Can Internal Migration Foster the Convergence in Regional Fertility Rates? Evidence from Nineteenth Century France *

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Abstract

This paper offers an explanation for the convergence of fertility rates across French départements in the second half of the nineteenth century that emphasises the diffusion of information through internal migration. It tests how migration affected fertility by building a decennial bilateral migration matrix between French départements for 1861-1911. The identification strategy uses exogenous variation in transportation costs resulting from the construction of railways. The results suggest that the convergence towards low birth rates can be explained by the diffusion of cultural and economic information pertaining to low-fertility behaviour by migrants, especially by migrants to and from Paris.

Keywords: Fertility, France, Demographic Transition, Migration.

JEL Codes: J13, N33, O15

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Most cross-country analyses of the fertility decline, whether they focus on nineteenth century Western Europe or on developing countries in Asia and Africa nowadays (e.g., Murtin, 2013, de Silva and Tenreyro, 2017), rely on national rates of fertility. As a result, they neglect two crucial aspects of the drop in fertility. First, the onset of the fertility decline is usually driven by a few regions within each country; second, the eventual convergence in regional fertility rates towards a countrywide low fertility level is a slow process.[1] Identifying the factors behind the convergence in regional fertility rates within a given country can contribute to our understanding of the evolution of fertility in other contexts and may be of particular relevance for growth-promoting policies in developing countries where fertility rates greatly vary between regions.[2]

This study analyses the convergence in fertility rates in France during the nineteenth century. French birth rates had already declined in the late eighteenth century, but it was only in the second half of the nineteenth century that differences in the fertility rates across French regions began to disappear. Regional fertility rates eventually reached a uniformly low level before WWI (Weir, 1994, Guinnane, 2011, Cummins, 2013). The decline in fertility from 1860 onwards is particularly noteworthy because, as highlighted by Dupâquier (1988) and discussed in more detail below, it did not simply imply a decline in the average fertility rate across French regions, but more importantly, a decline in the variance of the fertility rate.[3]

By focusing on France in the second half of the nineteenth century, this paper investigates whether the progressive convergence of fertility rates within a country may be fostered by the rise in internal migration that conveys preferences, beliefs and information about fertility between regions. This emphasis is motivated by the high rate

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[1] These two aspects of the fertility decline can be observed in countries and circumstances as different as England and France in the eighteenth and nineteenth centuries (Wrigley, 1981, Dupâquier, 1988, Bonneuil 1997) or India after the 1960s (Murthi et al., 1995).

[2] The total fertility rate began to decline in India in the 1960s and was equal to 2.4 in 2012. However, regional fertility rates in 2012 still varied between 1.7 (in Himachal Pradesh, Punjab, Tamil Nadu and West Bengal) and 3.3 in (Uttar Pradesh) (Office of the Registrar General India. 2013, Chap. 3). More generally, although the decline in fertility began in most developing countries in the 1960s, there remain substantial differences between countries within the same world region. Current forecasts suggest that global total fertility rates will only converge to two by 2100 (United Nations Population Division, 2017).

[3] The French fertility pattern is usually viewed as an anomaly in studies dealing with the role of fertility decline in the shift from the "Malthusian equilibrium" to modern economic growth (see, e.g., Galor and Weil, 2000, Lee, 2003, Galor, 2005a, Galor, 2005b, Galor, 2012). This is because France was less urbanised than England or the Netherlands in the eighteenth century and grew at a slower rate than England or Germany during the nineteenth century (Maddison 2001).

of internal migration that characterized nineteenth century France, in contrast to the low rate of French international migration.[4] As such, this study complements previous research on the impact of migratory movements in nineteenth century France which instead focused on the role of migrant networks in marriages (Bonneuil et al., 2008) and wealth transmission (Bourdieu et al., 2000). Moreover, it builds upon research dealing with the quantitative and causal assessment of economic factors on fertility convergence and with the social diffusion of fertility norms (e.g., Becker et al, 2012, Spolaore and Wacziarg, 2014, Murphy, 2015).

The notion that migration may have contributed to the convergence in fertility rates across French regions would be in line with studies that emphasise the impact of migration on economic activities and social networks. For instance, Fernandez and Fogli (2006) and Blau et al. (2011) show that the social norms of the source countries keep affecting the behaviour of second-generation immigrants, notably in matters of fertility. Relatedly, Beine et al. (2013) examine a cross-section of developing and developed countries during the twentieth century and suggest that fertility choices in migrant-sending countries are influenced by diaspora networks that transfer the fertility norms prevailing in the host countries, as conjectured by Fargues (2007) in his comparative study of migration and fertility in Morocco and Egypt. More generally, there is a growing literature documenting the role of migrants in the transmission of preferences, ideas and values (see, e.g., Clinginsmith et al. (2009) on religious attitudes and Spilimbergo (2009), Docquier et al. (2016), Mercier and Chauvet (2014) and Barsbai et al. (2017) on political preferences).[5]

There is currently no agreement about the causes of fertility convergence. There were, of course, changes in the economic conditions which were highlighted by theoretical models of the fertility transition (see, e.g., Lee, 2003, Guinnane, 2011, Galor, 2012, for surveys), e.g., the rise in the demand for human capital which occurred during the second Industrial Revolution, the decline in child mortality or the increase

[4] Few people left France to the New World during the "age of mass migration". See Hatton and Williamson (1998), Hatton (2010), as well as Abramitzky et al. (2013, 2014) and Bandiera et al. (2013) on international migration over the period considered in this paper.

[5] It might also be that the case that internal migration may have contributed to cultural harmonization since it was only in the course of the nineteenth century that France progressively developed a national culture, as reflected by the spread of French at the expense of regional languages (Weber, 1976). Before the nineteenth century, a substantial share of the population did not speak French in regions like Brittany (in the West) or Provence (in the South) and this language barrier reflected further cultural and behavioural differences, including in matters of fertility (see also Braudel, 1986, vol. 1, pp. 88-94).

in life expectancy.[6] In fact, a line of research, following the pioneering efforts of Weir (1983), has tried to provide a quantitative and causal assessment of these economic factors on the French fertility decline (e.g. Cummins 2013, de la Croix and Perrin 2016, Bignon and Garcia-Peñalosa, 2016, Diebolt et al 2017). In particular, the recent studies of Bignon and Garcia-Peñalosa (2016) and Diebolt et al (2017) emphasise the quantity-quality trade-off to explain aspects of the decline in fertility. Whether changes in economic conditions were large enough to explain the convergence in fertility rates across France is an open question.

Another strand of the literature has focused on the diffusion of social norms in explaining the European decline (e.g. Becker et al, 2012, Goldstein and Klüsener, 2014, Spolaore and Wacziarg, 2014) and in France in particular (e.g., Gonzalez-Bailon and Murphy, 2013, Murphy, 2015).[7] This literature emphasises the impact of culture, which is defined as preferences and beliefs previously developed in a different time and place, on current economic behaviour (Fernandez 2007). In this respect, the empirical analyses of Gonzalez-Bailon and Murphy (2013) and Murphy (2015) suggest that social interactions played a role in the diffusion of the fertility decline in France.

Our study focuses on the specific patterns of internal migration between 1861 and 1911 between the French départements, i.e., the administrative divisions of the French territory.[8] For this purpose, it relies on the successive issues of the French Census and on the *Enquête des 3000 familles* (Survey of the 3000 Families) that provides information based on parish registers on the places of birth and death of all the individuals whose last name starts by the three letters "TRA". These two datasets enable us to build a bilateral matrix of inter-départemental migrations for the 1861-1911 period (Bourdelais, 2004, Bourdieu et al., 2004, Dupâquier, 2004) which we combine with the data on département-level fertility computed by Bonneuil (1997). We then assess the migrants' contribution to the demographic transition across France by constructing, for

[6] For studies on the fertility decline and the decline in infant and child mortality, see e.g., Dupâquier and Poussou (1988), Eckstein et al. (1999) and Doepke (2005) for a different view. On the demand for human capital, see e.g., Galor and Weil (2000), Galor and Moav (2002), Hazan and Berdugo (2002), Becker et al. (2010, 2012), Klemp and Weisdorf (2012, forthcoming) and Vogl (2016). On increased life expectancy, see Galor (2012) as well as Hazan (2009) for a different view. On female labour participation, see, e.g., Doepke et al. (2015) and Hazan and Zoabi (2015).

[7] See also David and Sanderson (1987), Fargues (2007), Bertoli and Marchetta (2015), Munshi and Myaux (2006), and specifically La Ferrara et al. (2012) on the role of norms in the fertility transition currently taking place in developing countries.

[8] Départements were designed in 1790 so that it would take at most one day by horse travel to reach the administrative centre of the département from any location in the département. They were thus organised independently of fertility patterns and migratory movements in the eighteenth (and nineteenth) century.

each département, the fertility norms of immigrants and emigrants as weighted averages of the fertility rates in the migrants' origin and destination départements, in line with the approach of Spilimbergo (2007, 2009).

Our identification strategy relies on exogenous variations in the bilateral matrix of travel costs between the French départements that entailed a time- and space-varying decrease in travel costs and had a positive effect on migration.[9] The choice of this instrumental variable is motivated by the historical development of the railroad network which the central government designed to connect Paris, the capital, to the main economic centres of France (Lartilleux, 1950, Caron, 1997). There is indeed substantial anecdotal evidence, which is confirmed by our falsification tests, that the railroad network was developed independently from fertility patterns and migration choices. Still, as in any identification strategy, there are always concerns related to self-selection and the exclusion restriction; we indeed discuss in more detail below why we cannot fully exclude that other factors linked to informational and cultural proximity contributed to the decline in fertility. Nevertheless, our main results are robust to accounting for the diffusion of information from Paris as captured by the diffusion of a sophisticated news magazine within France as well as for the potential confounding effects of factors which are usually related to the fertility decline such as declining child mortality, increased life expectancy, rising education, industrialization and lower religiosity.

Our results show that fertility declined more (i) in areas that had increasingly more emigration, and (ii) whose migrants migrated towards areas with lower and faster decreasing fertility, especially Paris, while (iii) child mortality is the only socio-economic variable which has a significant, albeit limited, effect. The first of these findings is, in itself, counter-intuitive: emigration should have, all else equal, increased, and not decreased, the fertility in home regions through self-selection and an increase in the land-to-labor ratio (Livi-Bacci, 2012). The counteracting (and dominating) effect which we envision is in line with a ‘social remittances’ argument, whereby emigrants who moved from high- to low-fertility areas transmitted cultural and economic information about fertility norms and the cost of raising children in the regions where they had settled to the inhabitants of the regions where they came from. This

[9] In addition to fostering long-term and permanent migration, the development of the railroad network might also have fostered short-term migration. However, it is not clear whether patterns of fertility decline can be attributed to short-term migration, which had existed in France since the end of the Middle Ages and was motivated by the need for a temporary workforce during harvests. In fact, Châtelain (1976) documents that short-term migration began to decline in the second half of the nineteenth century, when long-term and permanent migration became more common.

information might have been then taken into account by actual and would-be emigrants, thus explaining why we find that départements with a larger share of emigrants experienced a larger drop in fertility. This interpretation is consistent with the second of our findings, namely that the drop in fertility was stronger in départements whose emigrants moved to destinations with lower and faster decreasing fertility. It is also supported by our counterfactual analysis which shows that emigration to Paris, which accounted for 26.33% of the total number of French internal emigrants between 1861 and 1911, explains 36.4% of the national decline in fertility, in line with the economic, political and cultural importance of Paris within France.

1. Data

Appendix Table A1 provides descriptive statistics for our main variables. They are measured at the département-level and cover the 1861-1911 period. Because of changes in its borders between 1815 and 1914, France had 87 départements before 1860, 90 between 1860 and 1871, and 87 after 1871. However, we restrict, for simplicity, our analysis to the 81 départements which were part of France throughout the 1815-1914 period and for which we have a complete dataset on fertility and migration.

1.1 Fertility Rates

We measure fertility rates in each French département for every decade between 1861 and 1911. Specifically we use data from Bonneuil (1997) who provides values of the Coale (1969) Fertility Index in each département from 1806 to 1906 and which we extend to 1911 using data from the 1911 French census. The Coale Fertility Index controls for the demographic structure of the female population. It is based on the fertility levels of the Hutterites, a strict religious group in Northern America with a very high level of fertility. A childless population would have a Coale Fertility Index equal to zero and a population with the fertility rate of the Hutterites would have a Coale Fertility Index equal to one.

The Coale Fertility Index f is defined as:

$$f = (\sum_k F_k^t . W_k^t)/(\sum_k H_k . W_k^t) \qquad (1)$$

where W_k^t is the number of women in age group k in year t, F_k^t is the rate of childbearing among women in the k^{th} age interval in year t and H_k represents the fertility rates observed for the Hutterites. In other words, the Coale Fertility Index f is the ratio of the number of observed births to the number of births if all women had Hutterite fertility.

It must be noted that the Coale Fertility Index computed by Bonneuil (1997) is a modified version of the standard Coale Fertility Index because it includes the fertility of all women and is not restricted to the fertility of married women. Moreover Bonneuil

(1997)'s data are free of the computational mistakes made by Coale and Watkins (1986) and highlighted by Wetherell (2001). In any case, to assuage concerns regarding the measurement issues associated with the Coale Fertility Index, we will report additional regression results using the Crude Birth Rate, which is computed as the number of births divided by the population in each département. While the Crude Birth Rate is undoubtedly less subject to potential biases than other fertility measures, it is also a less precise measure of fertility than the Coale Fertility Index (see, e.g., de la Croix and Perrin, 2016 for a discussion with a perspective that differs from ours on the Coale Fertility Index and the Crude Birth Rate).[10]

Bonneuil (1997) shows that, at the start of the nineteenth century, there were substantial differences in the fertility rates of the various départements that, presumably, reflected cultural and socioeconomic diversity within France (Weber, 1976, Braudel, 1986). In 1806, some départements already had low fertility rates: the Coale Fertility Index of *Calvados* (in the North-West of France, in the valley of the Seine River) was equal to 0.246 while that of *Lot-et-Garonne* (in the South-West in the valley of the Garonne River) was equal to 0.313. Conversely, the Coale Fertility Index of *Seine* (which comprised Paris and its immediate suburbs) was equal to 0.436 in 1806 but had already declined to 0.281 in 1851. In fact, the fertility of the average département declined from 0.408 in 1806 to 0.310 in 1851 while the standard deviation went from 0.107 in 1806 (26% of the mean) to 0.074 in 1851 (24% of the mean). This means that the decline in fertility during that period was relatively uniform across French départements, without any substantial convergence. It is noteworthy, therefore, that Paris and its surroundings experienced a much more pronounced fertility decline than the other départements (from slightly above average until 1851 to below average afterwards). Moreover, and even if it is beyond the scope of this study to explain the low fertility of départements located in the Garonne and Seine valleys at the start of the nineteenth century, we can nonetheless surmise that the navigability of the rivers in those valleys might have contributed to a lower level of fertility compared to neighbouring départements. When the railroad that connected Paris to the rest of the country provided the main source of decline in transport costs, the fertility decline accelerated in Paris, and it soon influenced the rest of France.

Indeed, it was only in the second half of the nineteenth century that regional differences in fertility disappeared: the average Coale fertility index of the French départements decreased from 0.310 in 1851 to 0.244 in 1911 while its standard

[10] In each year of the sample, the correlation between the Crude Birth Rate and the Coale Fertility Index is lower than 0.65.

deviation dropped from 0.074 (24% of the mean) to 0.038 (16% of the mean). This decline and convergence in the fertility levels of the French départements between 1861 and 1911 can be observed in the histogram in Figure 1 and the maps of the fertility rate in France in Figures 2 and 3.[11] In particular, in Figure 2, we classify the départements using the 25th, 50th and 75th percentiles of fertility in 1861. In so doing, we show that in Figure 2, the three lowest quartiles in 1861 include 20 départements while the highest one has 21 départements. However, in 1911, no département has a fertility rate which would have put it in the highest quartile in 1861. Furthermore, only five départements in 1911 have a fertility rate between the median and the 75th percentile in 1861 and only 15 départements are between the 25th percentile and the median. In fact, the fertility of most départements in 1911 is below the 25th percentile in 1861.

Another way of looking at fertility convergence is to examine the maps of the fertility rates in France between 1861 and 1911 in Figure 3. In each map for each year, we create bounds to classify départements into three groups: the lower bound is equal to 80 percent of the fertility rate for that year while the upper bound is equal to 120 percent of the average fertility rate for that year. The maps show that the number of départements in the two intervals away from the mean declined between 1861 and 1911, showing a convergence in the fertility rate across France. There were 11 départements in the lower interval and 16 in the upper interval in 1861 but only five in the lower interval and 12 in the upper interval in 1911.

Finally, we provide additional support for the unconditional convergence in regional fertility rates within France during the nineteenth century in the Appendix. Using the Coale Fertility Index and the Crude Birth Rate, we report in Appendix Tables B1-B3 standard unconditional convergence regressions (Barro and Sala-i-Martin, 1992) to show that the unconditional convergence in regional rates occurred in France but not in England & Wales, Germany or Italy before WWI.

1.2 Migration in Nineteenth Century France

Our data on emigrants from, and immigrants to, each French département between 1861 and 1911 stem from the TRA dataset, also known as the *Enquête des 3000 familles* (Survey of the 3000 Families). Using the data on the département-level number of individuals born in another département from the successive censuses of the French population, we compute the number of emigrants from each département using exclusively these census data. We then employ the Iterative Proportional Fitting Procedure (also known as the RAS algorithm) to estimate bilateral migrant stocks.

