ethics for an Age of Commerce*. Chicago:University of Chicago Press.
- McCloskey, Deirdre N.** 2010. *Bourgeois Dignity: Why Economics Can't Explain the Modern World*. Chicago:University of Chicago Press.
- McCloskey, Deirdre N.** 2016. *Bourgeois Equality: How Ideas, Not Capital or Institutions, Enriched the World*. Chicago:University of Chicago Press.
- Mokyr, Joel.** 2016. *A Culture of Growth: The Origins of the Modern Economy*. Princeton:Princeton University Press.
- Mours, Samuel.** 1958. *Les Églises Réformées en France. Tableaux et Cartes*. Paris:Librairie Protestante.
- Murphy, Tommy E.** 2015. “Old Habits Die Hard (Sometimes).” *Journal of Economic Growth*, 20(2): 177–222.
- Norberg, Kathryn.** 1985. *Rich and Poor in Grenoble, 1600-1814*. University of California Press.



- Oster, Emily.** 2016. “Unobservable Selection and Coefficient Stability: Theory and Evidence.” *Journal of Business & Economic Statistics*, 1–18.
- Perez, Céline.** 1999. “Les Refus de sacrement d’après les Nouvelles ecclésiastiques, 1756-1789.” Mémoire de maîtrise (dir. Bernard Hours), Lyon 3.
- Préclin, Edmond.** 1929. *Les jansénistes du XIIIe siècle et la constitution civile du clergé: le développement du richérisme, sa propagation dans le bas clergé, 1713-1791*. Paris:J. Gamber.
- Roche, Daniel.** 2000. *France in the Enlightenment*. Cambridge:Harvard University Press.
- Sauvy, Alfred.** 1960. “La Prévention des Naissances dans la Famille : Ses Origines dans les Temps Modernes.” *Population*, 15(1): 115–120.
- SGF.** 1878. *Annuaire Statistique de la France*. Paris:Imprimerie Nationale.
- Spolaore, Enrico, and Romain Wacziarg.** 2009. “The Diffusion of Development.” *The Quarterly Journal of Economics*, 124(2): 469–529.
- Spolaore, Enrico, and Romain Wacziarg.** 2013. “How Deep Are the Roots of Economic Development?” *Journal of Economic Literature*, 51(2): 325–69.
- Spolaore, Enrico, and Romain Wacziarg.** 2019. “Fertility and Modernity.” Working paper.
- Squicciarini, Mara P.** 2017. “Devotion and Development: Religiosity, Education, and Economic Progress in 19th-century France.” Working paper.
- Squicciarini, Mara P., and Nico Voigtländer.** 2015. “Human Capital and Industrialization: Evidence from the Age of Enlightenment.” *The Quarterly Journal of Economics*, 130(4): 1825–1883.
- Tackett, Timothy.** 1986. *Religion, Revolution, and Regional Culture in Eighteenth-Century France: The Ecclesiastical Oath of 1791*. Princeton:Princeton University Press.
- Tingle, Elizabeth C.** 2012. *Purgatory and Piety in Brittany, 1480-1720*. Farnham:Ashgate Publishing, Ltd.
- van de Walle, Etienne.** 2005. “Birth prevention before the era of modern contraception.” *Population and Societies*, 418.
- Van Kley, Dale K.** 1996. *The Religious Origins of the French Revolution: From Calvin to the Civil Constitution, 1560-1791*. New Haven and London:Yale University Press.

- Voigtländer, Nico, and Hans-Joachim Voth.** 2012. “Persecution Perpetuated: The Medieval Origins of Anti-Semitic Violence in Nazi Germany.” *The Quarterly Journal of Economics*, 127(3): 1339–1392.
- Vovelle, Michel.** 1973. *Piété baroque et déchristianisation en Provence au XVIIIe siècle: Les altitudes devant la mort d’après les clauses des testaments*. Paris:Pion.
- Weber, Eugen.** 1976. *Peasants into Frenchmen: The Modernization of Rural France, 1870–1914*. Stanford:Stanford University Press.
- Weber, Max.** 1904/1905. “Die protestantische Ethik und der “Geist” des Kapitalismus.” *Archiv für Sozialwissenschaft und Sozialpolitik*, 20: 1-54 and 21: 1-110: [English translation: *The Protestant Ethic and the Spirit of Capitalism*, translated by Talcott Parsons, 1930/2001, London: Routledge Classics.].
- Weir, David R.** 1994. “New Estimates of Nuptiality and Marital Fertility in France, 1740-1911.” *Population Studies*, 48(2): 307–331.
- Wrigley, Edward A.** 1985a. “The Fall of Marital Fertility in Nineteenth-Century France: Exemplar or Exception? (Part I).” *European Journal of Population / Revue européenne de Démographie*, 1(1): 31–60.
- Wrigley, Edward A.** 1985b. “The Fall of Marital Fertility in Nineteenth-Century France: Exemplar or Exception? (Part II).” *European Journal of Population / Revue européenne de Démographie*, 1(2): 141–177.
- Yoo, Hong Il.** 2019. “VCE2WAY: Stata module to adjust a Stata command’s standard errors for two-way clustering.” Statistical Software Components S458311, Boston College Department of Economics.

## Online appendix to Modernization Before Industrialization

## APPENDIX 3— THE DATA

### 3.1 RELIGIOSITY

**Table 3.1.1:** Correlation matrix (Religiosity and development)

*Note:* This table present correlations between late 18th c. religiosity, pre-secularization religiosity proxies, and development proxies at the *département* level. All observations are weighed by *département* population in 1793.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) <i>Religiosity (late 18th c.)</i>	1.000								
(2) Clergymen per 10,000 inhabitants (1791)	-0.047	1.000							
(3) Abbeys (1756)	0.029	0.292***	1.000						
(4) Tithe (1750)	-0.170	-0.230**	0.117	1.000					
(5) Huguenots per 10,000 inhabitants (1815)	0.082	-0.102	-0.044	-0.050	1.000				
(6) Centuries of Jesuit presence (bef. 1763)	0.041	-0.149	0.108	-0.028	-0.210*	1.000			
(7) log 1 + Encyclopedie sub. per 10,000 inhabitants (1777-1779)	0.022	-0.123	-0.019	0.067	0.168	0.257**	1.000		
(8) Literacy (1790)	0.002	0.178	-0.007	-0.032	-0.009	0.106	0.104	1.000	
(9) log Urbanization (1793)	0.260**	-0.206*	-0.007	-0.055	0.071	0.133	0.438***	0.198*	1.000

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

### 3.2 DÉPARTEMENT LEVEL

**Table 3.2.1:** Summary statistics at the *département* level

*Note:* All observations weighed by population in 1793.

	Mean	St. dev.	Minimum	Maximum	N
<b>Panel A: Fertility</b>					
Marital fertility index $I_g$ (1831)	0.56	0.12	0.35	0.81	77
Marital fertility index $I_g$ (1836)	0.54	0.11	0.33	0.78	77
Marital fertility index $I_g$ (1841)	0.52	0.11	0.32	0.76	77
Marital fertility index $I_g$ (1846)	0.51	0.11	0.31	0.73	77
Marital fertility index $I_g$ (1851)	0.49	0.11	0.30	0.75	85
Marital fertility index $I_g$ (1856)	0.49	0.11	0.29	0.74	85
Marital fertility index $I_g$ (1861)	0.49	0.12	0.28	0.78	88
Marital fertility index $I_g$ (1866)	0.49	0.13	0.28	0.77	88
Marital fertility index $I_g$ (1871)	0.49	0.13	0.28	0.81	86
Marital fertility index $I_g$ (1876)	0.48	0.14	0.27	0.84	86
Marital fertility index $I_g$ (1881)	0.48	0.14	0.27	0.82	86
Marital fertility index $I_g$ (1886)	0.45	0.13	0.25	0.80	86
Marital fertility index $I_g$ (1891)	0.43	0.12	0.23	0.77	86
Marital fertility index $I_g$ (1896)	0.41	0.12	0.23	0.74	86
Marital fertility index $I_g$ (1901)	0.40	0.11	0.23	0.72	86
Marital fertility index $I_g$ (1921)	0.34	0.07	0.21	0.54	89
Marital fertility index $I_g$ (1931)	0.30	0.06	0.18	0.45	89
Marital fertility index $I_g$ (1961)	0.33	0.04	0.23	0.40	89
<b>Panel B: Religiosity</b>					
Religiosity (late 18th c.)	0.49	0.22	0.08	0.90	85
Tithe (1750)	15.61	6.39	9.00	40.00	87
Abbeys (1756)	2.52	2.37	0.00	13.00	89
Centuries of Jesuit presence (bef. 1763)	1.26	0.69	0.00	2.02	89
Clergymen per 10,000 inhabitants (1791)	19.07	6.75	3.30	41.23	84
Huguenots per 10,000 inhabitants (1815)	167.15	443.76	0.16	3424.00	83