[11] This convergence is not explained by a general decline of fertility bounded by zero and can still be observed when the logarithm of the fertility rate is considered.

There may be concerns with the representativeness of the TRA dataset since it only provides information on the place of birth and death of all individuals whose surnames start by the three letters "TRA" (Blanchet and Kessler, 1992, Bourdelais, 2004, Dupâquier, 2004). In the Appendix, we show that we can reconstruct the geography of internal migration in France from the TRA data to the whole French population at the département level for the 1891-1911 period (for which the two datasets overlap) so as to alleviate concerns regarding the representativeness of the TRA dataset.[12]

The data enable us to compute bilateral migration stocks which are defined as the number of people born in département i and living in département j in year t. They show that migrants moved from rural to urban areas as can be seen in Figure 4, where we graph the migration patterns in France in 1891.[13] Many migrants moved to the closest industrial city, e.g., Lille in the North of France or Marseille in the South.[14] However, Paris attracted migrants from all over the country. Overall, the descriptive statistics Appendix Table A1 indicate that 17.3% of the French population lived outside their département of origin over the 1861-1911 period.[15] Figures 5 and 6 show the evolution in the shares of the stock of emigrants and immigrants between 1861 and 1911, and highlight the general increase in migration throughout the second half of the nineteenth century by classifying the share of emigrants and immigrants in each département using the 25th, 50th and 75th percentiles in 1861 for all the years in our sample. Figure 5 illustrates the rise in the share of emigrants in our sample since all but one département in 1911 were in the highest quartile in the 1861 distribution of the share of emigrants. A comparable increase in the share of immigrants over the 1861-1911 period can be observed in Figure 6.

The TRA dataset enables us to distinguish between male and female migrant stocks. At this stage, it is worth noting that the pattern of male and female migration is

[12]Abramitzky et al. (2011) show that the TRA dataset is representative of the whole French population in their assessment of nuptiality patterns.

[13] Cairncross (1949) and Baines and Woods (2004) document a similar pattern for for Great Britain.

[14] The main consequence of the development of the railroad network was that more people travelled. This is in line with the migration patterns which suggest that people moved to the closest industrial centres. However, to the best of our knowledge, there is no anecdotal evidence that people travelled longer distances on average. For instance, the development of the railroad progressively enabled more people travelled to touristic resorts by the turn of the twentieth century. These tourists usually vacationed in the touristic resorts which were closest to their home and/or those which were already popular among the richest segments of the population in the 1850s and 1860s (Blancheton and Marchi, 2011).

[15] For the sake of comparison, we can turn to the data compiled by Baines (1985) on internal migration within England and Wales between 1861 and 1900. His study suggests that the average percentage of emigrants from one county to another was around 10%.

not the same in our dataset, in line with some anecdotal evidence that men moved to become workers in industrial zones in rural areas (notably in the mining sector) while women moved to work as maids in cities (e.g., Dupâquier and Kessler, 1992). Indeed, if the patterns of migration between men and women were identical, then the correlation between the stocks of male and female migrants would be equal to one. However, our data indicate that the correlation between the stocks of male and female migrants was equal to 0.55 in 1861, 0.60 in 1871, 0.56 in 1881, 0.56 in 1891, 0.60 in 1901 and 0.59 in 1911. Such figures lead us to assess below whether male and female migration had similar or dissimilar effects on the decline in fertility.

In addition, it must be noted that the census provides in 1891, 1901 and 1911 bilateral migration data on all French nationals, i.e., the number of French nationals living in each département according to their département of origin. It also provides information on the gender of these migrants in 1901 and 1911. But since these data only cover the turn of the twentieth century, after most of the decline in fertility occurred, they can only be used as part of a robustness check.

Finally, it must be acknowledged that our study does not account for international migration for two reasons. First, the annual mean French gross emigration rate from 1860 to 1913 was low: there were only 0.18 international emigrants per 1000 inhabitants (including to French colonies and in particular to Algeria), compared to 9.25 for Italy, 4.61 for Great Britain and 1.5 for Germany (Hatton and Williamson, 1998). Second, foreign immigration to France was limited, only amounting to 2.9% of the total population in 1911 (Dupâquier and Poussou, 1995). Hence, international migration in and out France was low and did not prevent the decline and convergence of fertility rates within the country.

1.3 Economic and Social Characteristics of the Départements

In our empirical analysis, we control for the socio-economic factors which might have contributed to the convergence in fertility rates in France in the second half of the nineteenth century.

1.3.1 Life expectancy and infant mortality

We use Bonneuil (1997)'s computations of life expectancy at age 15 for the individuals living in each département during the 1806-1906 period which we extend to 1911 by using data from the French census. We also rely on the successive issues of the French census to compute infant mortality, which we define as the share of children who died before age one over the total number of births.

1.3.2 Education and religiosity

The regressions account for the potential effects of education on fertility. For this purpose, we compute the shares of the male and female population age five to 19 enrolled in primary and secondary schools using the data in the successive issues of the *Statistique de l'enseignement primaire* and of the French censuses. The rationale for constructing this variable, as opposed to two variables which would separately account for primary and secondary school attendance, pertains to the laws passed in 1881 and 1882 which made primary school attendance mandatory until the age of 13 and state-funded schools tuition-free and secular. In other words, after 1881-1882, primary school attendance was nearly the same across départements and close to 100% so that differences in school enrolment rates stemmed from differences in secondary school enrolment. Therefore, we consider school attendance between age five and 19 to get a better sense of educational achievements in France during the 1861-1911 period.

Moreover, education may be correlated with religiosity. Therefore, to assess the confounding effects of religious observance on fertility we collect data from the French census to compute the share of male and female children enrolled in Catholic (i.e., private) primary and secondary schools, as opposed to those studying in secular state-funded primary and secondary schools.[16]

In our regressions, we consider that the effect of schooling, and especially primary education (children aged 6-13) in Catholic schools, on fertility should be observed with a delay. This leads us to include the schooling variables with a 10-year lag in our regressions.[17]

1.3.3. Diffusion of information

Our regressions take into account the confounding effects of the diffusion of information across départements. It could indeed be surmised that the diffusion of low fertility norms did not only occur through migration, but also through other channels, notably the diffusion of newspapers and books.[18]

[16] Since data on actual church attendance is unavailable for the 1861-1911 period, we use a measure of school choice, which is very often motivated by religious observance (e.g., Cohen-Zada, 2006). However, it is not a priori clear whether the decline in religiosity was connected to the decline in fertility in France. Départements such as *Côtes du Nord* and *Nord* experienced a decline in fertility during the nineteenth century but remained staunchly Catholic until WWI and notably elected representatives who opposed the separation of Church and State in 1905 (Franck, 2010).

[17] It must be noted that after 1905, there is no governmental data on secular and Catholic schools but only on public and private schools. However, after 1905 and specifically after 1911, nearly all of the private schools were Catholic institutions (Franck and Johnson, 2016).

[18] Newspapers and books are high value-to-weight whose dissemination across France between 1851 and 1911 was more likely to be influenced by changes in the availability of transport rather than by changes in transportation costs. On the diffusion of newspapers and, in particular, on the importance of regional newspapers outside Paris, see, e.g., Manevy (1955), Bellanger (1969) and Albert (1972).

To account for this potential channel, we focus on the diffusion of the bimonthly "Revue des Deux Mondes", a sophisticated news magazine which was founded in 1829 and is still in print today (for a history of the review, see de Broglie, 1979). Specifically we use the information printed on the back cover of the successive issues of the "Revue des Deux Mondes" that list the town (and address) in each French département of the newsstands and bookshops which sold the review.[19] In addition to the number of outlets selling the "Revue des Deux Mondes", we include in our regressions an interaction term between the number of outlets and the fertility of the Seine département: this interaction variable is meant to account for the specific, and potentially larger, effect that Paris would have on the fertility decline and on the diffusion of ideas since the "Revue des Deux Mondes" was printed in Paris.

1.3.4 Workforce and urbanization

Our regressions account for the confounding effects of changes in the workforce in the nineteenth century, characterised by the decline in the agricultural sector and the growth of the industry, as well as of urbanization, on fertility. For this purpose, we use the successive issues of the French census to compute the shares of the workforce in the industrial and service sectors (the control group is the workforce in the agricultural sector) as well as the share of the population living in urban areas (the control group is the population in the rural areas).

2. Empirical methodology

2.1 Baseline Model

We estimate the impact of changing migration patterns on fertility within each département across time with the following equation:

$$\log(f_{i,t}) = a_1.\log(ERFN_{i,t}) + a_2.log(em_{i,t}) + a_3.log(em_{i,t}).\log(ERFN_{i,t}) + a_4.\log(IBFN_{i,t}) + a_5.log(im_{i,t}) + a_6.log(im_{i,t}).\log(IBFN_{i,t}) + b.\log(X_{i,t}) + \alpha_i + \alpha_t + \varepsilon_{i,t} \quad (2)$$

where $f_{i,t}$ is the fertility rate in département *i* in year *t*, $X_{i,t}$ is a vector of socio-economic variables in département *i* in year *t*, α_i and α_t are département- and year-fixed effects, $\varepsilon_{i,t}$ is an error term such that $\varepsilon_{i,t} \longrightarrow \mathcal{N}(0, \sigma^2)$.

[19] Data on subscriptions for the "Revue des Deux Mondes" are not available for the whole 1861-1911 period. Moreover, to the best of our knowledge, there is no systematic data on the subscriptions to the only daily newspaper published in Paris throughout our sample period, namely, "Le Temps". There are also no comprehensive data on book circulation between Paris and the rest of France.

The fertility norms of immigrants and emigrants are defined in line with Spilimbergo (2009) as weighted averages of the fertility rates in the migrants' origin/destination département such that

$$ERFN_{i,t} = \left(\sum_{j\neq i} M_{ij,t} . f_{j,t}\right) / \left(\sum_{j\neq i} M_{ij,t}\right) \quad (3)$$

where ERFN is the emigrants' residence fertility norm and $M_{ij,t}$ is the number of people born in département i living in département j at time t, $f_{j,t}$ is the fertility rate of *département j* at time t, and

$$IBFN_{i,t} = \left(\sum_{j\neq i} M_{ji,t} . f_{j,t}\right) / \left(\sum_{j\neq i} M_{ji,t}\right) \quad (4)$$

where IBFN is the immigrants' birthplace fertility norm.

In addition, let $P_{i,t}$ be the population of département i at time t.[20] We define the share of emigrants, $em_{i,t}$, in proportion of the population of département i at time t,

$$em_{i,t} = \left(\sum_{j\neq i} M_{ij,t}\right) / P_{i,t} \quad (5)$$

and the share of immigrants, $im_{i,t}$, among inhabitants of département i at time t, as

$$im_{i,t} = \left(\sum_{j\neq i} M_{ji,t}\right) / P_{i,t} \ . \quad (6)$$

Before presenting our identification strategy in the next sub-section, it is necessary to briefly discuss the methodological issues raised by the estimation of the determinants of the fertility convergence in nineteenth century France which explain the specification of our main regression in Equation (2): we need to take into account the empirical literature dealing with the estimation of the fertility decline (Brown and Guinnane, 2007, Guinnane, 2011) and research focusing on convergence in growth rates in across countries and regions (see, e.g., Magrini, 2004, Durlauf et al., 2005, and Breinlich et al, 2014, for surveys). First, in line with the criticisms of Brown and Guinnane (2007) and Guinnane (2011) vis-à-vis the empirical approach of Coale and Watkins (1986)'s analysis of the European fertility decline, we include interaction terms between the fertility norms and the shares of emigrants and immigrants to check whether the intensity of the diffusion is larger where there are more migrants. We also include département and time fixed effects to correct for unobserved heterogeneity between départements and time periods.

Second, as the empirical literature on regional growth and convergence makes it clear (e.g., Magrini, 2004), there is no standard estimation model of regional convergence. Therefore it is a priori unclear whether we should specify our main equation in first differences or in levels, and whether we should include a lagged dependent variable and/or lagged explanatory variables to account for the potential

[20] The population $P_{i,t}$ of département i at time t is restricted to the population of the population born in the 81 département which are part of France throughout our sample period.

delayed effects of economic changes. In Equation (2), we use a regression equation specified in levels. This is because our additional regressions, which are presented as robustness checks in Tables 7 and 8, suggest that the inclusion of a lagged dependent variable does not modify our main results while those in Tables 9 and 10 indicate that the specifications which account for lagged explanatory variables are not informative.

These methodological issues have two main implications for the general interpretation of the results. On the one hand, the model hypothesises that French départements experienced a conditional (and not absolute) convergence of fertility rates as the decline in fertility depended on the characteristics of each département. On the other hand, the specification in levels implies that départements were distributed randomly around their steady states of fertility over our sample period. While the first implication is probably uncontroversial, the second is slightly more debatable, although there is little evidence to show that it is incorrect.

2.2 Identification Strategy

Concerns regarding the identification of Equation (2) naturally arise. This is because the relationship between migration and fertility might be explained by the preference for low fertility norms of self-selected migrants or might be driven by omitted variables linked to the timing of migration.

However, it is worth noting that reverse causality may only be an issue if migrants are self-selected on preferences for fertility and choose their destination accordingly.[21] Individuals living in a low- (respectively, high-) fertility département who have preferences for large (small) families may have found it beneficial to migrate to a high- (low-) fertility département where their own preferences are more in line with the prevailing norms in terms of family size. However, this would have not contributed to a convergence but to a divergence in the fertility rate across départements. As such, reverse causality and the self-selection of emigrants would imply that our OLS coefficients underestimate the actual effect of migration on the fertility decline.

Still, we could hypothesise that, when high-skilled workers with a low preference for children leave high-fertility regions to low-fertility regions, they create a void of high-skilled individuals in their home regions which provide incentives for non-migrant parents to invest more in the quality of children and reduce fertility. However, this mechanism is unlikely to drive our main results since the percentage of high-skilled individuals (i.e., lawyers, doctors, etc…) in our sample period is only equal to 2.7%.

[21] Home fertility is well recognised as a push factor of international migration but fertility at destination is not thought to be a significant pull factor (Mayda, 2010).

2.2.1. First-stage equation

To identify Equation (2), we use changes in travel costs arising from the progressive development of the railroad network within France as an instrumental variable. This identification strategy is motivated by the fact that relative travel costs were time-varying from 1840 to 1890, as the railroad network was gradually built throughout the country. A decrease in travel costs should therefore lower the costs of migration and increase the stock of migrants. Indeed, transport costs were substantial enough to matter. Even in 1901, the cheapest train ticket (in third class) between Paris and Lyon (approximately 450 km) cost three days of a Parisian worker's wages and five days of a provincial one. A coach ticket was three times as expensive. In 1872, these numbers would have been six and ten and a half days (France - *Statistique des salaires*, 1901).[22]

Our first stage regression estimates a panel gravity model with the standard Poisson Pseudo Maximum Likelihood that solves for heteroskedasticity and for the existence of zero migrant stocks (Santos Silva and Tenreyro, 2006):

$$\log(M_{ij,t}) = a + b.\log(transport\ costs_{t-20}) + c.\log(transport\ costs_{t-30}) + \beta_t + \beta_o + \beta_d + u,\ \forall\, i,j,t, i \neq j \quad (7)$$

where $M_{ij,t}$ are the migrant stocks, $transport\ costs_{t-20}$ and $transport\ costs_{t-30}$ are the 20- and 30-year lagged transport costs while β_t, β_o and β_d are the year-, origin-département and destination-département fixed effects. The transport cost variable is therefore our main instrument: its construction and the choice of the lags in Equation (7) necessitate some detailed explanation which we provide below in sub-section 3.2.2.

Once we computed the predicted migrant stocks $\widehat{M}_{ij,t}$ in Equation (7), we can compute the predicted population $\widehat{P}_{i,t}$ of département *i* at time *t* such that

$$\widehat{P}_{it} = M_{ii,t} + \sum_{j \neq i} \widehat{M}_{ji,t} \quad (8)$$

where $M_{ii,t}$ is the number of people born in département *i* and living in département *i* in year t, i.e., the "stayers".

We can then compute the predicted emigrants' residence fertility norm $\widehat{ERFN}_{i,t}$

$$\widehat{ERFN}_{i,t} = \left(\sum_{j \neq i} \widehat{M}_{ij,t}.f_{j,t}\right) / \left(\sum_{j \neq i} \widehat{M}_{ij,t}\right) \quad (9)$$

where $f_{j,t}$ is the fertility rate of *département j* at time *t*, as defined above.

Furthermore, we compute the predicted immigrants' birthplace fertility norm $\widehat{IBFN}_{i,t}$

$$\widehat{IBFN}_{i,t} = \left(\sum_{j \neq i} \widehat{M}_{ji,t}.f_{j,t}\right) / \left(\sum_{j \neq i} \widehat{M}_{ji,t}\right) \quad (10)$$

the predicted share of emigrants $\widehat{em}_{i,t}$ in proportion of the population of département *i*

[22] For the sake of comparison, the cheapest ticket was worth five hours of the net minimum wage in 2012.

$$\widehat{em}_{i,t} = \left(\sum_{j \neq i} \widehat{M}_{ij,t}\right) / \hat{P}_{i,t} \tag{11}$$

and the predicted share of immigrants $\widehat{im}_{i,t}$ among inhabitants of département *i* as

$$\widehat{im}_{i,t} = \left(\sum_{j \neq i} \widehat{M}_{ji,t}\right) / \hat{P}_{i,t} \tag{12}$$

We then use these predicted variables in Equation (2) to obtain IV estimates of the effect of migration on the fertility decline.