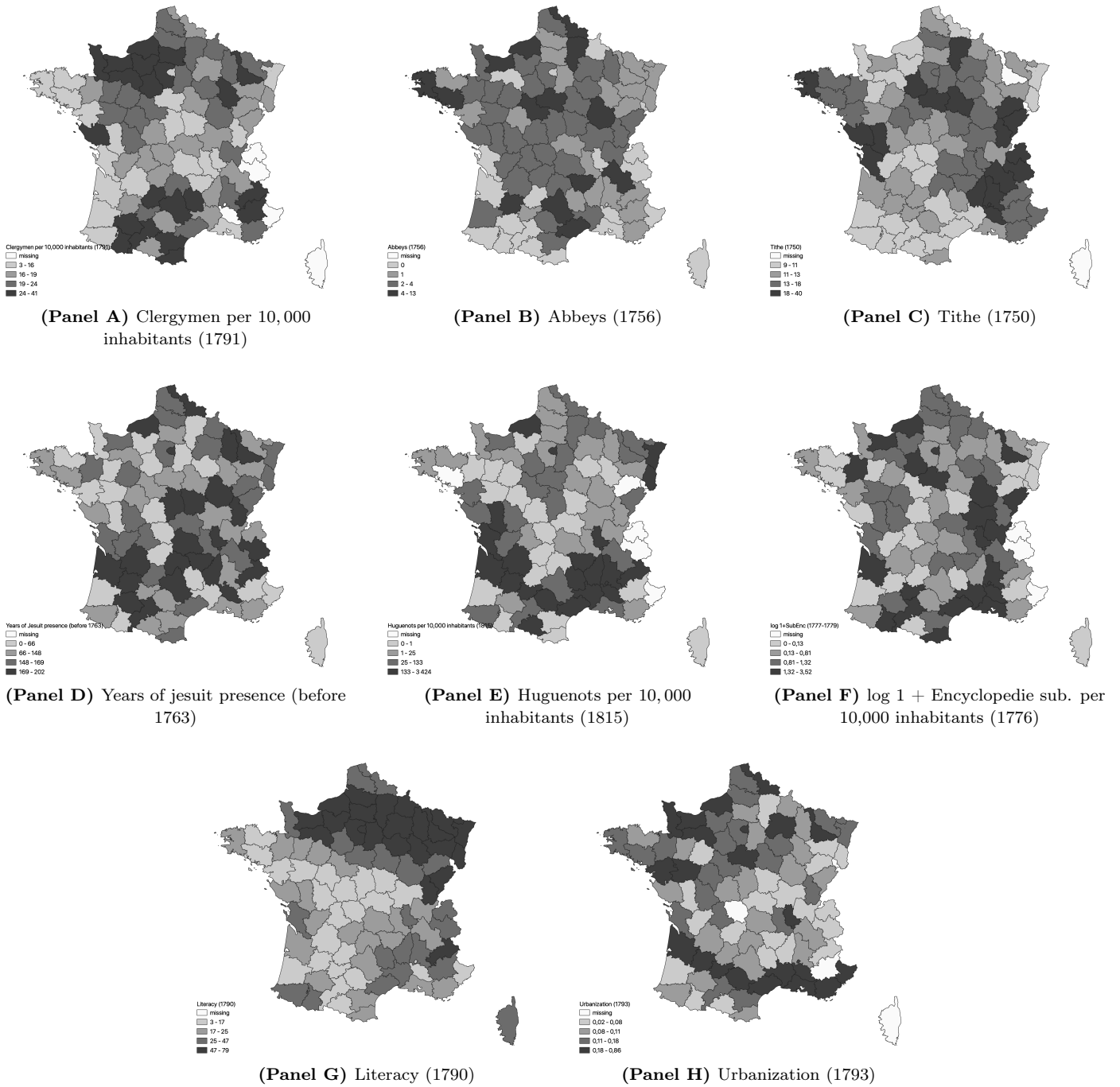
Share of Jansenist clergymen (1725)	0.15	0.67	0.00	4.05	84
<b>Panel C: Cultural and institutional factors</b>					
Books printed (1500)	140.87	583.43	0.00	3264.00	85
Presence of a printing press (1500)	0.43	0.50	0.00	1.00	85
Presence of a university (bef. 1750)	0.31	0.46	0.00	1.00	85
log 1 + Encyclopedie sub. per 10,000 inhabitants (1777-1779)	0.96	0.76	0.00	3.52	86
Pays d'Etat	0.33	0.47	0.00	1.00	89
Pays d'imposition	0.08	0.27	0.00	1.00	89
<b>Panel D: Education and schooling</b>					
Literacy (1790)	34.04	19.72	3.46	78.88	88
Literacy (1840)	56.55	20.14	18.40	97.10	88
Literacy (1860)	69.10	17.02	32.10	96.10	88
Literacy (1865)	73.36	15.59	37.90	97.00	88
Literacy (1881)	86.58	8.86	58.60	98.50	85
Literacy (1896)	94.93	4.21	80.60	99.70	85
<b>Panel E: Pre-industrial development</b>					
Average soldier height (1716-1749)	-0	1	-3	3	85
<i>Département</i> population (1793)	353,555	139,347	36,000	748,030	89
<i>Département</i> population (1841)	443,038	198,335	52,364	1,114,788	87
<i>Département</i> population (1861)	494,149	322,159	55,551	2,004,490	88
<i>Département</i> population (1866)	500,334	357,101	56,127	2,207,445	89
<i>Département</i> population (1881)	532,002	460,649	73,347	2,865,982	89
<i>Département</i> population (1901)	568,526	613,202	91,128	3,777,679	89
<b>Panel F: Contemporary development</b>					
Urbanization (1793)	0.18	0.16	0.02	0.86	86
Urbanization (1841)	0.19	0.16	0.02	0.88	87
Urbanization (1861)	0.23	0.17	0.04	0.93	88
Urbanization (1866)	0.23	0.17	0.04	0.94	88
Urbanization (1881)	0.26	0.18	0.05	0.96	89
Urbanization (1901)	0.30	0.18	0.05	0.97	89

**Table 3.2.2:** Control variables*Note:* This table displays the control variables used throughout in Section 4.

Specification	Variable	Source
(2)	<b>Religiosity (pre-secularization)</b> Clergymen per 10,000 inhabitant (1792) Tithe (1750) Huguenots per 10,000 inhabitant (1815) Centuries of Jesuit presence (bef. 1763) Abbeys (1756)	Tackett (1986) Marion (1912) Mours (1958) Grendler (2017) BDCassini (2017); Franck and Michalopoulos (2017)
(4)	<b>Cultural and institutional factors</b> Presence of a printing press (1500) Books printed (1500) log 1 + Encyclopedie sub. per 10,000 inhab. (1777-1779) Dummies for Pays status (Election, Etat, Imposition) Presence of a university (bef. 1750)	Clair (1976); Febvre and Martin (1958) ISTC (2008) Darnton (1973) Wikipedia Darby and Fullard (1970); Jedin, Latourette and Martin (1970)
(5)	<b>Education and schooling</b> Literacy rate (year of observation)	SGF (1878)
(6)	<b>Pre-industrial development</b> Population of department (year of observation) Average soldier height (1716 – 1749)	BDCassini (2017) Komlos (2006)
(7)	<b>Contemporary development</b> Urbanization rate (year of observation)	BDCassini (2017)

**Figure 3.2.1: Maps**

*Note:* This figure displays the spatial distribution of some variables of interest.