We report three series of tests to assuage concerns regarding the validity of our instruments. First, we show in Table 1 correlations between each underlying regressor and its instrumented counterparts. These correlations are all very high (above 0.82), thereby suggesting that our instruments are not weak. We also show in Appendix Table A2 that each underlying regressor is positively and significantly correlated at the 1% level with its instrumented counterpart in OLS regressions with year- and department fixed effects. Second we report a first stage F-statistic of weak instruments and third, a test of over-identification. Since our first stage equation in Eq. (7) estimates a panel gravity model with the standard Poisson Pseudo Maximum Likelihood that solves for heteroskedasticity and for the existence of zero migrant stocks (and not a standard 2SLS model), our instruments do not have the same dimension as our instrumented variables. Therefore, the computation of these last two tests requires a brief explanation.

First, the standard Poisson Pseudo Maximum Likelihood model does not directly provide a F-statistic, but instead a statistic based on the χ^2 distribution. Therefore the first-stage F-statistic which we report is based on the notion that the χ^2 distribution is the limiting distribution of the F-statistic (see Greene, 2012, pp.1023-1024). In this case, the denominator of the F-statistic converges to one and we can compute the F-statistic such that

$$\text{F-statistic} = \chi^2 / k. \tag{13}$$

where *k* is the degrees of freedom in the numerator of the F-statistic.

Second, we report an over-identification test since our first stage regression in Equation (7) uses two instruments. For this purpose, we run the following regression

$$\varepsilon_{i,t} = \gamma_0 + \gamma_1 . \overline{transport\ costs_{\iota,t-20}} + \gamma_2 . \overline{transport\ costs_{\iota,t-30}} \tag{14}$$

where the dependent variable is the error term $\varepsilon_{i,t}$ in Equation (2) and the explanatory variables are the average yearly values of *transports costs* in t-20 and t-30 in Equation (7). We use the average values of the *transports costs* variable in each origin département to run Equation (14) because *transports costs* is defined in Equation (7) as a matrix of costs between the départements so that its dimension is not that of $\varepsilon_{i,t}$.

We obtain a test for the validity of the over-identification restrictions (see, e.g., Davidson and MacKinnon, 2004, pp. 336-338; Wooldridge, 2010, pp.134-137) by testing the null hypothesis that

$$\text{H0: } \mathrm{E}\{\varepsilon_{i,t}, [\overline{transport\ costs_{\iota,t-20}}, \overline{transport\ costs_{\iota,t-30}}]\} = 0 \quad (15)$$

We then compute the statistic $NR^2 \sim \chi^2(q)$, where N is the number of observations in the sample, R^2 is the coefficient of determination of Equation (14), and q is the number of over-identifying restrictions. In Equation (14), q equals 1 so that the critical value of the test $\chi^2(1)$ is 2.71 at the 10% level, 3.84 at the 5% level, and 6.63 at the 1% level.

2.2.2. Construction and validity of the instrumental variable

We construct our instrumental variable *transport costs,* which assess the bilateral time-varying transport costs between départements, in a four-step procedure. First, we compute the great-circle distance between the administrative centres (*chef-lieu*) of adjacent départements. Second, we determine the available travel (railroad, road, sea) links between adjacent départements every ten years, accounting for the progressive development of the railroad network using Caron (1997)'s maps which we reproduce in the Appendix. Third, we use information on road or rail transport price per kilometer to compute travel cost between adjacent départements for all the years in our sample. This is possible because rail prices for passengers were regulated by the State. As such, in every year in our sample, the price of a train ticket was equal to a given amount times the distance between two train stations (Toutain, 1967, p. 277). Fourth, we apply a short-route finding algorithm taken from the UCINET network analysis program (Borgatti et al., 2006) to compute the cheapest route between every pair of *départements*. In so doing, we obtain a bilateral matrix of transport costs between every pair of *départements* every decade in our sample.

Let us illustrate those four steps with an example where we compute travel costs between the towns of Tours and Poitiers, which are located in the adjacent départements of Indre-et-Loire and Vienne. In the first stage, we determine that the great circle distance between Tours and Poitiers is equal to 93 km. In the second stage, we rely on the historical evidence that the railroad network linked Tours to Poitiers in 1851. As such, we consider that migrants would travel between Tours and Poitiers by road until 1851 and by railroad afterwards. For the third stage, we follow the cost of travel given by Toutain (1967) in Table 6 (for rail travels) and Table 16 (for road travels): his computations indicate that travel by road cost 0.125 French Francs per km in 1850 while travel by rail cost 0.067 French Francs per km in 1851 and 0.063 French Francs per km in 1860. Hence, the travel cost between Tours and Poitiers declined from 11.63 French Francs in 1850 to 6.23 French Francs in 1851 and 5.86 French Francs in 1860 after the train line between these two towns was opened. Fourth, we apply the short-route finding algorithm. Between two adjacent départements such as Indre-et-Loire and Vienne, the cheapest route is always the same and only the opening of the railroad entails a decline in travel costs. However, between towns in départements which are not adjacent, the cheapest route can change with the opening of the railroad network. For instance, between Troyes in the Aube département and Orléans in the Loiret département, the cheapest route was that of the road and was nearly a straight line which went through Auxerre (Yonne) and avoided the Parisian region. But after both départements were linked by the railroad in the 1870s, the cheapest route between Troyes and Orléans was that of the trains going through Melun (Seine-et-Marne), Paris (Seine) and Versailles (Seine-et-Oise).

Moreover, to estimate the impact of transport costs on the stock of migrants, we should ideally know the average age at which migrants left their home département so as to relate it to the timing of the decline in bilateral transport costs. However, the TRA dataset does not provide the age at which migrants moved from their home to their destination département but only the mean age of the stock of migrants. Specifically, the data indicate that migrants were on average 38 years old in 1861, 40 in 1871, 41 in 1881, 43 in 1891, 45 in 1901 and 50 in 1911. Still, there is anecdotal evidence pertaining to migration in the nineteenth century (e.g. Rosental, 1999) which suggests that the median migration age was around 20 years old: it was not only adults who left their home département, but also teenagers who sought work in factories.[23] As such, given the mean age of migrants in our dataset, as well as the uncertainty regarding the timing of the migration decision, we use the 20-year and 30-year lagged transport costs to explain migration stocks.[24]

To be a valid instrument, transport costs must not only correctly predict bilateral migration but they should also neither entail reverse causality nor violate the exclusion

[23] Following the 1851 law on child labour, 14-year-old boys (and girls) could work up to 10 hours per day in factories.

[24] There might be some concerns that using 20-year and 30-year lagged transport costs may not explain the stock of migrants as well as a shorter time lag, namely, 10-year lagged transport costs. Alternatively, we may think that longer time lags, i.e., 40-year lagged transport costs, may also explain the stock of migrants. It is indeed the case that all these lagged transports are highly correlated by construction. First, the decline in transport costs only occurred once; in other words, if the decline occurs between t-30 and t-20, then the transport costs in t-20 and t-10 will be equal. Second, the railroad network in France was built in a short time period that the first inter-départemental lines were built in the 1840s and the last inter-départemental line was built in 1890. As a result, when we consider migration in 1861, the transport costs in t-30 and t-20 are equal, and when we consider migration in 1911, the transport costs in t-10 and t-20 are equal. Because of these two elements, it is not surprising that regressing the lagged transport costs in t-10, t-20, t-30 and t-40 on the stock of migrants produces a regression (available upon request) where partial multicollinearity biases the results.

restriction by affecting the informational diffusion of fertility norms through other channels than migration. In theory, our identification strategy should show the sole causal effect of decline in transport costs on migration and on the convergence in fertility. However, in practice, we cannot ensure that it is migration per se rather than migration along additional vectors for the diffusion of norms which could have been enhanced by the decline in transport costs, that fostered the convergence in the fertility rate between départements. This leads us to provide a series of robustness checks in Section 4.3.

Still, to assuage concerns regarding the exclusion restriction and the validity of the identification strategy, we should point out that the historical account on the development of the French railroad network suggests that it took place independently of fertility patterns, and of the demand and supply for migration (Lartilleux, 1950, Caron, 1997, Caron, 2005). Railroads in France developed slowly and were, at first, isolated lines established by local entrepreneurs who sought to link a mine to the closest waterway to transport coal. The first railroad was established in 1827 between Saint-Etienne and Andrézieux, located on the Loire River. That line was further extended to link Saint-Etienne, Givors and Lyon in 1830-1832 and to link Andrézieux and Roanne in 1836. While that railway sometimes transported passengers in uncomfortable conditions, it was only in 1837 that the first train specifically designed for passengers opened between Paris and nearby Saint-Germain, followed in 1839 and 1840 by two lines linking Paris to Versailles. In the 1839-1840 period, other train lines between mines and waterways began to operate: between the mines of la Grand'Combe, Alès, Nîmes and Beaucaire on the Rhône river, between the mines of Epinac and the canal of Bourgogne, between Montpellier and Sète, as well as between Mulhouse and Thann. There were only three long distance lines transporting passengers: the line between Strasbourg and Basel (in Switzerland) was opened in 1841, and the two lines between Paris and Orléans and between Paris and Rouen were planned in 1838 and opened in 1843.

It was the 1842 law that fostered the development of a state-backed national railroad network where private companies were given long-term concessions to operate lines while the State funded the railroad infrastructure (Caron, 2005). This specific financing scheme explains that the early design of the railroad network sought to connect Paris to the main economic centres of the country: this pattern was called *L'Etoile de Legrand* (Legrand's star), after the under-secretary of public works in the 1840s, and reflected the centralized administrative regime around Paris which characterised France in the nineteenth century.[25] Major railway companies were established in the 1840s and 1850s, as well as smaller firms which only operated one train line. However, by the 1860s, there only remained six firms (*Nord*, *Est*, *Paris-Lyon-Marseille*, *Paris-Orleans*, *Ouest* and *Midi*) with a de facto regional monopoly. With the exception of the *Midi* company whose terminal station was located in Bordeaux, the terminal station of the five other railway companies was located in Paris, as a legacy of *L'Etoile de Legrand*. By 1890, the railroad network connected all the main administrative towns (*chef-lieu*) of each *département*. Nonetheless, another public spending program had been launched just before, in 1879, to connect all the minor administrative towns (sous-préfecture) of each département to the railroad network in Paris. In this respect, studies on the development of the railroad network in France (e.g., Lartilleux, 1950, Caron, 1997) seem to agree that the early design in the 1840s was based on an economic and geographic rationale, which reinforced state and economic centralization around Paris. While it is beyond the scope of this study to discuss whether the centralization around Paris was beneficial for France, this design of the railroad network at least made for sound financial investments and this was reflected in the stable value of the railway companies' share prices after 1865 (Le Bris, 2012). However, the additional public works which were launched in 1879 were only motivated by political expediency and harmed the profitability of railroad companies (Caron, 2005, Le Bris, 2012).

To provide additional support that the decisions which led to the establishment of the railroad network were not linked to fertility, but as the anecdotal evidence suggests, by economic, geographic and political considerations, we graph in Figure 7 the Coale fertility index of each département between 1811 and 1911 and a vertical line that indicates when the département was linked to Paris via the railroad. This Figure shows that the introduction of the railroad was independent of the level and early trends in the fertility rates of each département.

3. Results

3.1 First Stage Results: the Decline in Transport Costs and the Increase in Migrant Stocks

Table 2 reports the regression results of the first-stage regression in Equation (7) where we assess the relationship between our IV transport costs and migrant stocks.

[25] In the Appendix, we show the development of the railroad network in France following *L'Etoile de Legrand* by reproducing Caron (1997)'s maps.

Column 1 considers all migrants while Columns 2 and 3 distinguish between male and female migrants.[26] In all these regressions, the first stage F-statistics are above the critical values of Stock and Yogo (2005) and the associated p-values are all equal to zero, thus indicating that our instruments are not weak.

The first-stage regression results show that migrant stocks decline with higher travel costs, as could be expected. In other words, migrations increased as travel costs decreased. In particular, our results in Column 1 suggest that the elasticity between 20-year lagged transport costs and migrant stocks is -0.81 while that between 30-year lagged transport costs and migrant stocks is -0.64. Given that the median decrease in every decade of bilateral transports costs between 1831 (i.e. 1861-30 years) and 1891 (i.e. 1911-20 years) is equal to 11.6%, these figures suggest that the median increase in bilateral migrant stocks between 1851 and 1911 predicted by transport costs is 16.82% (i.e. (-0.81-0.64)*0.116), excluding the year fixed effects. This IV estimate is slightly larger but in the order of magnitude of the actual figure, which is equal to 13.13%, and this provides some support for the general relevance of our identification strategy. Moreover, the first stage regression results reported in Columns 2 and 3 suggest that there is no specific effect of transport costs for men or women, either in terms of size or in terms of magnitude.

A potential concern with our identification strategy is that transport costs and migration may be correlated with other factors which also influence fertility rates. We discuss this issue in Section 4.3 and provide several robustness checks for the size, significance level and validity of our results.

3.2 The Effect of Migration on the Decline in Fertility

Table 3 analyses the impact of male and female migration on the convergence in the fertility rates of the French départements using the Coale Fertility Index. Columns 1 and 2 report OLS estimates while Columns 3 and 4 show IV estimates. Column 1 and 3 only include the fertility norms of emigrants and immigrants, the shares of migrants and the interaction variables while Columns 2 and 4 also include our set of control variables. It appears that none of these controls has a significant effect on fertility, except for infant mortality.[27] In Table 4, we report equivalent regressions using the

[26] The results in Columns 2 and 3 of Table 2 should be seen as robustness checks since our instrumental variable, transport costs, does not vary by gender.

[27] The lack of significance of most socio-economic variables could be explained by the fact that our study picks the tail of a long process that began in the late eighteenth century. However, as noted in the introduction, France was overall less urban and less industrialised than England in the eighteenth century,

Crude Birth Rate. In both Tables (as in the subsequent Tables where we report IV regressions), the p-value of the statistic NR^2 is above 0.10, suggesting that our instruments pass a test for validity of the over-identification restrictions.

The results in Table 3 suggest that immigrants and emigrants did not have the same effect on the fertility convergence between 1861 and 1911. It is only in the OLS regressions in Columns 1 and 2 that the *Share of Immigrants* and the interaction term between the *Immigrants' Birthplace Norm* and the *Share of Immigrants* have positive and significant coefficients. In the IV regressions, the *Immigrants' Birthplace Norm* has a positive coefficient which is significant in Column 3 when control variables are excluded but insignificant in Column 4 when control variables are included. We note that in Table 4, the effect of *Immigrants' Birthplace Norm* variable is significant and positive in both Columns 3 and 4. Overall, the results suggest that immigrants came from high-fertility regions and did not immediately adopt the low fertility norms of their destination départements, although their effect was not significantly large enough to mitigate the fertility decline.

In fact, the positive and significant coefficient of *Emigrants' Residence Norm* suggests that départements whose emigrants moved to destinations with strongly declining fertility experienced a larger decline in their own fertility. In the IV regression with the control variables reported in Column 4 of Table 3, the coefficient associated with the *Emigrants' Residence Norm* is 0.764. As such, a one-standard deviation (0.038) increase in the *Emigrants' Residence Norm* would lead to a 0.029 increase in the fertility rate, i.e., 10.6% of the sample mean fertility. Moreover, the *Share of Emigrants* has a negative and significant coefficient (-3.942) suggests that départements with the largest increase in the share of emigrants experienced the largest drop in fertility.

However, we cannot interpret the coefficients of the interacted variables by themselves. We note that in the IV regression in Column 4 of Table 3, the interaction variable *Emigrants' Residence Norm * Share of Emigrants* has a negative and significant coefficient at the 1% level equal to -2.965.[28] This suggests two possible interpretations. On the one hand, the interaction variable mitigates the effect of the two

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did not have a substantially lower level of infant mortality than neighbouring countries like England or Holland, while financial markets and financial intermediation were not more developed in France than in other Western European countries. It is therefore not clear why limited changes in urbanization and industrialization within France in the late eighteenth century mattered little when they occurred and only had a delayed impact in the late nineteenth century, after controlling for département and time fixed effects.

[28] In the studies of Spilimbergo (2009) and Beine et al. (2013) whose specification is very similar to ours, this interaction term is not significant.

variables *Emigrants' Residence Norm* and *Share of Emigrants* taken separately because individuals who remained in départements with an increasing share of emigrants moving to low-fertility areas were more likely to have a high number of children. On the other hand, the interaction variable suggests that the effect of the *Emigrants' Residence Norm* is lower at high levels of emigration. This is suggestive of diminishing returns to migration in terms of informational transmission, in line with the rest of the literature (e.g., Spilimbergo (2009) and Beine et al. (2013)). In any event, our counterfactual analysis in Section 5 provides a quantitative discussion of how these different effects balance out. However, we first provide a series of robustness checks in the next subsection.

3.3 Robustness Checks

Some concerns pertaining to our analysis may be related to the endogenous relationship between migration and fertility. While reverse causality and the self-selection of migrants are unlikely to bias our estimates as we discussed in Section 3.2, our identification strategy is meant to address potential omitted variable bias and ensure the validity of the exclusion restriction in our regressions. Specifically, as we already acknowledged in Section 3.2, it could be argued that transport costs in the second half of the nineteenth century were associated with other forces that could have shaped the joint evolution of migration and fertility. To assuage these concerns, we run a series of robustness checks in this section.