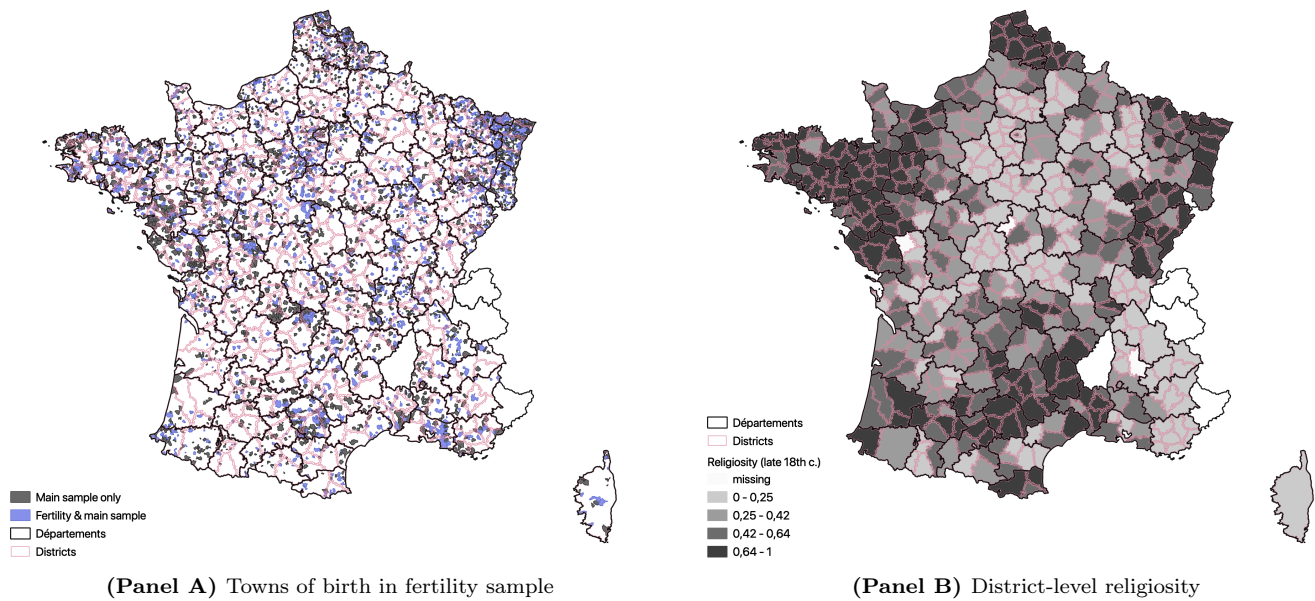
### 3.3 INDIVIDUAL LEVEL

**Table 3.3.1:** Summary statistics at the individual and district levels

	Mean	St. dev.	Minimum	Maximum	N
<b>Panel A: Fertility</b>					
Number of children	3.85	3.23	1.00	36.00	18,663
Fertility of parents	4.65	3.44	1.00	28.50	18,663
Age at birth of first child	29.17	6.93	15.00	65.00	17,941
<b>Panel B: Religiosity (district level)</b>					
<i>Religiosity (late 18th c.)</i>	0.59	0.88	0.00	1.00	453
Abbeys (1756)	0.44	1.74	0.00	7.00	454
Centuries of Jesuit presence (bef. 1763)	0.54	2.23	0.00	2.01	454
<b>Panel C: Development and Enlightenment (town and district level)</b>					
Urbanization (year of observation)	0.23	0.42	0.00	1.00	2,673
log 1 + Encyclopedie sub. per 10,000 inhabitants (1777-1779)	0.58	2.45	0.00	5.55	452

**Figure 3.3.1: Districts**

*Note:* This figure displays administrative boundaries (*départements* and districts) and towns used in the individual level dataset. The fertility sample consists in all individuals with a recorded horizontal lineage, while the main sample consists in all other individuals with a recorded rate of fertility plus those in the *fertility sample*. Our main measure of interest is unavailable in the *départements* in white.





APPENDIX 4— MAIN EMPIRICAL FINDINGS AT THE DÉPARTEMENT LEVEL

4.1 BASELINE RESULTS

Table 4.1.1: Determinants of  $I_g$

Note: This table displays the results of the same regression as in Table 1, at different points in time from 1831 to 1901.  
 \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	dep var: Fertility index $I_g$ 1841						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Religiosity (late 18th c.)	0.257*** (0.054)	0.254*** (0.048)	0.257*** (0.066)	0.269*** (0.065)	0.269*** (0.065)	0.265*** (0.068)	0.268*** (0.071)
Religiosity (pre-secularization)		Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects			Yes	Yes	Yes	Yes	Yes
Cultural and institutional factors				Yes	Yes	Yes	Yes
Education and schooling					Yes	Yes	Yes
Pre-industrial development						Yes	Yes
Contemporary development							Yes
Mean of $I_g$ (1841)	.52	.52	.52	.52	.52	.52	.52
Standard deviation of $I_g$ (1841)	.11	.10	.10	.10	.10	.10	.10
Perc. 25-75 Religiosity (late 18th c.)	.10	.09	.10	.10	.10	.10	.10
Observations	76	73	73	73	73	73	73
R-squared	0.27	0.41	0.62	0.75	0.75	0.75	0.75

(Panel A) 1841

	dep var: Fertility index $I_g$ 1881						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Religiosity (late 18th c.)	0.374*** (0.061)	0.373*** (0.057)	0.347*** (0.073)	0.337*** (0.070)	0.335*** (0.071)	0.320*** (0.079)	0.320*** (0.078)
Religiosity (pre-secularization)		Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects			Yes	Yes	Yes	Yes	Yes
Cultural and institutional factors				Yes	Yes	Yes	Yes
Education and schooling					Yes	Yes	Yes
Pre-industrial development						Yes	Yes
Contemporary development							Yes
Mean of $I_g$ (1881)	.47	.46	.46	.46	.46	.46	.46
Standard deviation of $I_g$ (1881)	.13	.12	.12	.12	.12	.12	.12
Perc. 25-75 Religiosity (late 18th c.)	.14	.14	.13	.13	.12	.12	.12
Observations	82	77	77	77	77	77	77
R-squared	0.37	0.47	0.65	0.76	0.76	0.77	0.77

(Panel C) 1881

	dep var: Fertility index $I_g$ 1861						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Religiosity (late 18th c.)	0.315*** (0.055)	0.326*** (0.056)	0.350*** (0.063)	0.325*** (0.062)	0.324*** (0.063)	0.322*** (0.069)	0.309*** (0.071)
Religiosity (pre-secularization)		Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects			Yes	Yes	Yes	Yes	Yes
Cultural and institutional factors				Yes	Yes	Yes	Yes
Education and schooling					Yes	Yes	Yes
Pre-industrial development						Yes	Yes
Contemporary development							Yes
Mean of $I_g$ (1861)	.49	.48	.48	.48	.48	.48	.48
Standard deviation of $I_g$ (1861)	.12	.12	.12	.12	.12	.12	.12
Perc. 25-75 Religiosity (late 18th c.)	.12	.12	.13	.12	.12	.12	.11
Observations	83	79	79	79	79	79	79
R-squared	0.31	0.36	0.63	0.78	0.78	0.78	0.79

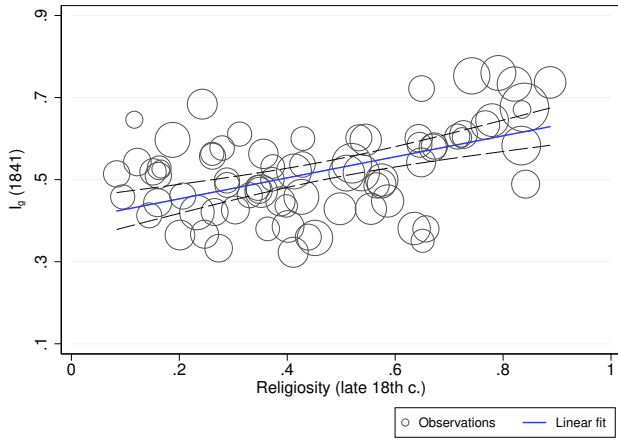
(Panel B) 1861

	dep var: Fertility index $I_g$ 1901						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Religiosity (late 18th c.)	0.304*** (0.054)	0.309*** (0.049)	0.268*** (0.057)	0.250*** (0.053)	0.245*** (0.053)	0.253*** (0.061)	0.254*** (0.060)
Religiosity (pre-secularization)		Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects			Yes	Yes	Yes	Yes	Yes
Cultural and institutional factors				Yes	Yes	Yes	Yes
Education and schooling					Yes	Yes	Yes
Pre-industrial development						Yes	Yes
Contemporary development							Yes
Mean of $I_g$ (1901)	.39	.39	.39	.39	.39	.39	.39
Standard deviation of $I_g$ (1901)	.10	.10	.10	.10	.10	.10	.10
Perc. 25-75 Religiosity (late 18th c.)	.11	.11	.10	.09	.09	.09	.09
Observations	82	77	77	77	77	77	77
R-squared	0.33	0.52	0.70	0.82	0.83	0.83	0.83

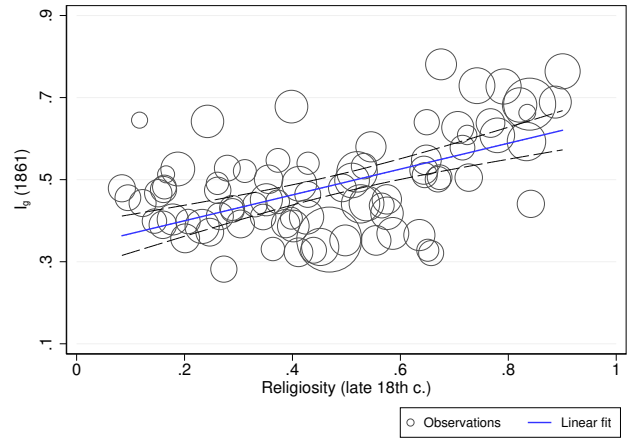
(Panel D) 1901

**Figure 4.1.1: Determinants of  $I_g$  (scatterplot, uncontrolled)**

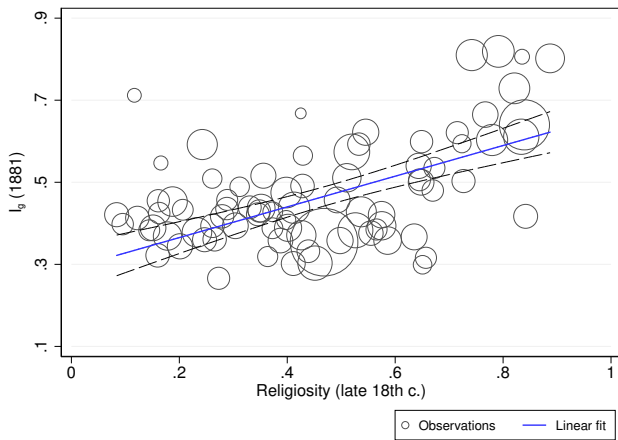
*Note:* This Figure displays the results of the same regression as in specification (1) in Table 4.1.1.



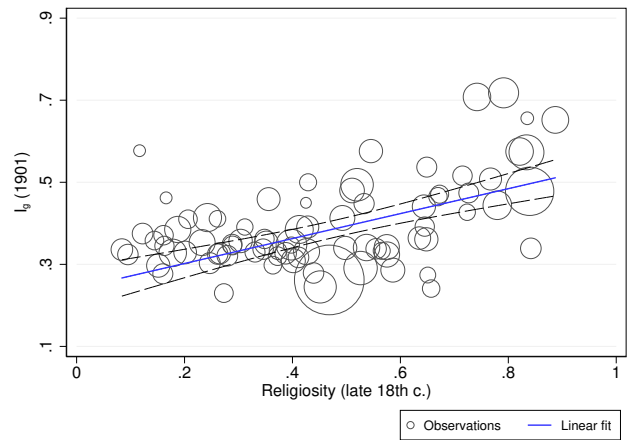
**(Panel A) 1841**



**(Panel B) 1861**



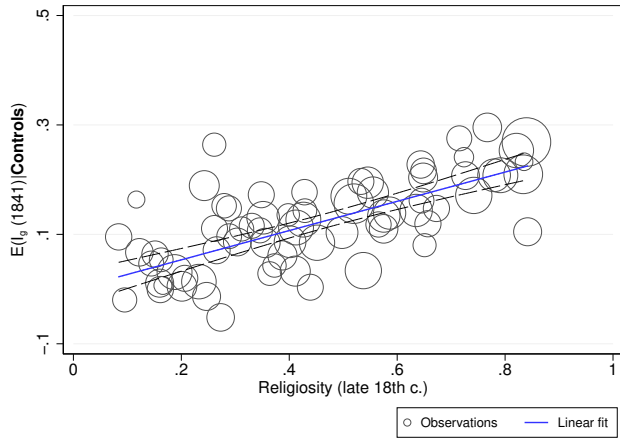
**(Panel C) 1881**



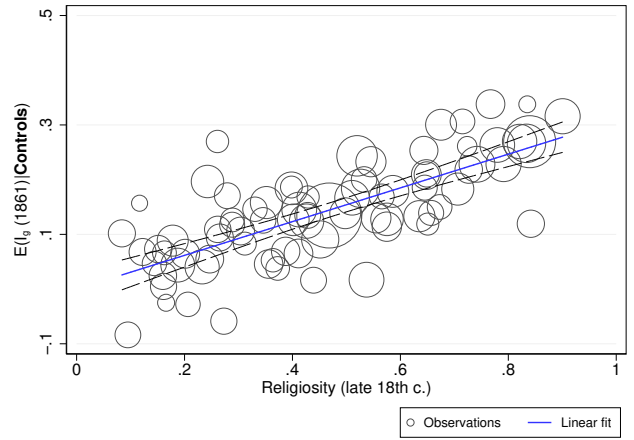
**(Panel D) 1901**

**Figure 4.1.2: Determinants of  $I_g$  (scatterplot, with controls)**

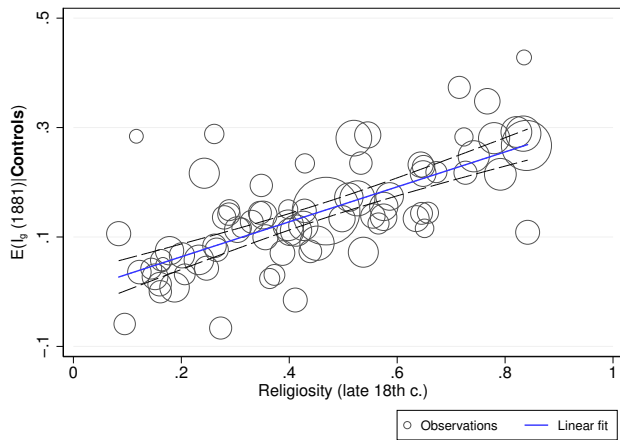
*Note:* This Figure displays the results of the same regression as in specification (7) in Table 4.1.1.



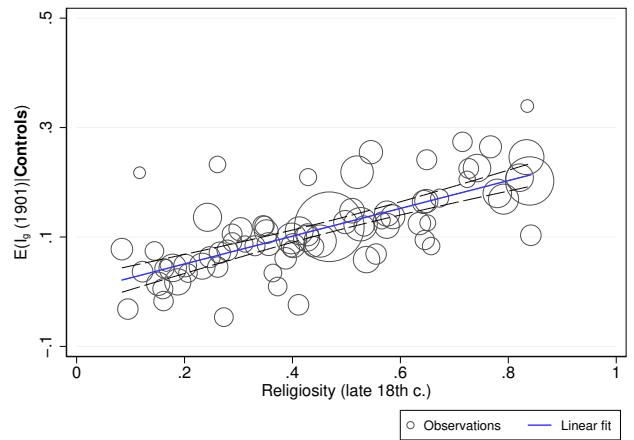
**(Panel A) 1841**



**(Panel B) 1861**



**(Panel C) 1881**



**(Panel D) 1901**

## 4.2 ACCOUNTING FOR SPATIAL DEPENDENCE

**Table 4.2.1:** Accounting for spatial dependence in the determinants of  $I_g$

*Note:* This table displays the results of the same regression as in Table 3, at different points in time from 1831 to 1901.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

		dep var: Fertility index $I_g$ 1841						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Panel A: Testing spatial correlation on OLS residuals</b>								
<b>Assumption 1:</b> 250 kilometers correlation range ; <b>2:</b> 500 kms (in parenthesis)								
p-val of Moran's test for spatial dependence ( $H_0$ : error is iid)		.00 (.00)	.00 (.00)	.99 (.86)	.69 (.61)	.70 (.62)	.72 (.62)	.70 (.62)
Fraction of simulations with significant (p=.001) spatial noise		4% (2%)	5% (4%)	2% (2%)	0% (0%)	0% (0%)	0% (0%)	0% (0%)
Fraction of simulations where independent variable explains (p=.001) noise		8% (8%)	7% (10%)	2% (1%)	1% (0%)	1% (0%)	1% (0%)	1% (0%)
<b>Panel B: Spatial correlation-adjusted standard errors</b>								
<i>Religiosity (late 18th c.)</i>		0.257	0.254	0.257	0.269	0.269	0.265	0.268
Non-adjusted standard errors		(0.049)***	(0.048)***	(0.062)***	(0.058)***	(0.058)***	(0.062)***	(0.063)***
Conley standard errors (Assumption 1)		(0.081)***	(0.062)***	(0.058)***	(0.048)***	(0.047)***	(0.046)***	(0.048)***
Conley standard errors (Assumption 2)		[0.091]***	[0.066]***	[0.042]***	[0.032]***	[0.031]***	[0.028]***	[0.031]***
<b>(Panel A) 1841</b>								
		dep var: Fertility index $I_g$ 1861						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Panel A: Testing spatial correlation on OLS residuals</b>								
<b>Assumption 1:</b> 250 kilometers correlation range ; <b>2:</b> 500 kms (in parenthesis)								
p-val of Moran's test for spatial dependence ( $H_0$ : error is iid)		.00 (.00)	.00 (.00)	.67 (.96)	.83 (.82)	.85 (.88)	.95 (.71)	.97 (.69)
Fraction of simulations with significant (p=.001) spatial noise		10% (11%)	14% (10%)	7% (5%)	1% (0%)	1% (0%)	1% (0%)	1% (0%)
Fraction of simulations where independent variable explains (p=.001) noise		12% (10%)	10% (11%)	4% (2%)	3% (1%)	3% (1%)	4% (2%)	2% (1%)
<b>Panel B: Spatial correlation-adjusted standard errors</b>								
<i>Religiosity (late 18th c.)</i>		0.315	0.326	0.350	0.325	0.324	0.322	0.309
Non-adjusted standard errors		(0.052)***	(0.055)***	(0.065)***	(0.057)***	(0.057)***	(0.059)***	(0.060)***
Conley standard errors (Assumption 1)		(0.078)***	(0.074)***	(0.073)***	(0.053)***	(0.053)***	(0.058)***	(0.061)***
Conley standard errors (Assumption 2)		[0.089]***	[0.083]***	[0.068]***	[0.041]***	[0.042]***	[0.048]***	[0.048]***
<b>(Panel B) 1861</b>								
		dep var: Fertility index $I_g$ 1881						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Panel A: Testing spatial correlation on OLS residuals</b>								
<b>Assumption 1:</b> 250 kilometers correlation range ; <b>2:</b> 500 kms (in parenthesis)								
p-val of Moran's test for spatial dependence ( $H_0$ : error is iid)		.00 (.00)	.00 (.00)	.87 (.76)	.89 (.71)	.89 (.73)	.79 (.57)	.79 (.57)
Fraction of simulations with significant (p=.001) spatial noise		10% (10%)	7% (8%)	3% (2%)	1% (0%)	1% (0%)	1% (0%)	1% (0%)
Fraction of simulations where independent variable explains (p=.001) noise		8% (11%)	8% (12%)	2% (1%)	1% (0%)	1% (0%)	2% (1%)	2% (1%)
<b>Panel B: Spatial correlation-adjusted standard errors</b>								
<i>Religiosity (late 18th c.)</i>		0.374	0.373	0.347	0.337	0.335	0.320	0.320
Non-adjusted standard errors		(0.055)***	(0.054)***	(0.072)***	(0.067)***	(0.067)***	(0.071)***	(0.071)***
Conley standard errors (Assumption 1)		(0.092)***	(0.071)***	(0.069)***	(0.051)***	(0.051)***	(0.048)***	(0.047)***
Conley standard errors (Assumption 2)		[0.104]***	[0.077]***	[0.052]***	[0.038]***	[0.038]***	[0.033]***	[0.033]***
<b>(Panel C) 1881</b>								
		dep var: Fertility index $I_g$ 1901						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Panel A: Testing spatial correlation on OLS residuals</b>								
<b>Assumption 1:</b> 250 kilometers correlation range ; <b>2:</b> 500 kms (in parenthesis)								
p-val of Moran's test for spatial dependence ( $H_0$ : error is iid)		.00 (.00)	.00 (.00)	.90 (.81)	.95 (.77)	.95 (.79)	.79 (.57)	.74 (.54)
Fraction of simulations with significant (p=.001) spatial noise		8% (11%)	5% (8%)	2% (1%)	0% (0%)	0% (0%)	0% (0%)	0% (0%)
Fraction of simulations where independent variable explains (p=.001) noise		8% (12%)	8% (12%)	2% (1%)	1% (0%)	1% (0%)	2% (1%)	2% (1%)
<b>Panel B: Spatial correlation-adjusted standard errors</b>								
<i>Religiosity (late 18th c.)</i>		0.304	0.309	0.268	0.250	0.245	0.253	0.254
Non-adjusted standard errors		(0.049)***	(0.044)***	(0.059)***	(0.051)***	(0.051)***	(0.054)***	(0.055)***
Conley standard errors (Assumption 1)		(0.078)***	(0.058)***	(0.050)***	(0.039)***	(0.039)***	(0.033)***	(0.032)***
Conley standard errors (Assumption 2)		[0.088]***	[0.062]***	[0.037]***	[0.036]***	[0.036]***	[0.023]***	[0.024]***
<b>(Panel D) 1901</b>								