3.3.1 Timing of the fertility decline

A potential concern with our main regression results in Table 3 pertains to the timing of the impact of migration on the decline of fertility. First, the decline in fertility began in the late eighteenth century, as we mentioned in the introduction. Second, even though permanent migration took place within France before the development of the railroad, our identification strategy exploits the development of the railroad network. This raises two types of concerns. On the one hand, there are concerns that the development of the railroad network followed past migration movements (even though there is no anecdotal evidence that this was the case as we stressed above). On the other hand, there is no possibility of instrumenting migration before the 1840s because of the limited development of the railroad network, thereby preventing us from carrying out our IV strategy for the earlier period of the decline. Moreover, most control variables are unavailable before 1851. For instance, there is no data on the occupations of the French population in the earliest censuses.

To alleviate concerns regarding the timing of migration, we run several robustness checks in Tables 5 to 10. First, Table 5 show that our main regression results hold when we rerun the OLS regressions over the 1821-1911 period. Indeed, the coefficient associated with the *Emigrants' Residence Norm* variable has a positive and significant coefficient over the 1821-1911 and 1821-1851 periods (Columns 1 and 2 of Table 5). Still, as can be seen when comparing these results to the regression over the 1861-1911 period in Column 3 (which reproduces the OLS regression in Column 2 of Table 3), the effect of migration on the fertility decline is larger and more significant over the later period of our sample. This result is in line with the literature (Dupâquier, 1988, Bonneuil, 1997) which emphasises that the convergence in fertility rates occurred in the second half of the nineteenth century. Second, in Table 6, we test if there is a relationship between migrant stocks between 1861 and 1911 (whether instrumented by the fall in transport costs or not), and the fertility decline between 1811 and 1861. It is reassuring to find that there is no such relationship. Third, in Tables 7 and 8, we find that the results are robust to the inclusion of the lagged dependent variable Fertility (t-10), using both the Coale Fertility Index and the Crude Birth Rate. Comparing these regressions to the convergence regressions in Appendix Tables B.1 and B.3 these results suggest that there was a process of convergence in the fertility rates within France during the second half of the nineteenth century which can be partly explained by internal migration. Finally, in Tables 9 and 10, we report regression results where we account for the lagged values of our explanatory variables using both the Coale Fertility Index and the Crude Birth Rate. We find that the *Emigrants' Residence Norm* (t) variable in year *t* explains the decline in fertility in year *t* while the lagged explanatory variables, *Emigrants' Residence Norm* (t-10) and *Immigrants Birthplace Norm* (t-10), are dominated in terms of size and significance by the effect of the variables in year *t*. As such, it does not seem that lagged explanatory variables played a major role in the fertility decline.

3.3.2. Aspects of cultural and social norms related to fertility and human capital

Variables which are potentially endogenous to migration and fertility in the regressions in Table 3 include factors pertaining to social norms and human capital.[29] These potential vectors of cultural diffusion can be related to aspects of human capital, such as the total number of periodicals published in each year and each département. To build this variable, we collect from the successive issues of the *Bibliographie de la France ou Journal général de l'imprimerie* as well as from Avenel (1895, 1901) and Mermet (1880-1901).

These endogenous variables can also be related to aspects of religiosity as proxied by the construction of new religious buildings for Catholics, Protestants and Orthodox

[29] These variables may be viewed as "bad controls", in the terminology of Angrist and Pischke (2008).

Christians during the 1861-1911 period, using the *Mérimée* database on historical monuments from the French Ministry of Culture. While religious buildings do not necessarily reflect the religiosity of the overall population, they nonetheless reflect the ability of religious groups at the local level to influence local politics so as to finance religious buildings (at least before 1905 and the separation of Church and State). They are thus a measure of religiosity which is not necessarily strongly correlated with school choice, unlike the variables discussed in Section 2.

Finally, demographic variables could be endogenous to both migration and fertility as they reflect the rigidity of social norms such as the tolerance vis-à-vis sex outside marriage and the pressure for men and women to marry. Thus, we collect data on the successive issues of the French census to build data on the share of births out of wedlock, the share of illegitimate births as a share of out-of-wedlock births, as well as the shares of married men and women for the 20-24, 25-29 and 30-34 age groups.

The regression results that include these potentially endogenous variables are reported in Tables 11 and 12. We find that none of these variables has a consistent effect on the coefficients of our variables of interest, either in terms of size or in terms of significance level.

3.3.3. Accounting for increased industrialization and trade due to the development of the railroad network

Our identification strategy rests on the anecdotal evidence that the development of the railway network occurred independently of the demand and supply for migration, and thus on the economic forces which could have driven migratory movements. Thus, a potential problem is that railways stimulated industrialization and trade, thereby shaping migration flows. While our main regressions in Table 3 already control for the share of the workforce in industry and services, we report in Table 13 regression results that account for two additional variables which may have been correlated with the development of the railroad.

First, we account for the quantity of mineral fuels (measured in tons) which is consumed in each département by mineral industries. As outlined in the successive issues of the *Statistique de l'Industrie Minérale* (Statistics of the Mineral Industry), mineral fuels were transported via the railroad from one département (or from foreign countries) to another département. This variable also enables us to account for the development of a specific industry which might have drawn many migrants. Second, we account for wheat prices in each département using the data collected by Labrousse et al. (1970) for 1861 and 1871, and the relevant issues of the *Statistique Agricole de la France* (Agricultural Statistics of France) for the remainder of the sample. While there were still internal trade barriers, called "octrois", which impeded trade within France before WWI (Franck et al., 2014), there was nonetheless a process of increased internal trade and market integration during the nineteenth century, especially in the wheat market (Chevet and Saint-Amour, 1991; Ejrnaes and Persson, 2000). As such, we could hypothesise that variations in wheat prices could be correlated with variations in migration rates as the development of the railroad network would ease the transport of agricultural goods, such as wheat which was grown in most French départements.

In Table 13, we find that the quantity of mineral fuels consumed by mineral industries is positively and significantly correlated with fertility in the OLS and IV regressions in Columns (1) and (2), suggesting that the development of these mineral industries slowed down the decline in the fertility rate. Moreover, we find that wheat prices are negatively correlated with fertility rates, but this effect is only significant in the OLS regression in Column (3), not in the IV regression in Column (4). In any case, in all the regressions reported in Table 13, the quantity of mineral fuels consumed by mineral industries and wheat prices have no substantial effect on the coefficients of our variables of interest, either in terms of size or significance level.[30] These results should thus assuage concerns that migration could have lowered fertility through the growth in industrialization and trade fostered by the development of the railroad network.

3.3.4. Spatial correlation

Previous studies on the decline of fertility within European countries in the nineteenth century, e.g., Becker et al. (2012) and Goldstein and Klüsener (2014) on Prussia and Murphy on France (2015), account for spatial autocorrelation in their empirical analysis. In particular, Murphy (2015) found that, over the 1876-1896 period, the fertility of each French département was affected by the fertility of neighbouring départements, accounting for common unobserved factors which are spatially correlated. Since our study also emphasises the impact of social and informational interactions in fertility choice, it is important to ensure that our main results are not driven by spatial correlation.

In Table 14, we report regression results that account for spatial correlation using a weighting matrix based on the great-circle distance between the administrative centres

[30] In Appendix Table A3, we examine whether the results are robust to using the the deviation in Wheat Prices (instead of the logarithm of wheat prices as in Table 8). We define the one-sided deviation of wheat prices as $\text{Deviation Wheat Prices (t)} = (Wheat\ Prices_{it} - mwp_t)/swp_t$, where $Wheat\ Prices_{it}$ is the price of wheat in département i in year t, mwp_t is the average wheat price in year t and swp_t is the standard deviation of wheat prices in year t. The results in Appendix Table A3 show that the inclusion of this one-sided measure of wheat prices, as well as of its squared and absolute value, do not have an impact on the economic and statistical effect of migration on fertility.

of each département.[31] It is reassuring to find that our main regression results are robust to accounting for the inclusion of spatial autocorrelation.

4 Channels of the fertility decline: a counterfactual analysis

In this section, we discuss possible channels through which emigration affected fertility. Specifically we carry out a counterfactual analysis to examine potential differences between the migration of men and of women, as well as the role of migration from and to Paris.

Tables 15 and 16 present regression results on a sample that only includes male and female migrants, respectively. Moreover, the sample in the regressions shown in Table 17 excludes all migrants (i.e., men and women) to and from the *Seine* département, whose territory mainly comprised Paris. In Tables 15 and 16, the significance and the size of the coefficients associated with *Emigrants' Residence Norm*, *Share of Emigrants* and *Emigrants' Residence Norm * Share of Emigrants* are roughly similar to those in Table 3. These results suggest that male and female migrants contributed similarly to the fertility decline, even though the stocks of male and female migrants were not perfectly correlated as we reported above in Section 2.[32]

In Table 17, we report regression results on a sample that excludes male and female migration from and to the *Seine* département. They are different from those in Table 3 since the coefficients associated with *Emigrants' Residence Norm*, *Share of Emigrants* and *Emigrants' Residence Norm * Share of Emigrants* are smaller in Table 13 and not systematically statistically significant across the OLS and IV regressions. They actually suggest that migration to Paris played a major role in the decline in fertility in France, even though our data indicate that only 26.33% of migrants moved to the Seine

[31] In Table 14, we use the xsmle command in Stata to run the spatial regressions. This command does not allow for 2SLS estimation but it bears repeating here that our approach is not that of a 2SLS regression but one where the first stage estimates a matrix of migration, as we discuss in Section 3. For a discussion of spatial panel data models, see, e.g., Elhorst (2010, 2012).

[32] We note that in Table 16 the *Share of (Female) Immigrants* and the *(Female) Immigrants' Residence Norm * Share of (Female) Immigrants* variables have positive and significant coefficients. This effect is however not found for male immigrants. While these results confirm our remark in Section 4.1 that immigrants had overall no effect on the decline in fertility, they nonetheless suggest that female immigrants did not immediately adopt the lower norms of their département of destination. Most likely, female migrants had more children than the women in their destination département but fewer children than in their origin département. As such, their behaviour did not prevent the convergence in fertility rates.

département throughout the period.[33] We develop this intuition in our counterfactual analysis below.

We compute the counterfactual values of the fertility rate in each département under the assumption that the size, bilateral structure, and fertility of emigrants and immigrants would have remained at their 1861 level. For this purpose, we use the OLS and IV regression results in Columns 2 and 4 (with the control variables) of Tables 3, 15, 16 and 17 (i.e., on the samples of all migrants, only male migrants, only female migrants, as well as of all migrants excluding *Seine* as destination and origin). In Table 18, we report these counterfactual values at the national level along with the actual fertility data between 1861 and 1911. In addition, in Table 19, we present the same counterfactual analysis using our other measure of fertility, i.e., the Crude Birth Rate. The histogram for the actual values of Crude Birth Rate is shown in Figure 8 for each year in our sample. We assess the fit of each model with the Pearson χ^2 statistic as in Buchinsky et al. (2014).[34] Overall, in both Tables 18 and 19, the Pearson χ^2 statistic shows that our regressions capture the impact of migration on fertility decline.

To illustrate our analysis, we report four graphs based on the counterfactual values obtained with the IV regressions reported in Column 4 of Tables 3, 15, 16 and 17 and reported in Table 18. First, Figures 9 and 11 show the evolution of the actual and counterfactual values for the IV regressions of the unweighted average fertility rate at the national level between 1861 and 1911 under the assumption that no changes in fertility norms and in the shares of migrants had occurred after 1861. Second, Figure 10 and 12 show the distribution of these values across départements in the form of histograms, thus highlighting the decline in the standard error of fertility rates over time and the progressive convergence of fertility rates across French départements.

Three general observations can be drawn from Tables 18 and 19 as well as from Figures 9 and 11. First, the counterfactual values of the average Coale fertility index are larger than the actual values. For instance, Table 18 (see Panel A of Figures 9 and 10) indicates that the average French Coale fertility index would had been 0.297 in 1911 had there been no change in migration of men and women after 1861, instead of 0.244. Since the national Coale fertility index in 1861 was equal to 0.310, these findings imply that the 0.066 drop in fertility in France between 1861 and 1911 can be broken down into a 0.53 point drop (80.3%) caused by migration and a 0.013 drop (19.7%)

[33] Only 5.25% of the total emigrants were born in the *Seine* département throughout the period.

[34] The Pearson χ^2 statistic is computed as $\chi^2 = \sum_{i=1}^{81}(Predicted_i - Observed_i)^2/Predicted_i$. The critical values at the 10%, 5% and 1% levels of significance are $\chi^2_{.90}(80)$=64.218, $\chi^2_{.95}(80)$ =60.391 and $\chi^2_{.99}(80)$=53.540.

which can be attributed to other economic and demographic factors, both common to all départements (and absorbed by the time fixed effects) and specific to each departement (e.g. the differential evolution of infant mortality). In the robustness checks carried out with the Crude Birth Rate in Table 19 and Figures 10 and 12, we find that the drop from 0.026 in 1861 to 0.019 in 1911 can also be attributed to migration and other economic and demographic factors in roughly similar proportions: 0.006 of the drop (85.7%) can be attributed to migration and 0.001 (14.3%) can be attributed to economic and demographic variables. It is also interesting to note that the counterfactual values for the standard deviation of the Coale Fertility Index in Table 18 are larger than the predicted values, but still lower than the actual values. In other words, while our model slightly under-estimates the standard deviation of fertility, it nonetheless suggests that migration contributed to the convergence of fertility rates across France. Moreover, the figures in Table 18 (see Panels C and D of Figures 9 and 11) suggest that the fertility decline can be equally attributed to male and female migration.

Second, the counterfactual values indicate that the average French Coale Fertility Index would have been equal to 0.270 (see Panel E of Figures 9 and 11) under the assumption that no change in fertility norms in origin départements and in the share of immigrants had occurred after 1861 and equal to 0.268 under the assumption that no change in fertility norms in destination départements and in the share of emigrants had occurred after 1861 (see Panel F of Figures 9 and 11). These findings suggest that the depressing effects on fertility of the changes in *Emigrants' Residence Norm* and *Share of Emigrants* and of the changes in *Immigrants' Birthplace Norm* and *Share of Immigrants* are equally large, at least at the national level. However, the counterfactual analysis carried out with the Crude Birth Rate suggests that the fertility decline can be entirely attributed to the effects of the *Emigrants' Residence Norm* and *Share of Emigrants* variables.

Third, Tables 18 and 19 suggest that Paris played a major role in the decline in fertility rates throughout the period.[35] The counterfactual average value of the Coale fertility index in the IV regression in the absence of migration to and from *Seine* is found to be much higher than its actual level in 1911 (0.286 vs. 0.244) as can be seen

[35] The *Seine* département, which includes Paris, along with *Seine-et-Oise* and *Seine-et-Marne*, which comprise the Parisian suburbs, were areas of low fertility by the mid-nineteenth century. In 1901 and 1911, the fertility of *Seine* was below the 5th percentile of fertility in France. In addition, the total French population amounted to 37,386,313 inhabitants in 1861 and to 41,479,006 in 1911, while there were 1,953,660 inhabitants in Seine in 1861 and 4,154,042 in 1911. Hence, *Seine* accounted for 5.2% of the French population in 1861 and 10% in 1911

in Panel B of Figures 9 and 11. Given that the national Coale fertility index in 1861 was equal to 0.310, these findings imply that the counterfactual fertility decline without Paris is only 36.4% of the actual drop (0.024 points instead of 0.066). In other words, migrants to and from Seine explain 63.7% of the fertility decline, even though 26.33% of the total migrants moved to the *Seine* département while 5.25% of the total migrants were born in the *Seine* département and live elsewhere between 1861 and 1911. Thus, our counterfactual analysis suggests that the information sent back to their département of origin by one immigrant to *Seine* had the same depressing effect on fertility as two immigrants who moved to other départements. The results are even more striking when we use the Crude Birth Rate and exclude migrants to and from Seine: they suggest that the counterfactual fertility level would have been equal 0.030 and therefore higher than the actual rate in 1861 (0.026) and 1911 (0.019).

In addition, we use information from the census which provide in 1891, 1901 and 1911 data on all French nationals living in each département according to their département of origin. Thus, in Tables 20 and 21, we rerun the counterfactual analysis on the census data for 1891, 1901 and 1911 over the Coale Fertility Index and the Crude Birth Rate. The results suggest the same quantitative effect for the diffusion of fertility norms on the convergence in fertility rates as in the other regression results that rely on the main dataset.

As such, these observations suggest that emigrants to the *Seine* département mattered more than other emigrants, and this is in line with the cultural, economic and political importance of Paris within France. We may speculate that would-be emigrants sought to move to Paris, even if they eventually migrated to the closest regional industrial centre, and chose to have few children because they learnt from emigrants from their regions that individuals who were already living in Paris had few children. This might have been a cultural element of Parisian life, and there is evidence that the political and economic elites living in Paris already had few children by the end of the eighteenth century (Livi-Bacci 1986). But this feature of Parisian life might also have been grounded in an economic rationale: Parisians had few children because raising many children in Paris was costly and difficult. In fact, it was customary for Parisians to send new-borns to foster care in the countryside, even though this was expensive and infant mortality rates were high (Rollet-Echalier, 1990).[36] Moreover, another type of

[36] The poorer the French couples were, the further away they would have to send their children from Paris. In the second half of the nineteenth century, well-to-do families would employ a wet nurse at home to take care of their children (Faÿ-Sallois, 1980). See also Rapoport and Vidal (2007) for additional anecdotal evidence and an interpretation in terms of endogenous parental altruism formation.

information which could have been transmitted from Paris to the rest of France could pertain to increased knowledge of contraceptive techniques which was criticised by the moralists of the day (on this issue, see, e.g., Bergues et al., 1960, Murphy, 2015).[37]

Another potential channel for the impact of emigration on fertility pertains to resistance to change in a high fertility region, which can stem from the cost individuals face from departing from the current social norm of high-fertility. When emigration intensifies, there could be less pressure to maintain a high rate of fertility, as would-be parents expect their children to leave their home regions in search of better economic conditions.[38]

Overall, our analysis of the results suggests an explanation for the lower fertility rates in France before WWI which pertains to the diffusion via migrants of information regarding fertility levels in the areas where migrants moved to. That information combined a cultural component and an economic rationale related to the cost of child rearing, and was especially influenced when it was conveyed by migrants to Paris.

5 Conclusion

In this study, we investigate the impact of internal migration on the fertility convergence within France between 1861 and 1911. Using various historical data sources, we build a bilateral migration matrix between French départements, with observations every ten years. We then assess the effects of the changing fertility norms of emigrants and immigrants in their birthplace and residence départements. We address the endogeneity of migration choices by using time-varying bilateral travel costs resulting from the gradual development of the railroad network as an instrumental variable.

Our results suggest that the transmission of economic and cultural information via migration explains most the convergence in fertility rates across France while the decline in child mortality is the only socio-economic factor which has a significant impact on the decline in fertility. In particular, we find that départements with more emigration and more emigrants to destinations characterised by lower and faster decreasing fertility rates experienced a sharper fertility decline. Emigrants sent back information to their region of origin regarding the low fertility rates in their region of destination that might have been taken into account by those who had stayed behind, but who might have wanted to emigrate in the future. This information regarding social

[37] Relatedly, Boyer and Williamson (1989) suggest that the fertility transition in England between 1851 and 1911 could be partly attributed to the diffusion of contraceptive techniques.

[38] We owe this point to a referee.

norms about family size could have also have been grounded in an economic rationale pertaining to the cost of raising children in urban areas, and specifically in Paris.

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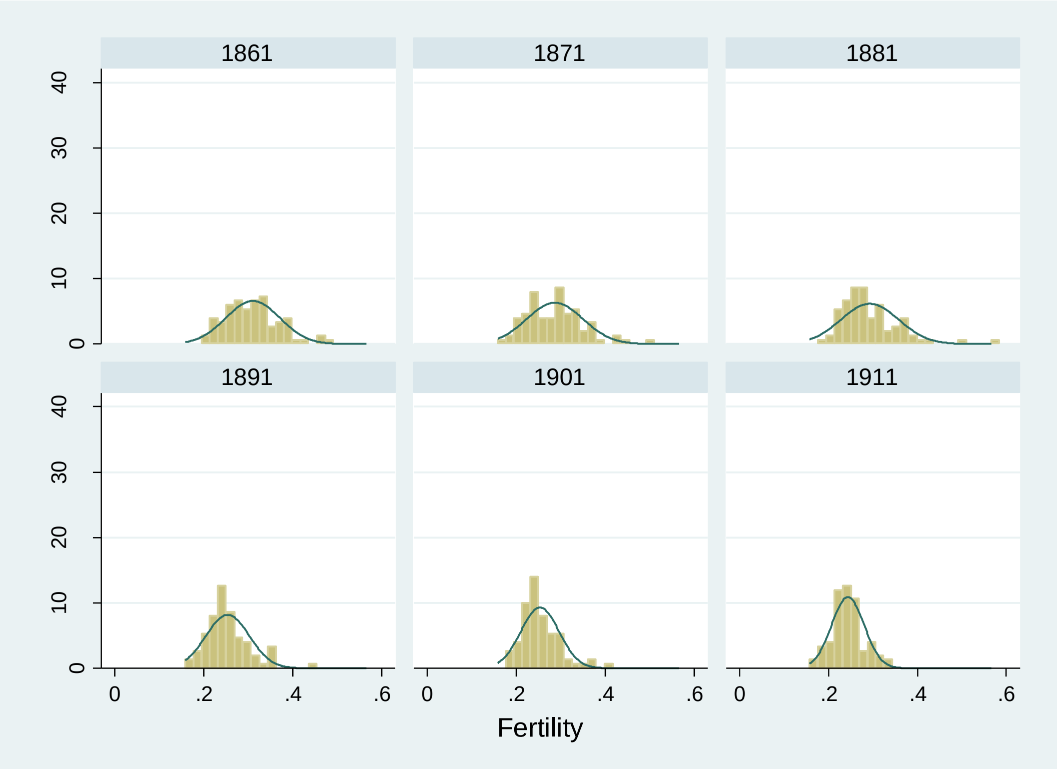
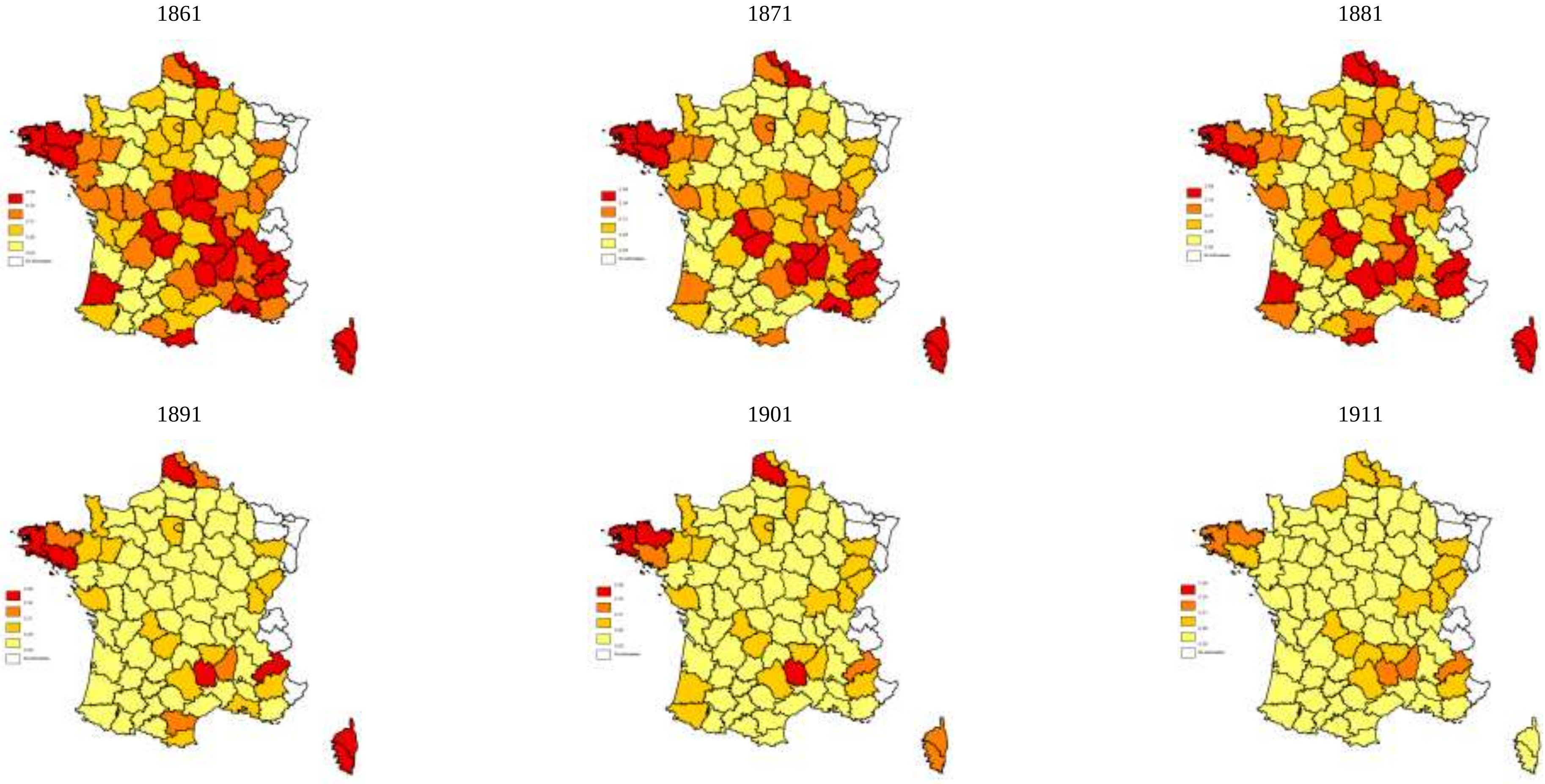
Figure 1. Histogram of Fertility across French départements, 1861-1911 (Coale Fertility Index)



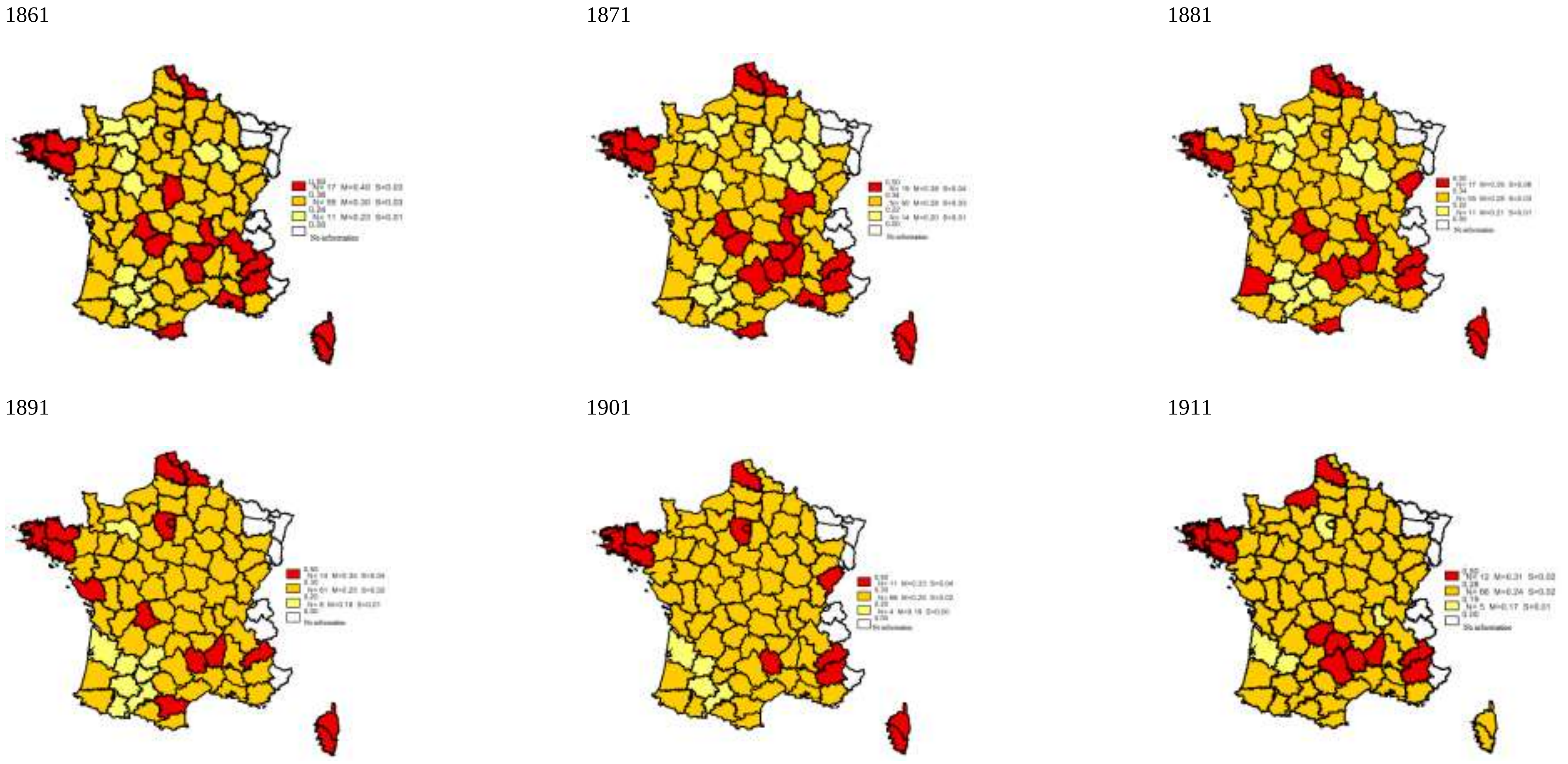
Source: (Bonneuil 1997) and authors' computations for 1911.

Figure 2. The decline in fertility across French départements, 1861-1911 (Coale Fertility Index)



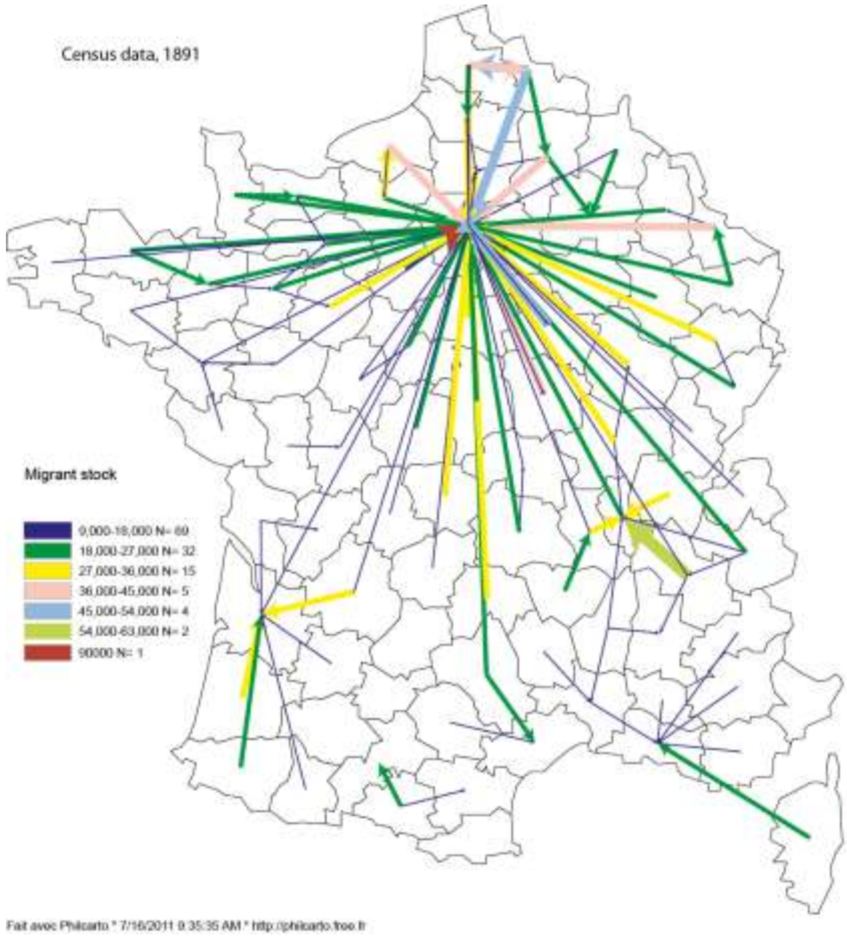
Source: (Bonneuil 1997) and authors' computations for 1911. See text for explanations.