**Table 4.2.2:** Accounting for spatial dependence in the determinants of transition date ( $I_g < .5$ )

*Note:* This table displays the results of the same regression as in Table 3, using the first year with  $I_g < .5$  as a dependent variable.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

		dep var: First year with fertility index $I_g$ lower than .5						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Panel A: Testing spatial correlation on OLS residuals</b>								
<b>Assumption 1:</b> 250 kilometers correlation range ; <b>2:</b> 500 kms (in parenthesis)								
p-val of Moran's test for spatial dependence ( $H_0$ : error is iid)		.00 (.00)	.00 (.00)	.67 (.96)	.87 (.77)	.87 (.80)	.95 (.65)	.84 (.59)
Fraction of simulations with significant (p=.001) spatial noise		6% (4%)	6% (6%)	5% (3%)	0% (0%)	0% (0%)	0% (0%)	1% (0%)
Fraction of simulations where independent variable explains (p=.001) noise		8% (8%)	8% (11%)	4% (2%)	3% (2%)	3% (2%)	2% (2%)	2% (1%)
<b>Panel B: Spatial correlation-adjusted standard errors</b>								
<i>Religiosity (late 18th c.)</i>		98.112	99.647	120.262	111.710	112.670	117.506	118.735
Non-adjusted standard errors		(13.224)***	(13.899)***	(17.710)***	(16.195)***	(15.930)***	(16.296)***	(16.922)***
Conley standard errors (Assumption 1)		(18.969)***	(16.189)***	(18.659)***	(14.255)***	(14.693)***	(14.999)***	(14.658)***
Conley standard errors (Assumption 2)		[20.787]***	[16.858]***	[14.172]***	[10.839]***	[10.203]***	[9.787]***	[9.562]***

### 4.3 ACCOUNTING FOR OMITTED VARIABLES

**Table 4.3.1:** Determinants of  $I_g$  (1866) under selection on unobservables

*Note:* This table displays the estimation of the cross-sectional regression of the marital fertility index  $I_g$  in 1866 on late eighteenth century religiosity. *Religiosity (late 18th c.)* is defined as the share of refractory clergy (non-jurors) in 1791. Controls are described in Appendix Table 3.2.2. All observations are weighed by *département* population in the year of observation. We model unobservables selection à la Oster (2016). We set  $R_{max}^2 = \min\{1.3R^2, .9\}$  and  $\delta = 1$  to construct bounds on the treatment effect and report bootstrapped standard errors on 1,000 replications. We drop replications with multiple equilibria and in which the estimated betas (with and without controls) are not statistically different from one another and the chosen solution is more distant than the alternative solution to the standard OLS. Appendix Tables 4.3.2 and 4.3.3 display the same set of results at different points in time, and for the determinants of transition year.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	dep var: Fertility index $I_g$ 1866						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Assumption A:</b> Unobservable selection prop. to observable; <b>B:</b> $\propto$ diffusion of Enlightenment							
<i>Religiosity (late 18th c.)</i>							
Oster's $\beta$ : $\beta_A$	.	0.401*** (0.083)	0.457*** (0.171)	0.342*** (0.104)	0.338*** (0.107)	0.334*** (0.114)	0.325*** (0.117)
Oster's $\beta$ : $\beta_B$	.	.	.	0.338*** (0.099)	0.350*** (0.100)	0.347*** (0.104)	0.310*** (0.105)
Religiosity (pre-secularization)		Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects			Yes	Yes	Yes	Yes	Yes
Cultural and institutional factors				Yes	Yes	Yes	Yes
Education and schooling					Yes	Yes	Yes
Pre-industrial development						Yes	Yes
Contemporary development							Yes
Oster's $\delta$ : $\delta_A$	.	10.78	1.41	2.08	2.07	2.03	1.99
Oster's $\delta$ : $\delta_B$	.	.	.	24.67	-12.54	-15.03	7.18
Max R-squared	0.46	0.53	0.85	0.90	0.90	0.90	0.90

**Table 4.3.2:** Determinants of  $I_g$  under selection on unobservables

*Note:* This table displays the results of the same regression as in Table 4.3.1, at different points in time from 1831 to 1901.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	dep var: Fertility index $I_g$ 1841						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Assumption A:</b> Unobservable selection prop. to observable; <b>B:</b> $\propto$ diffusion of Enlightenment							
<i>Religiosity (late 18th c.)</i>							
Oster's $\beta$ : $\beta_A$	.	0.263*** (0.060)	0.288* (0.154)	0.298** (0.126)	0.297** (0.130)	0.296** (0.145)	0.302** (0.144)
Oster's $\beta$ : $\beta_B$	.	.	.	0.270** (0.109)	0.272** (0.110)	0.273** (0.118)	0.266** (0.120)
Oster's $\delta$ : $\delta_A$	.	-355.53	1.64	2.05	2.05	1.84	1.86
Oster's $\delta$ : $\delta_B$	.	.	.	-176.33	-37.85	-22.24	65.72
Max R-squared	0.35	0.54	0.81	0.90	0.90	0.90	0.90

(Panel A) 1841

	dep var: Fertility index $I_g$ 1861						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Assumption A:</b> Unobservable selection prop. to observable; <b>B:</b> $\propto$ diffusion of Enlightenment							
<i>Religiosity (late 18th c.)</i>							
Oster's $\beta$ : $\beta_A$	.	0.359*** (0.078)	0.431*** (0.151)	0.336*** (0.112)	0.335*** (0.115)	0.331*** (0.120)	0.309** (0.120)
Oster's $\beta$ : $\beta_B$	.	.	.	0.321*** (0.107)	0.343*** (0.108)	0.342*** (0.112)	0.295*** (0.112)
Oster's $\delta$ : $\delta_A$	.	8.79	1.54	2.11	2.08	1.98	1.97
Oster's $\delta$ : $\delta_B$	.	.	.	37.06	-6.57	-6.99	11.20
Max R-squared	0.41	0.47	0.82	0.90	0.90	0.90	0.90

(Panel B) 1861

		<i>dep var:</i> Fertility index $I_g$ 1881						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Assumption A:</b> <i>Unobservable selection prop. to observable; B: <math>\propto</math> diffusion of Enlightenment</i>								
<i>Religiosity (late 18th c.)</i>								
Oster's $\beta$ : $\beta_A$	.	0.398*** (0.083)	0.330 (0.264)	0.320* (0.168)	0.314** (0.160)	0.275 (0.175)	0.276 (0.188)	
Oster's $\beta$ : $\beta_B$	.	.	.	0.390*** (0.127)	0.410*** (0.136)	0.447*** (0.148)	0.441*** (0.148)	
Oster's $\delta$ : $\delta_A$	.	-13.79	1.30	1.68	1.69	1.51	1.52	
Oster's $\delta$ : $\delta_B$	.	.	.	-2.23	-1.54	-0.85	-1.14	
Max R-squared	0.48	0.61	0.84	0.90	0.90	0.90	0.90	

(Panel C) 1881

		<i>dep var:</i> Fertility index $I_g$ 1901						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Assumption A:</b> <i>Unobservable selection prop. to observable; B: <math>\propto</math> diffusion of Enlightenment</i>								
<i>Religiosity (late 18th c.)</i>								
Oster's $\beta$ : $\beta_A$	.	0.327*** (0.067)	0.240 (0.238)	0.238** (0.094)	0.232*** (0.088)	0.240** (0.103)	0.242** (0.110)	
Oster's $\beta$ : $\beta_B$	.	.	.	.	0.286*** (0.086)	0.292*** (0.091)	0.323*** (0.099)	0.336*** (0.107)
Oster's $\delta$ : $\delta_A$	.	-7.09	1.54	2.51	2.61	2.33	2.31	
Oster's $\delta$ : $\delta_B$	.	.	.	-1.63	-0.92	-0.47	-0.54	
Max R-squared	0.43	0.68	0.90	0.90	0.90	0.90	0.90	

(Panel D) 1901

**Table 4.3.3:** Determinants of transition date ( $I_g < .5$ ) under selection on unobservables

*Note:* This table displays the results of the same regression as in Table 4.3.1, using the first year with  $I_g < .5$  as a dependent variable.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

		<i>dep var:</i> First year with fertility index $I_g$ lower than .5						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Assumption A:</b> <i>Unobservable selection prop. to observable; B: <math>\propto</math> diffusion of Enlightenment</i>								
<i>Religiosity (late 18th c.)</i>								
Oster's $\beta$ : $\beta_A$	.		108.662*** (23.231)	177.851*** (46.744)	137.266*** (40.275)	134.729*** (34.530)	144.025*** (33.140)	146.608*** (35.575)
Oster's $\beta$ : $\beta_B$	.	.	.	.	103.413*** (37.187)	108.968*** (30.701)	116.009*** (30.675)	110.576*** (33.766)
Oster's $\delta$ : $\delta_A$	.	5.25	1.16	1.51	1.60	1.55	1.54	
Oster's $\delta$ : $\delta_B$	.	.	.	7.06	14.17	37.46	6.57	
Max R-squared		0.52	0.58	0.80	0.90	0.90	0.90	0.90

## 4.4 MECHANISMS AND ALTERNATIVE EXPLANATIONS

**Table 4.4.1:** Mechanisms and alternative explanations: determinants of  $I_g$

*Note:* This table displays the results of the same regression as in Table 4, at different points in time from 1841 to 1901.  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	dep var: Fertility index $I_g$ 1841								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Religiosity (late 18th c.)</i>		0.242*** (0.069)		0.269*** (0.069)	0.357 (0.262)		0.265*** (0.068)	0.319*** (0.112)	0.252*** (0.074)
<b>Panel A: Development</b>									
Population density (1841)	0.002** (0.001)	0.002 (0.001)							0.002 (0.001)
log Urbanization (1841)			-0.016 (0.035)	-0.018 (0.029)	-0.005 (0.046)				-0.015 (0.028)
— × <i>Religiosity (late 18th c.)</i>					-0.033 (0.098)				
<b>Panel B: Enlightenment</b>									
log 1 + <i>SubEnc</i> (1777-1779)						-0.060*** (0.022)	-0.056*** (0.016)	-0.027 (0.051)	-0.053*** (0.019)
— × <i>Religiosity (late 18th c.)</i>								-0.056 (0.093)	
Full set of controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	74	73	74	73	73	74	73	73	73
R-squared	0.63	0.71	0.59	0.70	0.70	0.65	0.75	0.75	0.77

(Panel A) 1841

	dep var: Fertility index $I_g$ 1881								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Religiosity (late 18th c.)</i>		0.301*** (0.077)		0.297*** (0.077)	0.533 (0.379)		0.320*** (0.079)	0.311** (0.129)	0.314*** (0.082)
<b>Panel A: Development</b>									
Population density (1881)	-0.000 (0.000)	0.000 (0.000)							-0.000 (0.000)
log Urbanization (1881)			-0.012 (0.037)	-0.013 (0.033)	0.023 (0.076)				0.010 (0.046)
— × <i>Religiosity (late 18th c.)</i>					-0.078 (0.126)				
<b>Panel B: Enlightenment</b>									
log 1 + <i>SubEnc</i> (1777-1779)						-0.036 (0.027)	-0.045** (0.022)	-0.050 (0.049)	-0.052** (0.024)
— × <i>Religiosity (late 18th c.)</i>								0.009 (0.099)	
Full set of controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	78	77	78	77	77	78	77	77	77
R-squared	0.66	0.74	0.66	0.74	0.75	0.67	0.77	0.77	0.77

(Panel C) 1881

	dep var: Fertility index $I_g$ 1861								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Religiosity (late 18th c.)</i>		0.291*** (0.073)		0.314*** (0.078)	0.319 (0.329)		0.322*** (0.069)	0.395*** (0.081)	0.285*** (0.075)
<b>Panel A: Development</b>									
Population density (1861)	-0.000** (0.000)	-0.000 (0.000)							-0.000 (0.000)
log Urbanization (1861)			0.028 (0.034)	0.003 (0.030)	0.003 (0.059)				0.019 (0.033)
— × <i>Religiosity (late 18th c.)</i>					-0.002 (0.117)				
<b>Panel B: Enlightenment</b>									
log 1 + <i>SubEnc</i> (1777-1779)							-0.049** (0.022)	-0.048*** (0.015)	0.003 (0.042)
— × <i>Religiosity (late 18th c.)</i>								-0.096 (0.074)	-0.054*** (0.016)
Full set of controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80	79	80	79	79	80	79	79	79
R-squared	0.66	0.75	0.63	0.75	0.75	0.66	0.78	0.79	0.79

(Panel B) 1861

	dep var: Fertility index $I_g$ 1901								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Religiosity (late 18th c.)</i>		0.242*** (0.062)		0.228*** (0.059)	0.656* (0.340)		0.253*** (0.061)	0.284*** (0.094)	0.254*** (0.066)
<b>Panel A: Development</b>									
Population density (1901)	-0.000 (0.000)	0.000 (0.000)							-0.000 (0.000)
log Urbanization (1901)			-0.025 (0.030)	-0.023 (0.027)	0.042 (0.057)				0.009 (0.033)
— × <i>Religiosity (late 18th c.)</i>					-0.133 (0.102)				
<b>Panel B: Enlightenment</b>									
log 1 + <i>SubEnc</i> (1777-1779)							-0.029 (0.018)	-0.038** (0.015)	-0.021 (0.035)
— × <i>Religiosity (late 18th c.)</i>								-0.033 (0.071)	-0.040** (0.018)
Full set of controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	78	77	78	77	77	78	77	77	77
R-squared	0.74	0.81	0.75	0.81	0.82	0.76	0.83	0.83	0.83

(Panel D) 1901

**Table 4.4.2:** Mechanisms and alternative explanations: determinants of transition date ( $I_g < .5$ )

*Note:* This table displays the results of the same regression as in Table 4, using the first year with  $I_g < .5$  as a dependent variable.

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

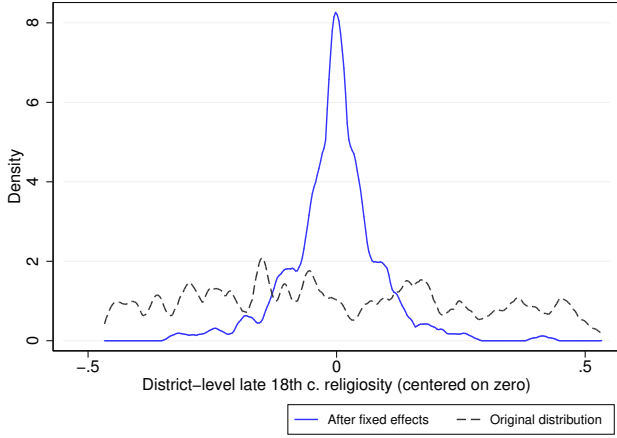
	dep var: First year with fertility index $I_g$ lower than .5								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Religiosity (late 18th c.)</i>		120.460*** (20.165)		121.098*** (20.252)	194.327** (82.636)		117.506*** (18.884)	120.075*** (23.754)	119.806*** (20.819)
<b>Panel A: Development</b>									
Population density (1831)	-0.034 (0.058)	0.027 (0.036)							0.010 (0.028)
log Urbanization (1831)			-5.395 (10.712)	-9.979 (6.972)	2.072 (14.205)				-6.442 (6.523)
— × <i>Religiosity (late 18th c.)</i>					-28.673 (32.130)				
<b>Panel B: Enlightenment</b>									
log 1 + <i>SubEnc</i> (1777-1779)							-16.281*** (6.086)	-14.468*** (4.389)	-12.750 (11.103)
— × <i>Religiosity (late 18th c.)</i>								-3.303 (21.491)	-13.698*** (4.825)
Full set of controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	81	80	79	78	78	81	80	80	78
R-squared	0.48	0.72	0.48	0.73	0.73	0.53	0.76	0.76	0.76