Figure 3. The convergence in fertility across French départements, 1861-1911 (Coale Fertility Index)



Source: (Bonneuil 1997) and authors' computations for 1911. See text for explanations

Figure 4: Main bilateral migration corridors - 1891 Census data

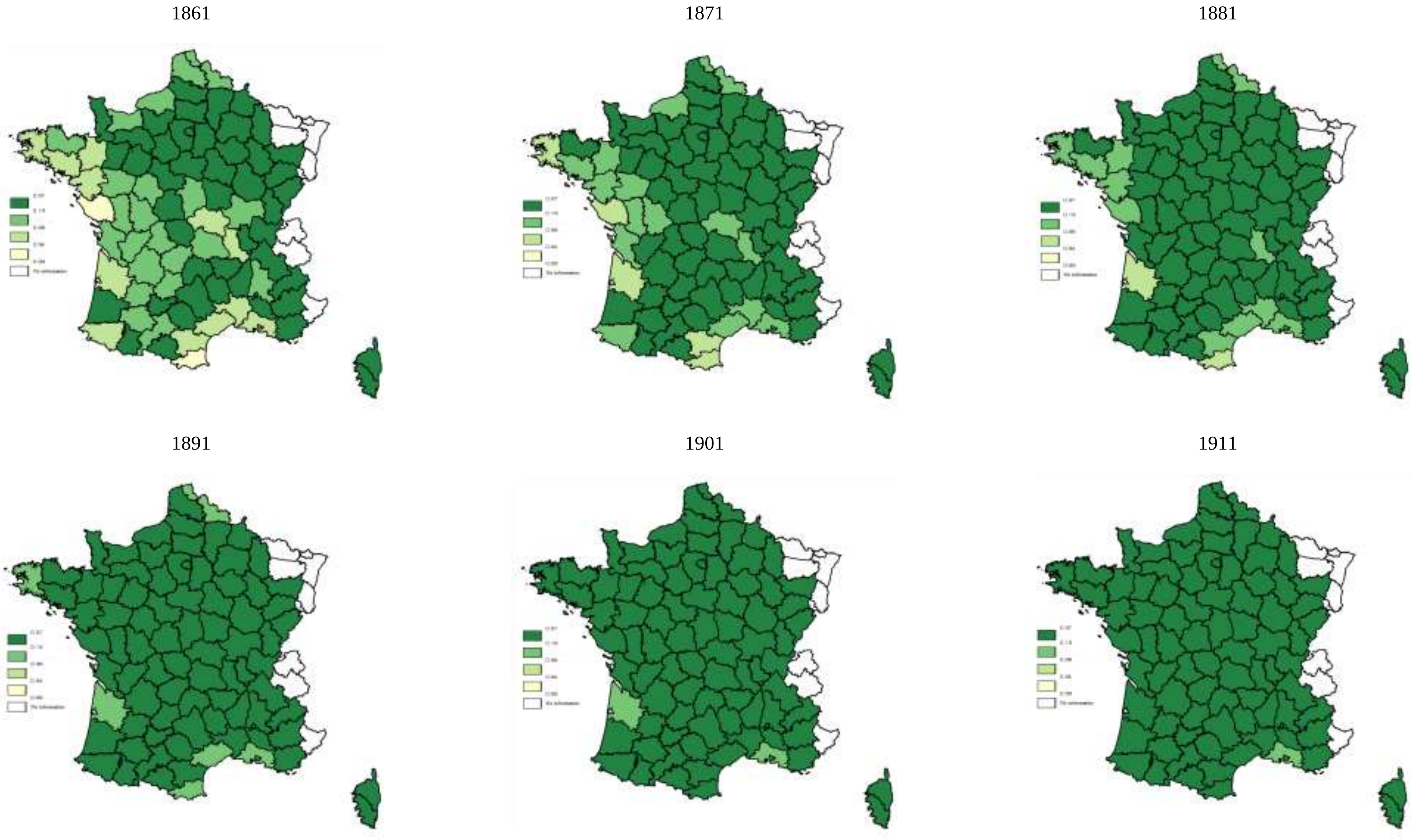


Notes:

• For the sake of readability, this map does not report all the 7,832 observations (=89*88, as there are 89 *départements*) of the migrant stocks but only those which are larger than 10% of the largest stock, i.e., the 128 stocks larger than 9,000 (as the largest stock was formed by the 90,000 inhabitants of the *Seine département* born in the neighbouring *Seine-et-Oise département*).

• In the legend, the first two numbers represent the bounds of the bracket for the stock of migrants; N represents the number of links between *départements* in each bracket.

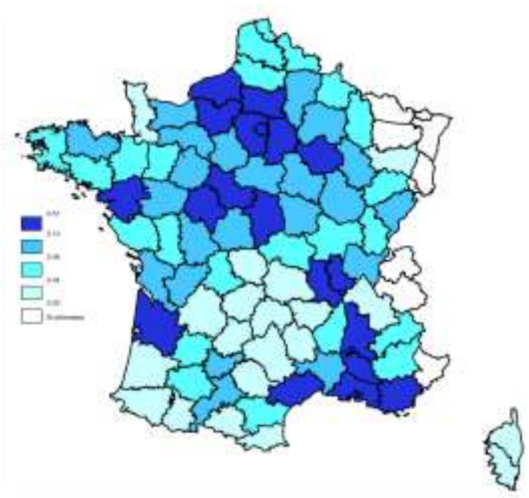
Figure 5. Stock of the share of emigrants across French départements, 1861-1911



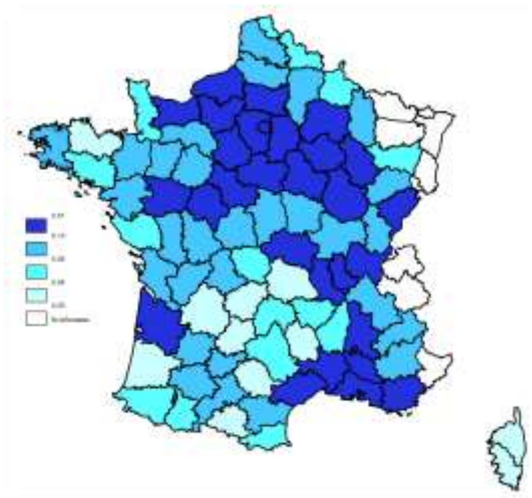
Source: Authors' computations. See text for explanation.