APPENDIX 5— INDIVIDUAL-LEVEL RESULTS

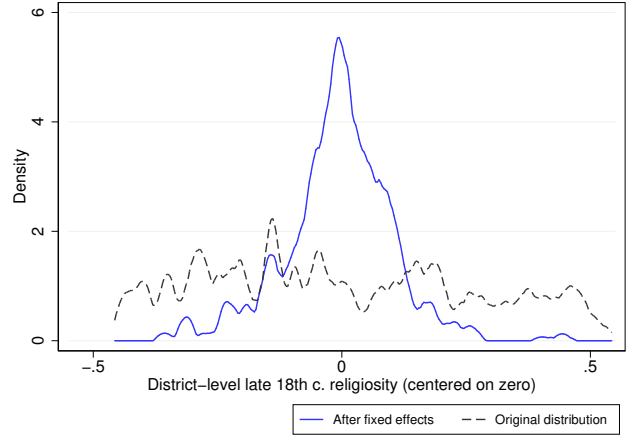
5.1 BASELINE RESULTS

Figure 5.1.1: Treatment distribution with fixed effects

Note: This figure displays the distribution of *Religiosity (late 18th c.)* at the district of birth level, with and without fixed effects. FE include period, *département*, *département* by period, male dummy in Panel A, plus a *fertility sample dummy* in Panel B.



(Panel A) Fertility sample



(Panel B) Full sample

Table 5.1.1: Determinants of fertility at the individual level (full sample)

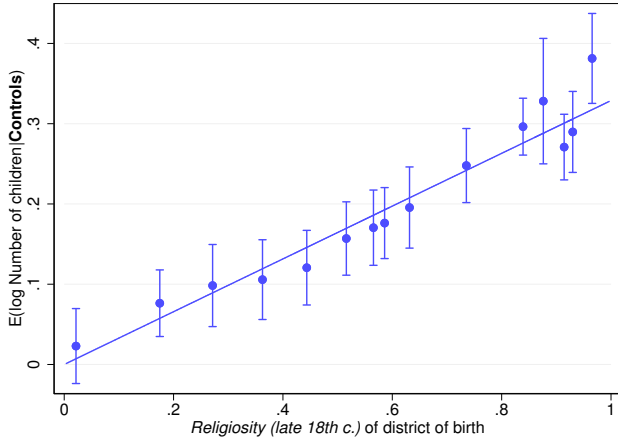
Note: This table displays the results of the same regression as in Table 5, in the full sample. In all specifications, we include a dummy = 1 for observations in the *fertility sample*.  
 \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	<i>dep var:</i> log Number of children						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Religiosity (late 18th c.)</i>	0.152*** (0.058)	0.141*** (0.052)	0.145*** (0.053)	0.149*** (0.054)	0.187** (0.086)	0.169* (0.101)	0.113 (0.115)
_____ × After transition							0.050 (0.149)
<b>Sample</b>							
Observed after demographic transition	Yes	Yes	Yes	Yes	Yes	Yes	
Observed between 1700 and 1900							Yes
<b>Controls</b>							
Individual-level controls		Yes	Yes	Yes	Yes	Yes	Yes
Religiosity (pre-secularization)			Yes	Yes	Yes	Yes	Yes
Development and Enlightenment				Yes	Yes	Yes	Yes
Département of birth fixed effects					Yes	Yes	Yes
Département of birth by period fixed effects						Yes	Yes
Mean of log <i>fert</i>	.73	.73	.73	.73	.73	.73	0
Standard deviation of log <i>fert</i>	.81	.81	.81	.81	.81	.81	.83
Perc. 25-75 <i>Religiosity (late 18th c.)</i>	.08	.07	.08	.08	.10	.09	
Observations (couples)	14,984	14,699	14,699	14,611	14,611	14,611	20,922
Clusters (districts)	492	491	491	489	489	489	494
R-squared	0.12	0.26	0.26	0.26	0.28	0.38	0.39

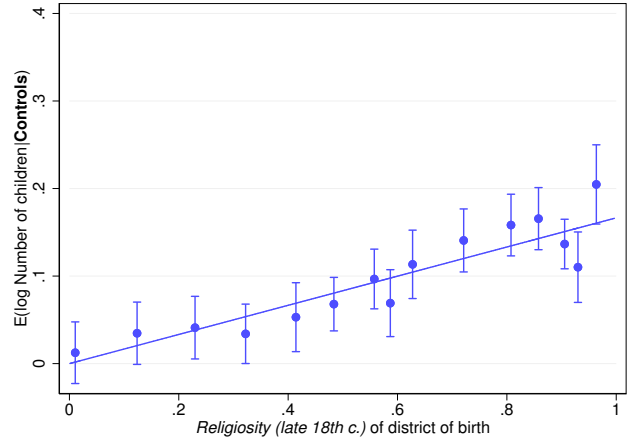


**Figure 5.1.2:** Determinants of fertility at the individual level: binscatter

Note: This figure displays the binscatter of specification (6) in Tables 5 and 5.1.1, partialled-out of the effect of all controls and fixed effects. We use the Stata command *binsreg* (Cattaneo et al., 2019).



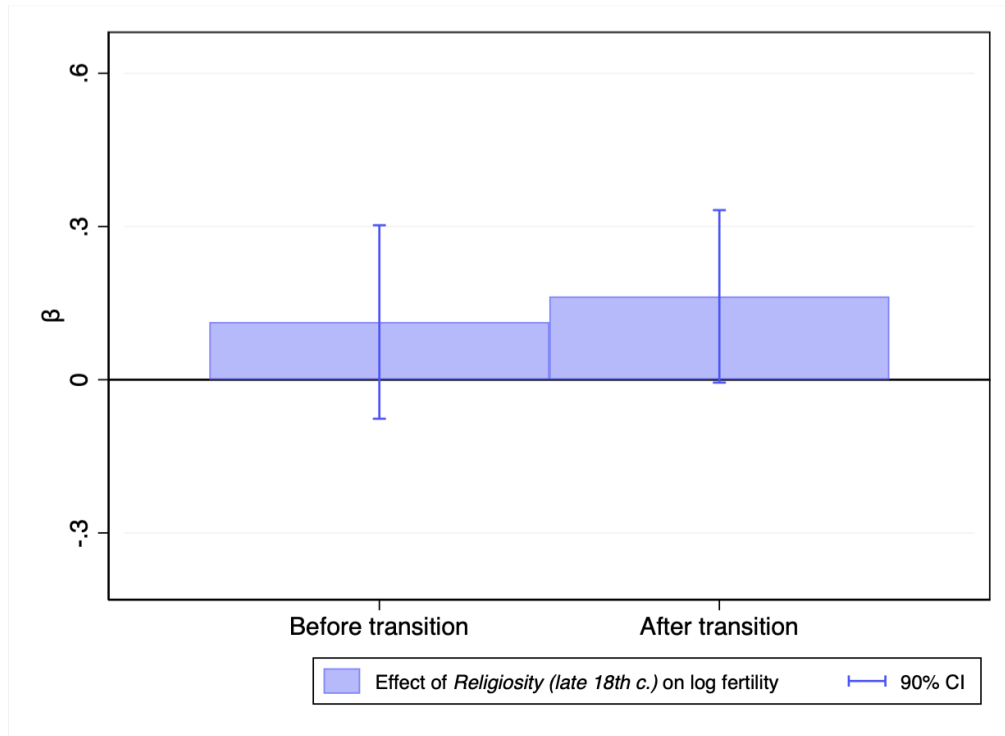
(Panel A) Fertility sample



(Panel B) Full sample

**Figure 5.1.3:** Effect of *Religiosity (late 18th c.)* before and after transition: full sample

Note: This figure displays the estimated coefficients on *Religiosity (late 18th c.)* before and after the transition, from specification (7) of Table 5.1.1.