Figure 6. Stock of the share of immigrants across French départements, 1861-1911

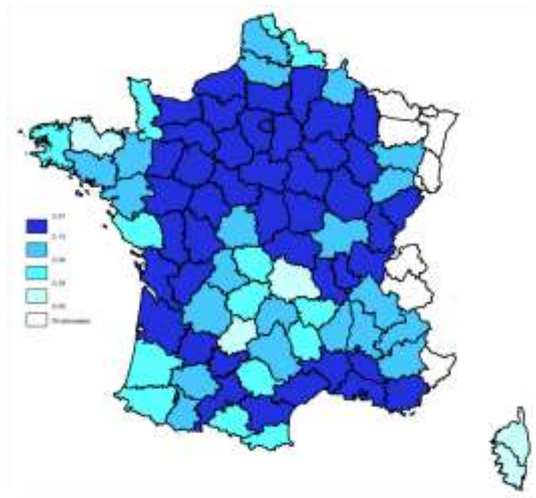
1861



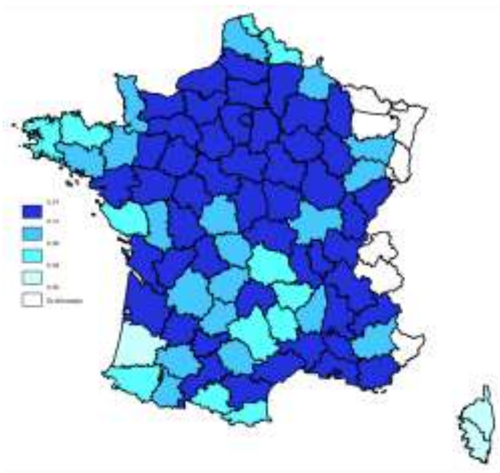
1871



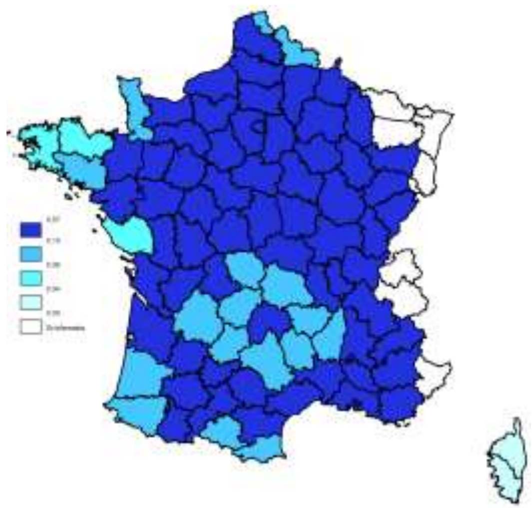
1881



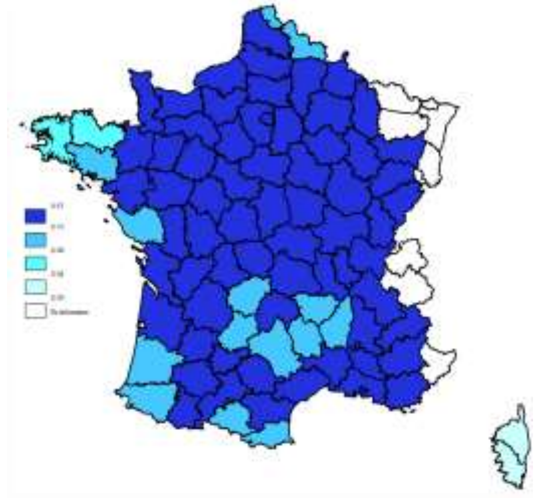
1891



1901

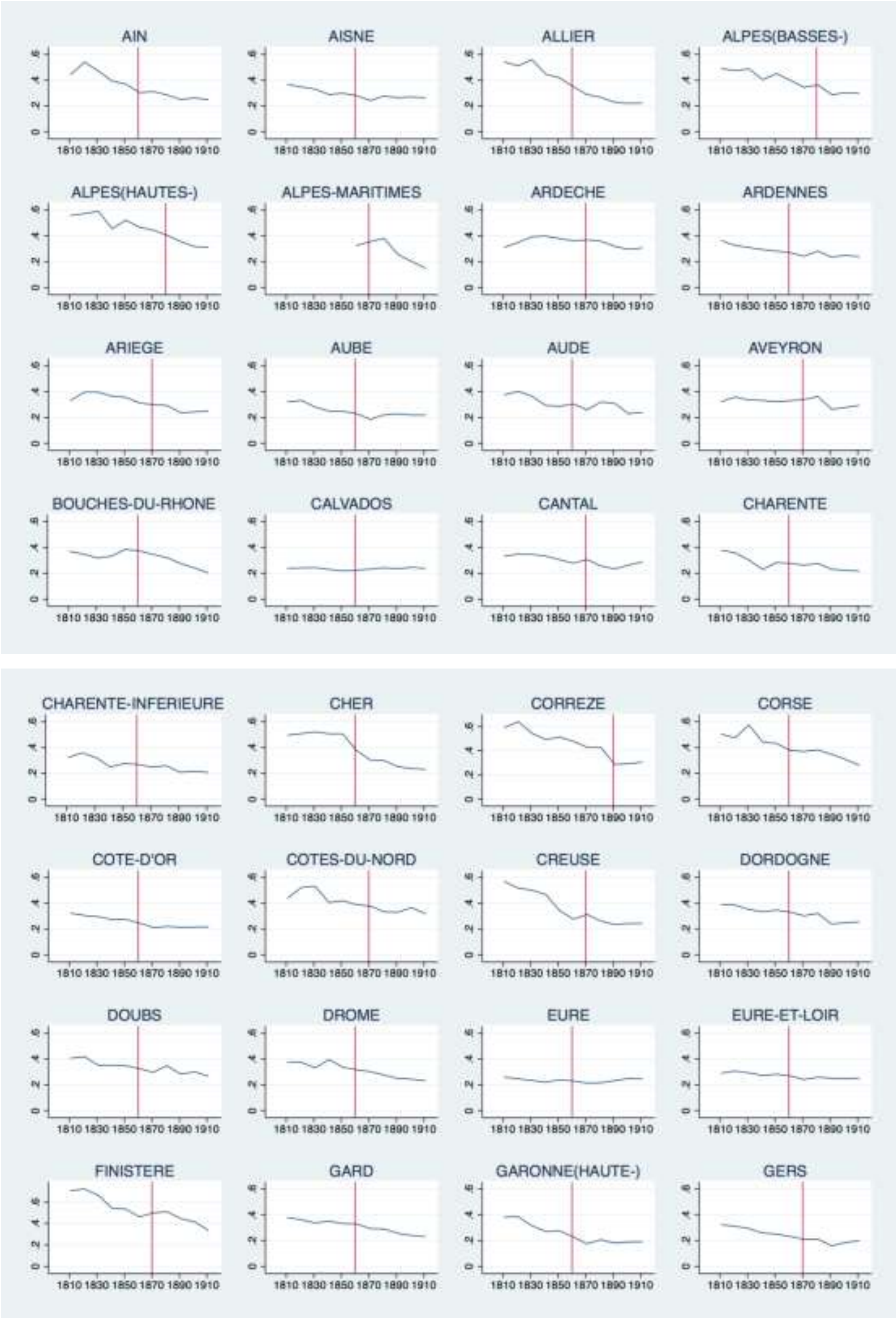


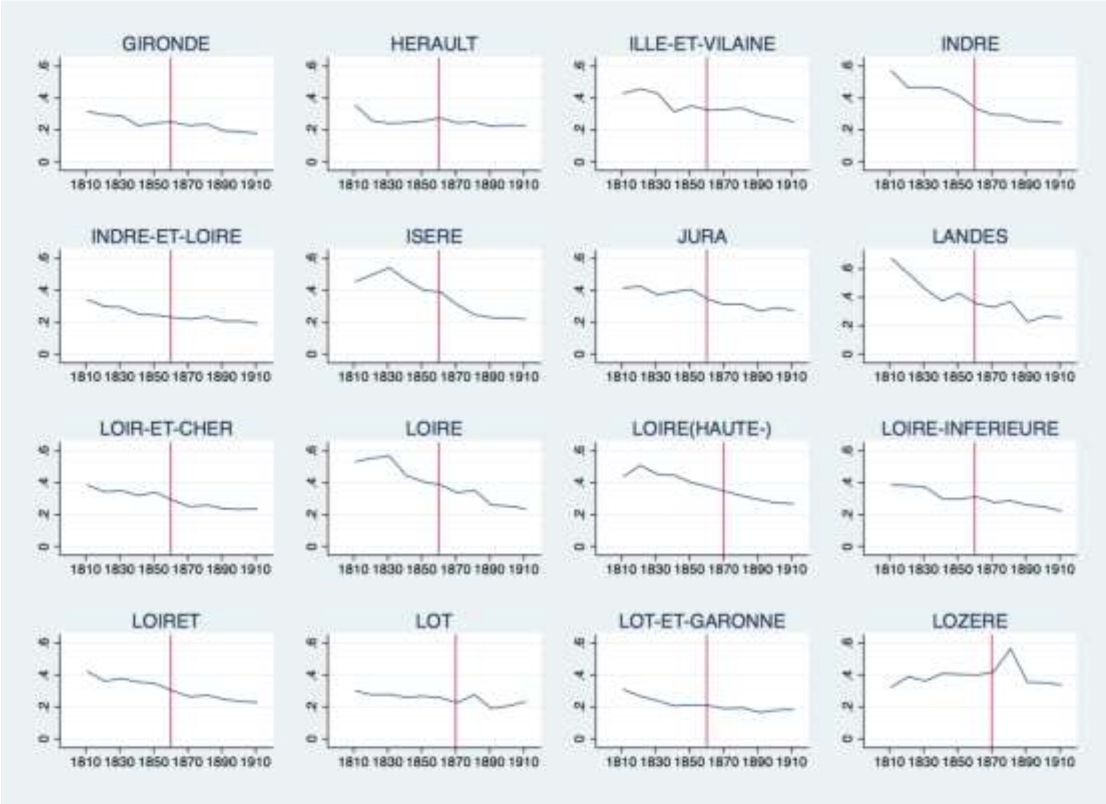
1911

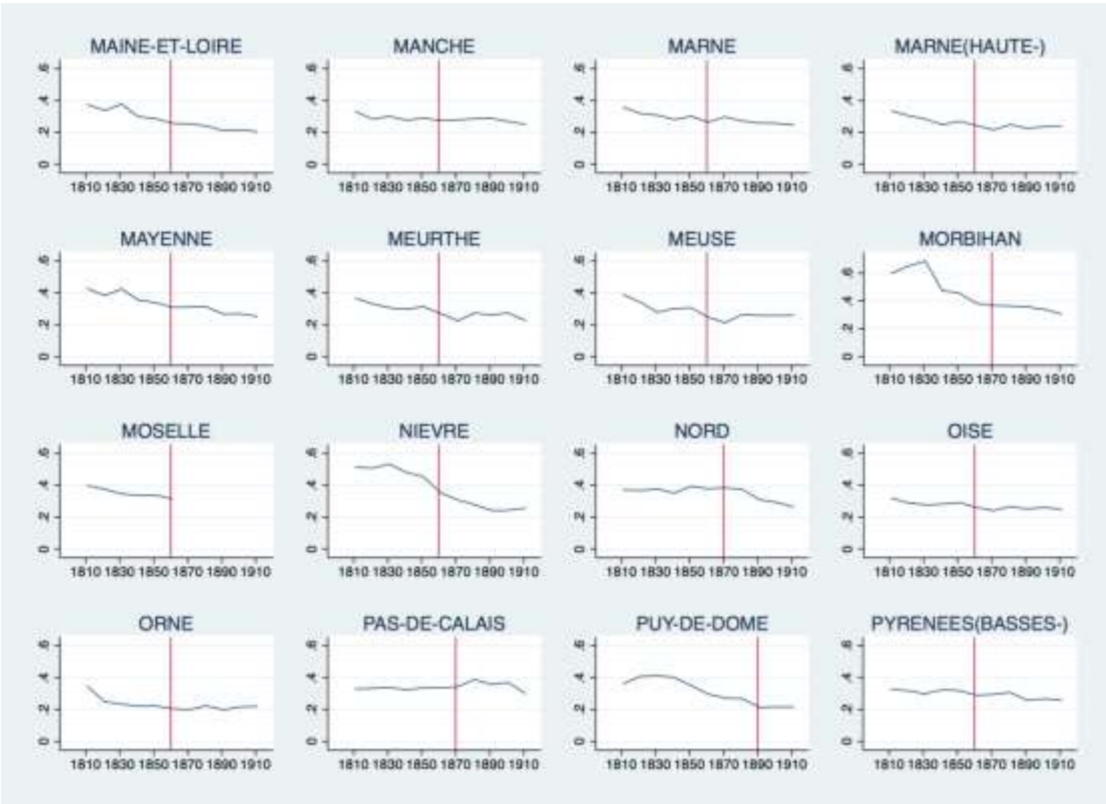


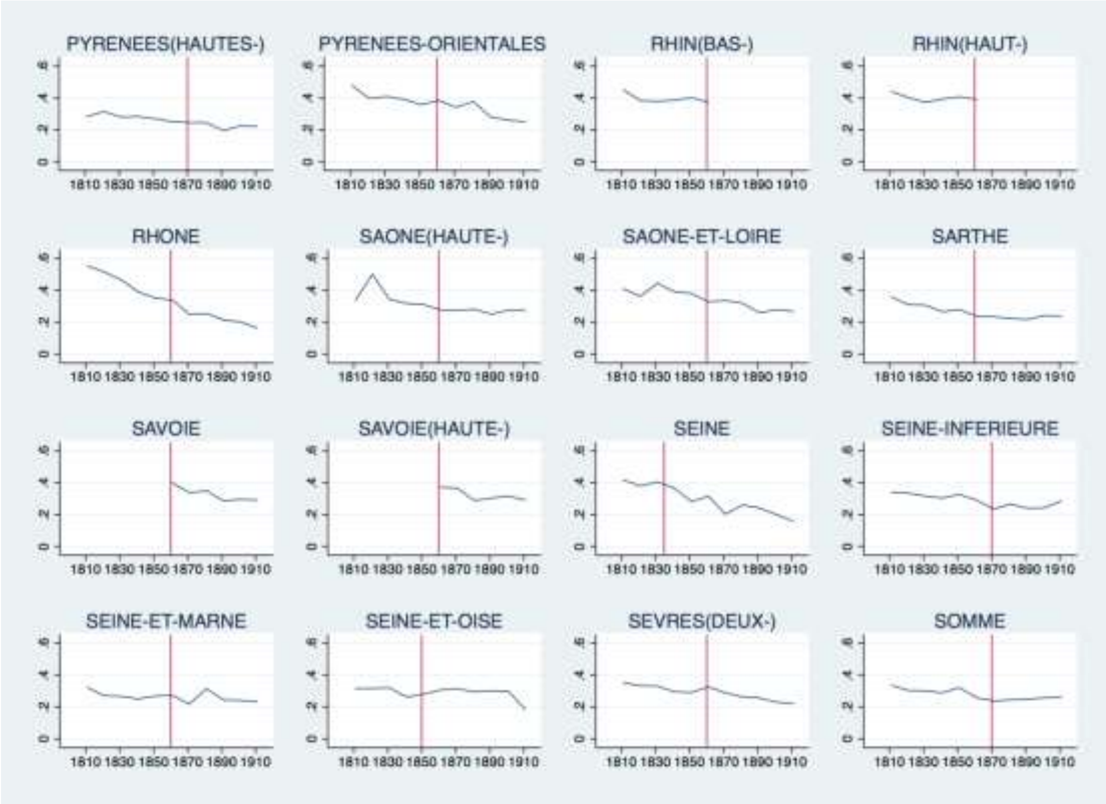
Source: Authors' computations. See text for explanation.

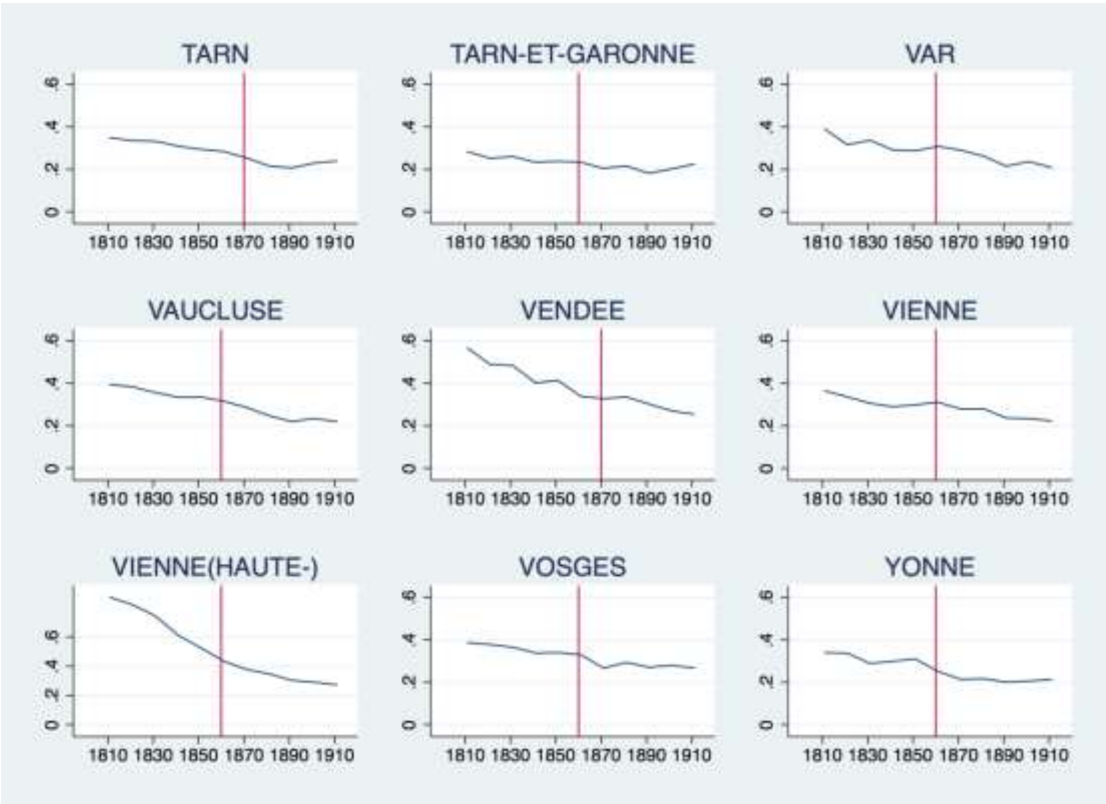
Figure 7: Fertility rates and the railroad network, 1811-1911.




GIRONDE
HERAULT
ILLE-ET-VILAINE
INDRE
INDRE-ET-LOIRE
ISERE
JURA
LANDES
LOIR-ET-CHER
LOIRE
LOIRE(HAUTE-)
LOIRE-INFERIEURE
LOIRET
LOT
LOT-ET-GARONNE
LOZERE
0 .2 .4 .6
1810 1830 1850 1870 1890 1910

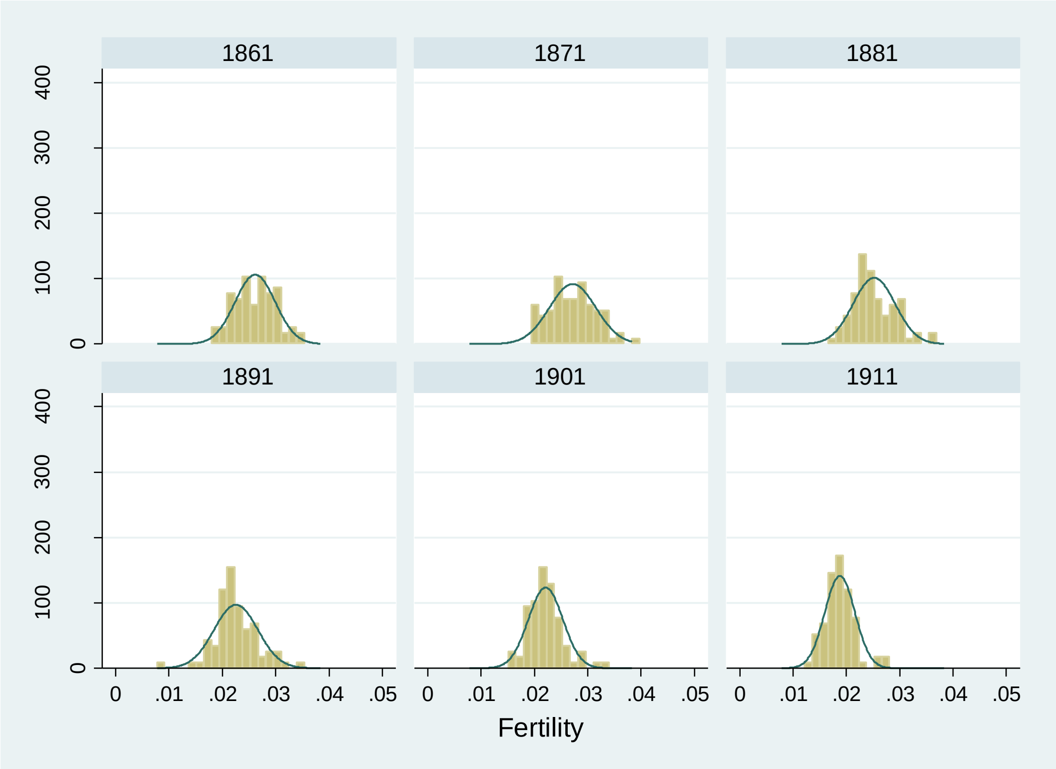

MAINE-ET-LOIRE
MANCHE
MARNE
MARNE(HAUTE-)
MAYENNE
MEURTHE
MEUSE
MORBIHAN
MOSELLE
NIEVRE
NORD
OISE
ORNE
PAS-DE-CALAIS
PUY-DE-DOME
PYRENEES(BASSES-)
0 .2 .4 .6
1810 1830 1850 1870 1890 1910





Note: The line corresponds to the year when the *département* was linked to Paris via the railroad network.
Source: For the Fertility Coale Index, see the text. See (Caron 1997) for the railroad network.

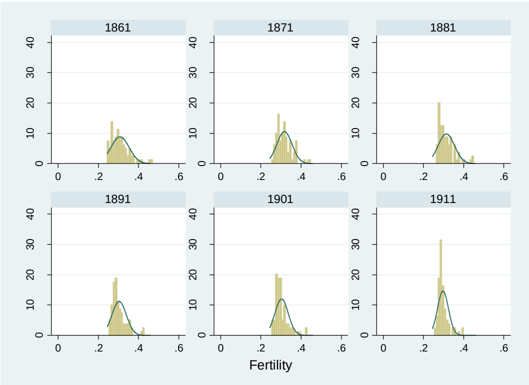
Figure 8. Fertility across French départements, 1861-1911 (Crude Birth Rate)



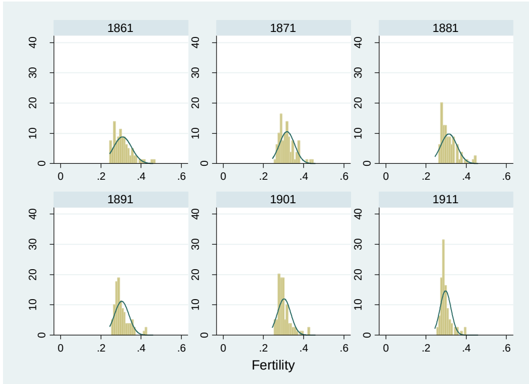
Source: Authors' computations.

Figure 9. Counterfactual histogram of fertility in France, 1861-1911 (Coale Fertility Index)

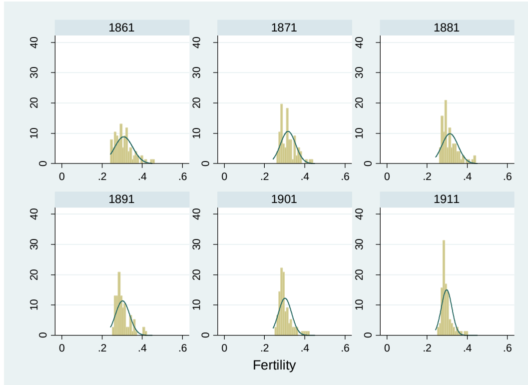
Panel 9a. Counterfactual fertility in France under no change in migration after 1861



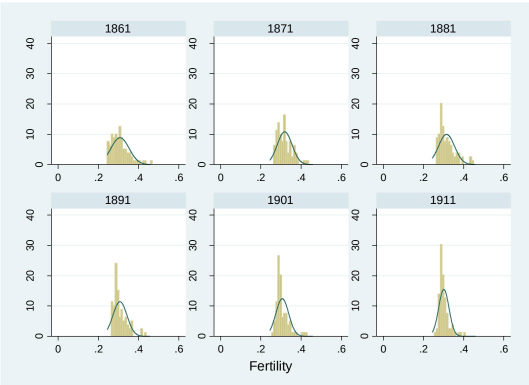
Panel 9b. Counterfactual fertility in France under no changes in migration from and to Paris after 1861



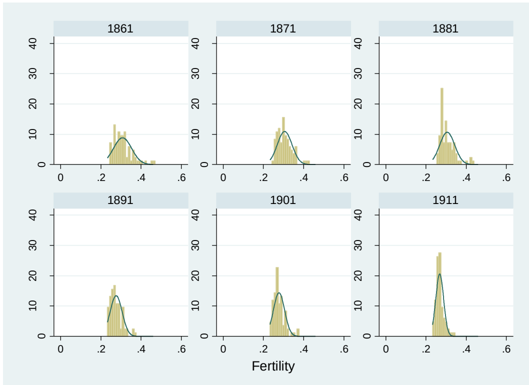
Panel 9c. Counterfactual fertility in France under no changes in female migration after 1861



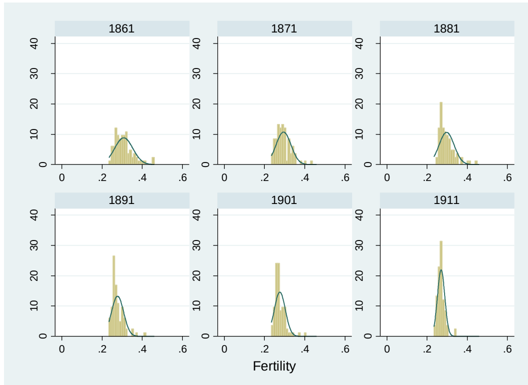
Panel 9d. Counterfactual fertility in France under no changes in male migration after 1861



Panel 9e. Counterfactual fertility in France under no change in immigration after 1861



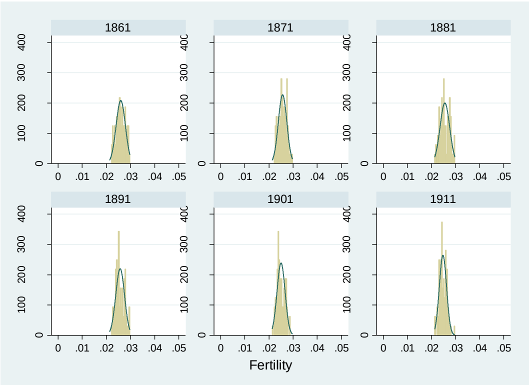
Panel 9f. Counterfactual fertility in France under no change in emigration after 1861



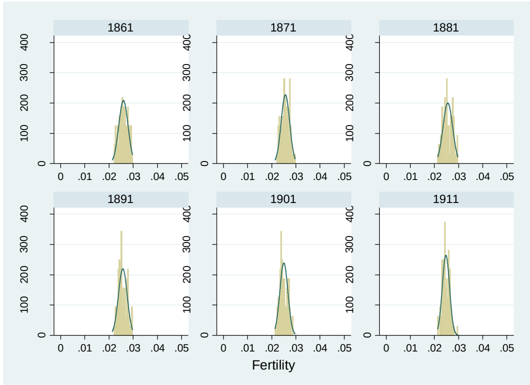
Note: This figure provides histograms for the counterfactual values of the fertility rate in the French départements using the IV regression results with the control variables in Column 4 of Tables 3, 15, 16 and 17 and as reported in Table 18.