## 5.2 MIGRANTS AND INTERGENERATIONALLY TRANSMITTED CULTURAL TRAITS

**Table 5.2.1:** Determinants of fertility at the individual level: migrants (fertility sample)

*Note:* This table displays the results of the individual-level regression of the log total number of children ever born on late eighteenth century religiosity. *Religiosity (late 18th c.)* is defined as the share of refractory clergy (non-jurors) in 1791, at the district of birth and marriage level. The migrant sample contains all individuals who migrated between birth and marriage. Individual level controls include a quadratic in the age of marriage and in the log number of children of the individual's parents. Religiosity (pre-secularization) controls include the number of abbeys in 1756 and the duration of Jesuit presence until 1763 (both at the district of marriage level). Development and Enlightenment controls include the urban status of the town of marriage in the year of observation and the log of Encyclopedie subscriptions in 1777 – 1779 at the district of marriage level. All specifications include period fixed effects and a male dummy. We report two-way clustered standard errors (at the couple and district of marriage level). Table 5.2.2 reports the same regressions for the full sample. Figure 5.2.1 displays the estimated coefficient over time from specification (6).  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	<i>dep var:</i> log Number of children				
	(1)	(2)	(3)	(4)	(5)
<i>Religiosity (late 18th c.)</i> of district of marriage	0.427*** (0.129)	0.221*** (0.075)	0.156* (0.088)	0.167 (0.136)	0.387* (0.221)
_____ × Years elapsed since transition					-0.003 (0.003)
<b>Sample</b>					
After demographic transition	Yes	Yes	Yes	Yes	Yes
Migrants only			Yes	Yes	Yes
<b>Controls</b>					
Individual-level controls	Yes	Yes	Yes	Yes	Yes
Religiosity (pre-secularization)	Yes	Yes	Yes	Yes	Yes
Development and Enlightenment	Yes	Yes	Yes	Yes	Yes
Département of marriage fixed effects	Yes				
Département of marriage by period fixed effects	Yes				
District of birth fixed effects		Yes		Yes	Yes
Corr. birth/marriage	0.91	0.91	0.43	0.43	0.43
Observations (couples)	8,002	7,340	1,261	1,261	1,261
Clusters (districts)	401	391	290	290	290
R-squared	0.40	0.28	0.20	0.40	0.40

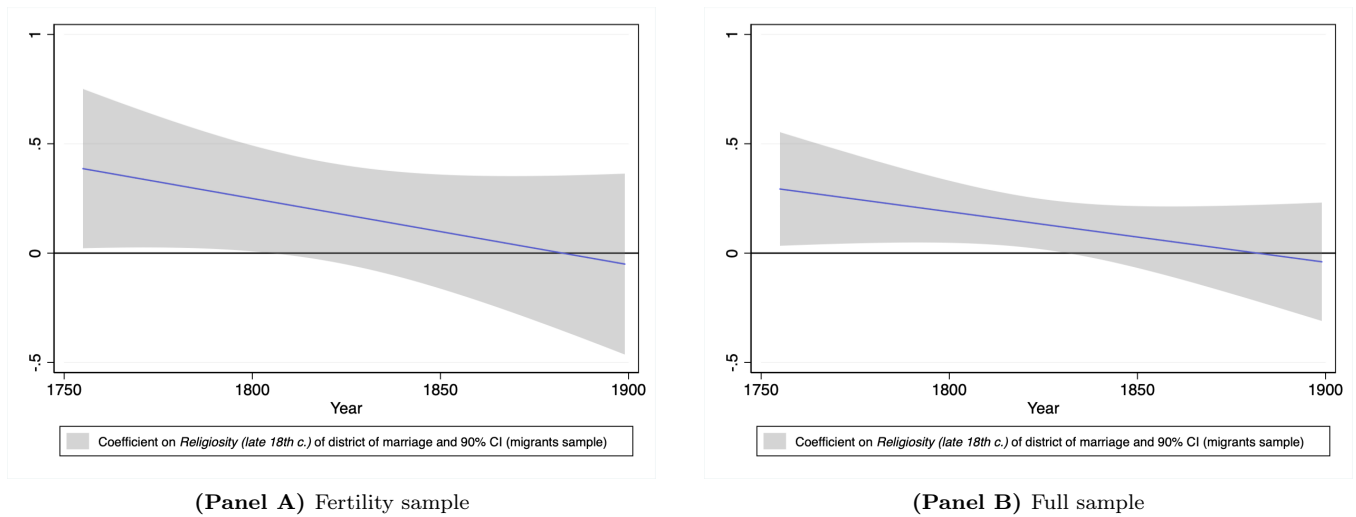
**Table 5.2.2:** Determinants of fertility at the individual level: migrants (full sample)

*Note:* This table displays the results of the same regression as in Table 5.2.1, in the full sample. In all specifications, we include a dummy = 1 for observations in the *fertility sample*.  
 \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	<i>dep var:</i> log Number of children				
	(1)	(2)	(3)	(4)	(5)
<i>Religiosity (late 18th c.)</i> of district of marriage	0.167 (0.106)	0.125*** (0.043)	0.119* (0.067)	0.142** (0.070)	0.293* (0.158)
_____ × Years elapsed since transition					-0.002 (0.002)
<b>Sample</b>					
After demographic transition	Yes	Yes	Yes	Yes	Yes
Migrants only			Yes	Yes	Yes
<b>Controls</b>					
Individual-level controls	Yes	Yes	Yes	Yes	Yes
Religiosity (pre-secularization)	Yes	Yes	Yes	Yes	Yes
Development and Enlightenment	Yes	Yes	Yes	Yes	Yes
Département of marriage fixed effects	Yes				
Département of marriage by period fixed effects	Yes				
District of birth fixed effects		Yes		Yes	Yes
Corr. birth/marriage	0.90	0.90	0.38	0.38	0.38
Observations (couples)	11,766	10,815	2,193	2,193	2,193
Clusters (districts)	457	452	373	373	373
R-squared	0.42	0.33	0.21	0.35	0.35

**Figure 5.2.1:** Determinants of fertility at the individual level: migrants

*Note:* This figure displays the estimated coefficient in specification (6) of Table 5.2.1, that is the coefficient on *Religiosity (late 18th c.)* of the district of marriage, abstracting from district of birth fixed effects (in the migrants sample).



APPENDIX 6— ROOTS OF SECULARIZATION

Table 6.0.1: Summary statistics at the diocese level

Note: All observations weighed by diocese population in 1793.

	Mean	St. dev.	Minimum	Maximum	N
<i>Religiosity (late 18th c.)</i>	0.48	0.25	0.05	0.95	122
log 1 + <i>Jansenists</i> (1716-1725)	2.36	2.04	0.00	7.31	133
Average exposure to N clergymen (1791)	655.10	298.00	290.94	1,615.42	131
Centuries of Jesuit presence (bef. 1763)	1.15	0.76	0.00	2.02	133
Abbayes (1756)	2.19	2.29	0.00	12.00	133
log 1 + Encyclopedie sub. per 10,000 inhabitants (1777-1779)	0.87	0.82	0.00	3.57	133
Population (1793)	318,377.16	210,239.06	20,902.00	1,063,871.00	133
Urbanization (1793)	2.58	0.86	0.00	4.45	133

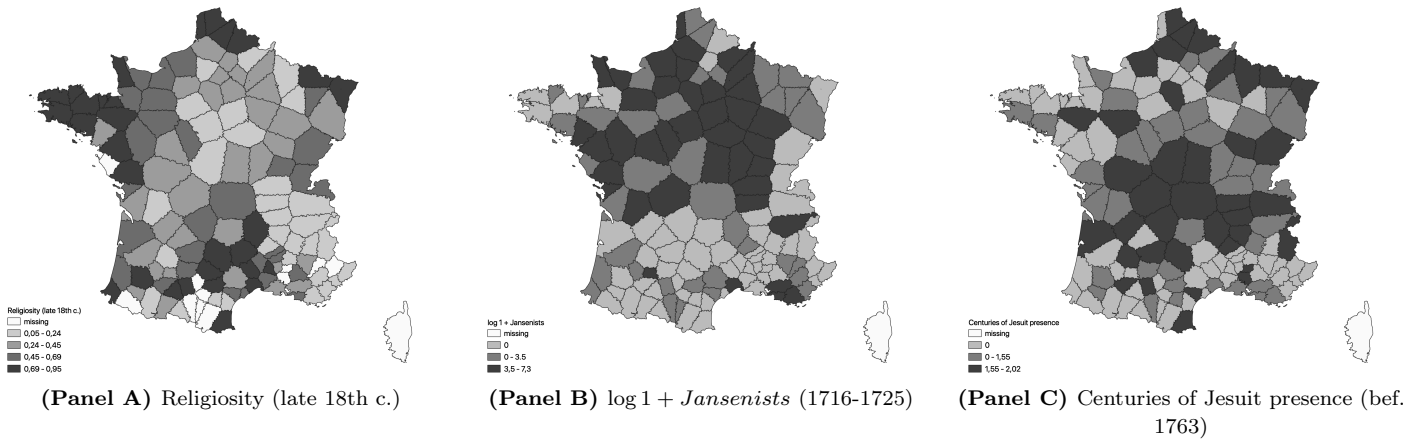
Figure 6.0.1: Dragonnades

Note: "The new missionaries" (1686), engraving by Engelmann. From: Musée Protestant, Geneva



**Figure 6.0.2: Maps**

*Note:* This figure displays the spatial distribution of some variables of interest, at the diocese level.



**Figure 6.0.3: Marginal effect of log 1 + Jansenists**

*Note:* This figure displays the marginal effect of log 1 + Jansenists on religiosity in the late 18th c. This is the same regression as in specification (6) of Table 6, with log 1 + Jansenists interacted with centuries of Jesuit presence before 1763. We display the effect with and without region fixed effects.