Figure 10. Counterfactual histogram of fertility in France, 1861-1911 (Crude Birth Rate)

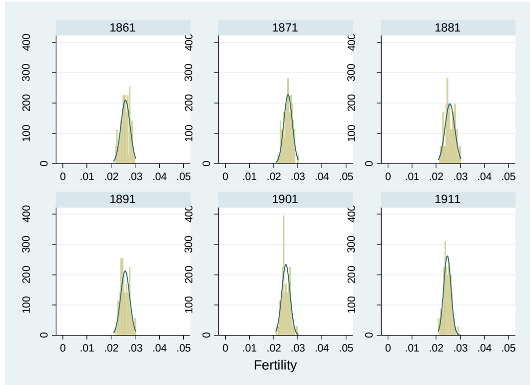
Panel 10a. Counterfactual fertility in France under no change in migration after 1861



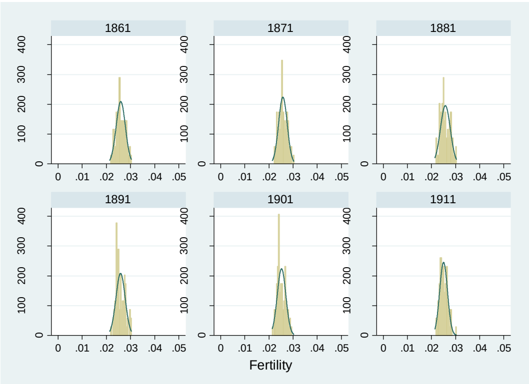
Panel 10b. Counterfactual fertility in France under no changes in migration from and to Paris after 1861



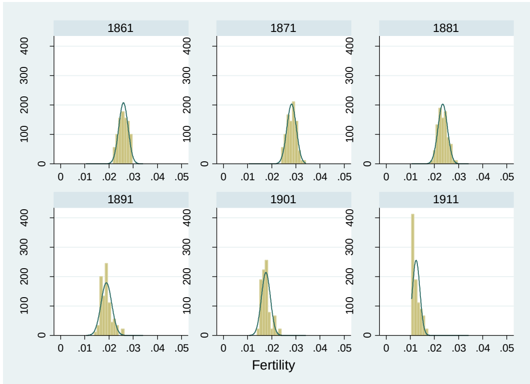
Panel 10c. Counterfactual fertility in France under no changes in female migration after 1861



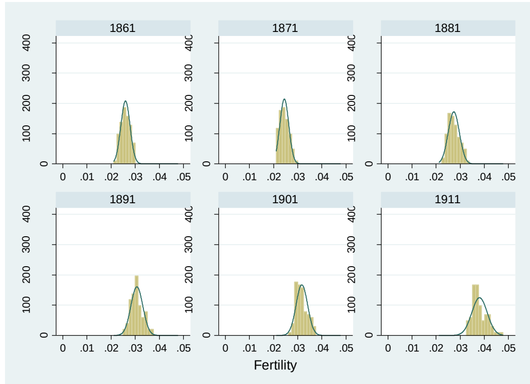
Panel 10d. Counterfactual fertility in France under no changes in male migration after 1861



Panel 10e. Counterfactual fertility in France under no change in immigration after 1861



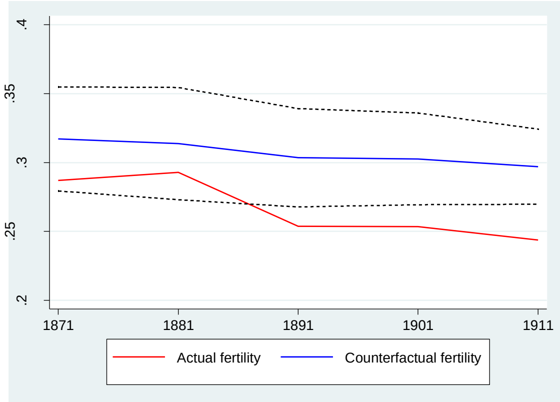
Panel 10f. Counterfactual fertility in France under no change in emigration after 1861



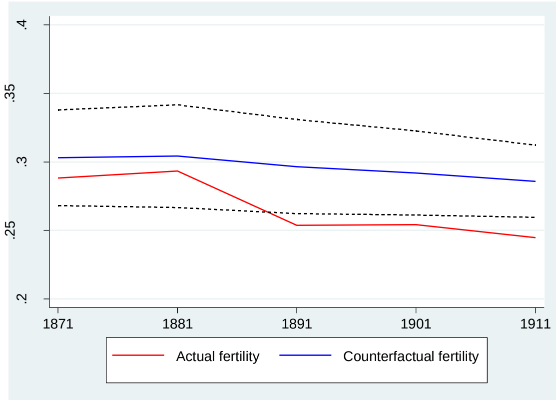
Note: This figure provides histograms for the counterfactual values of the fertility rate in the French départements using the IV regression results with the control variables as reported in Table 19.

Figure 11. Counterfactual fertility in France, 1861-1911 (Coale Fertility Index)

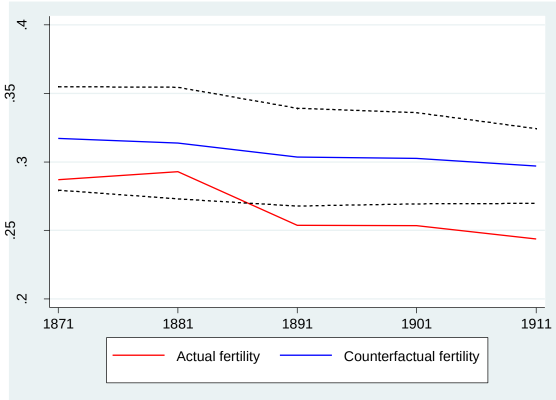
Panel 11a. Counterfactual fertility in France under no change in migration after 1861



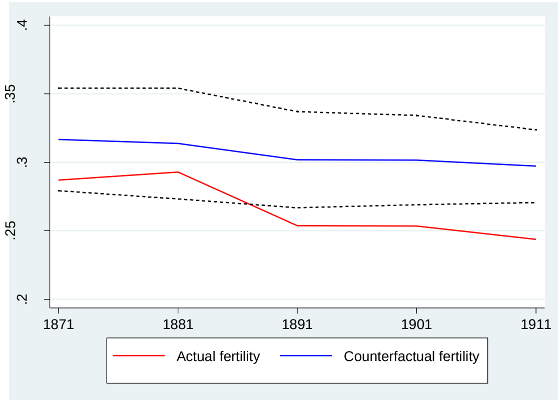
Panel 11b. Counterfactual fertility in France under no changes in migration from and to Paris after 1861



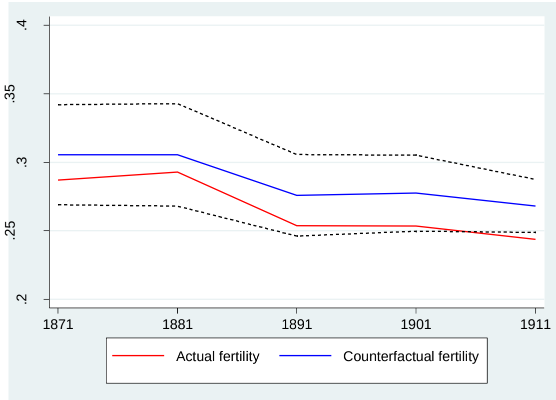
Panel 11c. Counterfactual fertility in France under no changes in female migration after 1861



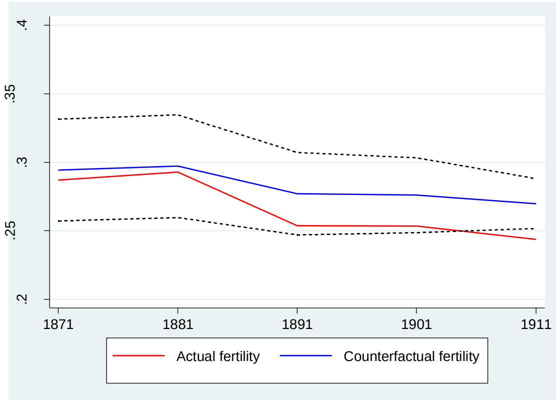
Panel 11d. Counterfactual fertility in France under no changes in male migration after 1861



Panel 11e. Counterfactual fertility in France under no change in immigration after 1861



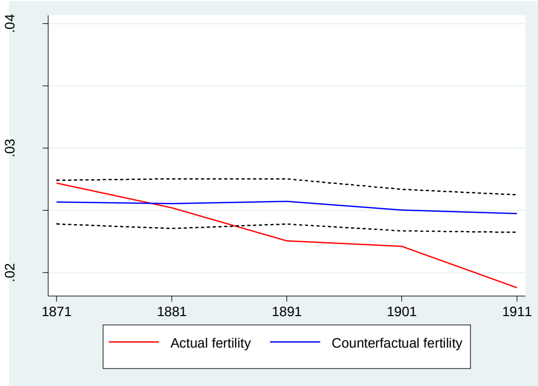
Panel 11f. Counterfactual fertility in France under no change in emigration after 1861



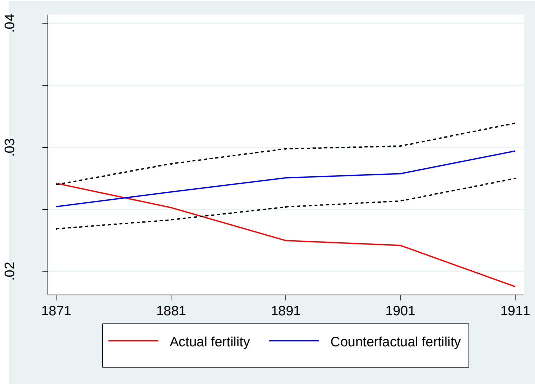
Note: This figure provides histograms for the counterfactual values of the fertility rate in the French départements using the IV regression results with the control variables as reported in Table 18.

Figure 12. Counterfactual fertility in France, 1861-1911 (Crude Birth Rate)

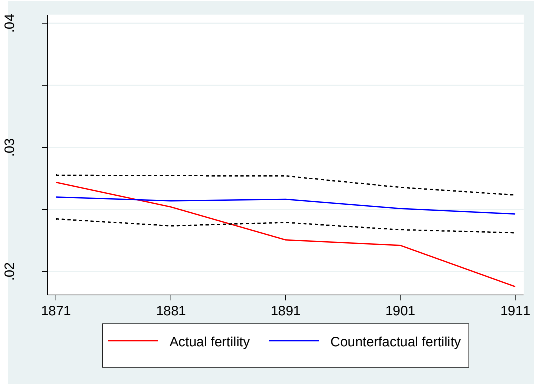
Panel 12a. Counterfactual fertility in France under no change in migration after 1861



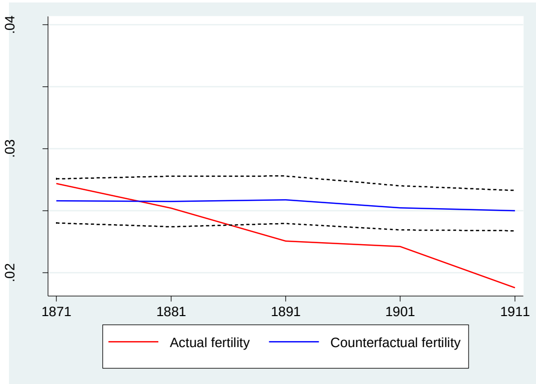
Panel 12b. Counterfactual fertility in France under no changes in migration from and to Paris after 1861



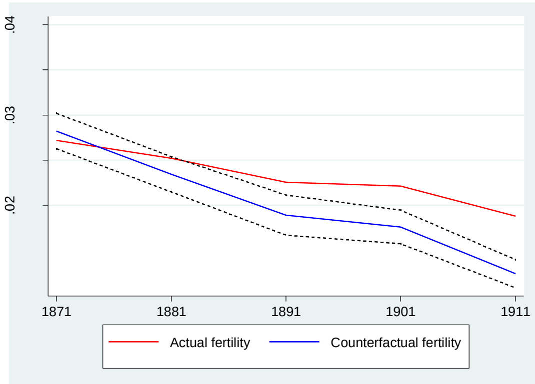
Panel 12c. Counterfactual fertility in France under no changes in female migration after 1861



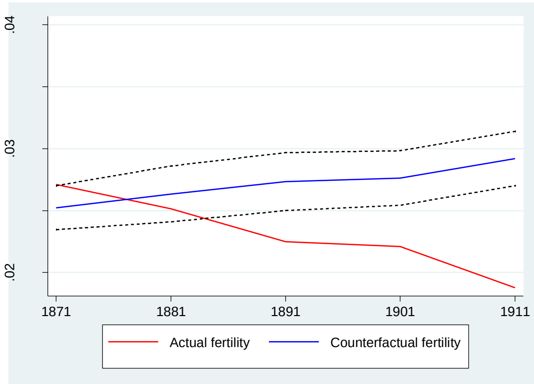
Panel 12d. Counterfactual fertility in France under no changes in male migration after 1861



Panel 12e. Counterfactual fertility in France under no change in immigration after 1861



Panel 12f. Counterfactual fertility in France under no change in emigration after 1861



Note: This figure provides histograms for the counterfactual values of the fertility rate in the French départements using the IV regression results with the control variables as reported in Table 19.

Table 1. The relationship between each underlying regressor and its instrumented counterpart: coefficients of correlations

		Instrumented Variables					
		Emigrants' Residence Norm (t)	Immigrants' Birthplace Norm (t)	Emigrants' Residence Norm (t) * Share of Emigrants(t)	Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	Share of Emigrants(t)	Share of Immigrants (t)
Underlying Regressors	Emigrants' Residence Norm (t)	0.88					
	Immigrants' Birthplace Norm (t)		0.82				
	Emigrants' Residence Norm (t) * Share of Emigrants(t)			0.93			
	Immigrants' Birthplace Norm (t) * Share of Immigrants (t)				0.97		
	Share of Emigrants(t)					0.92	
	Share of Immigrants (t)						0.97

Note: The correlations are computed over the full dataset (486 observations) whose summary statistics are shown in Table A1.

Table 2: Travel costs and migration: first stage regressions

The dependent variable is $m_{ij,t}$ the (log of the) stock of migrants born in *département i* living in *département j* at time *t*

	Stock of All Migrants	Stock of Male Migrants	Stock of Female Migrants
Transport Costs t-20	-0.811***	-0.806***	-0.822***
	(0.068)	(0.096)	(0.087)
Transport Costs t-30	-0.635***	-0.681***	-0.581***
	(0.061)	(0.085)	(0.090)
Year Fixed Effects	Yes	Yes	Yes
Origin-Département. & Destination-Département	Yes	Yes	Yes
Log Likelihood	-30,110,946	-20,904,507	-18,802,845
$\chi 2$	8807.3	6912.7	5802.0
Degrees of Freedom	157	157	157
F-statistic (1^{st} stage)	56.10	44.03	36.96
F-statistic (1^{st} stage) p-value	0.000	0.000	0.000
Clusters	5,700	5,700	5,700
Observations	34,200	34,200	34,200

Note: Robust standard errors clustered at the origin-département. & destination-département are reported in brackets. *** indicates significance at the 1%-level, ** indicates significance at the 5%-level, * indicates significance at the 10%-level.

Table 3: Determinants of the fertility decline in France, 1861-1911: all migrants (Coale Fertility Index)

	(1) OLS	(2) OLS	(3) IV	(4) IV
	Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.543***	0.376***	0.331	0.764**
	[0.123]	[0.101]	[0.322]	[0.299]
Immigrants' Birthplace Norm (t)	0.136	-0.0957	1.331***	0.433
	[0.118]	[0.0910]	[0.268]	[0.294]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.739***	-1.246**	-2.962***	-2.965***
	[0.649]	[0.591]	[0.884]	[0.826]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	1.548	2.808***	-0.275	1.006
	[1.012]	[0.724]	[1.362]	[0.859]
Share of Emigrants (t)	-2.766**	-1.906**	-4.081***	-3.942***
	[1.078]	[0.885]	[1.380]	[1.250]
Share of Immigrants (t)	3.481**	4.669***	0.851	1.761
	[1.375]	[0.983]	[1.868]	[1.084]
Life Expectancy Age 15 (t)		-0.0091		-0.0086
		[0.0091]		[0.0103]
Infant Mortality (t)		0.707**		0.654*
		[0.297]		[0.332]
log(Urban) (t)		-0.0200		0.196
		[0.300]		[0.291]
log(Industries) (t)		-0.0128*		-0.0029
		[0.0075]		[0.0070]
log(Professionals) (t)		-0.0131		-0.0058
		[0.0131]		[0.0122]
log(Female Education) (t-10)		-0.0389		-0.0211
		[0.0397]		[0.0395]
log(Male Education) (t-10)		0.0146		0.0087
		[0.0475]		[0.0494]
log(Share of Girls in Primary Catholic Schools) (t-10)		0.0123		0.0164
		[0.0179]		[0.0208]
log(Share of Boys in Primary Catholic Schools) (t-10)		0.0004		0.0042
		[0.0158]		[0.0151]
log(Revue des Deux Mondes Outlets) (t)		0.0555		0.0099
		[0.0365]		[0.0402]
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)		0.0390		0.0142
		[0.0246]		[0.0279]
Constant	-0.442**	-0.797	0.724**	0.651
	[0.191]	[0.524]	[0.318]	[0.749]
Within R2	0.6	0.76	0.7	0.77
F-stat	40.7	47.74	40.7	57.98
Prob>F-stat	0.00	0.00	0.00	0.00
Overidentification restriction test (p-value)			0.439	0.382
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81
Observations	486	486	486	486

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 4: Determinants of the fertility decline in France, 1861-1911: all migrants (Crude Birth Rate)

	(1)	(2)	(3)	(4)
	OLS	OLS	IV	IV
	Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.307**	0.180	-1.364***	-1.116***
	[0.152]	[0.135]	[0.420]	[0.364]
Immigrants' Birthplace Norm (t)	0.157	0.0487	2.504***	2.037***
	[0.120]	[0.0935]	[0.345]	[0.337]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-0.315	-0.152	0.0755	0.0975
	[0.453]	[0.504]	[0.458]	[0.491]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	0.686	1.131**	-0.552	-0.0851
	[0.530]	[0.492]	[0.789]	[0.723]
Share of Emigrants (t)	-2.123	-1.439	0.446	0.482
	[1.769]	[1.918]	[1.794]	[1.918]
Share of Immigrants (t)	3.470*	4.905***	-1.999	-0.404
	[1.985]	[1.844]	[3.147]	[2.838]
Life Expectancy Age 15 (t)		-0.0341***		-0.0154*
		[0.0093]		[0.0093]
Infant Mortality (t)		-0.882***		-0.237
		[0.324]		[0.320]
log(Urban) (t)		-0.146		0.047
		[0.124]		[0.128]
log(Industries) (t)		-0.004		0.001
		[0.0062]		[0.0058]
log(Professionals) (t)		0.001		-0.004
		[0.0105]		[0.0096]
log(Female Education (t))		-0.043		-0.014
		[0.0333]		[0.0342]
log(Male Education (t))		0.019		0.002
		[0.0473]		[0.0418]
log(Share of Girls in Primary Catholic Schools) (t)		0.006		-0.007
		[0.0165]		[0.0149]
log(Share of Boys in Primary Catholic Schools) (t)		0.0397***		0.0325**
		[0.0139]		[0.0136]
Revue des Deux Mondes Outlets		0.014		0.046
		[0.151]		[0.154]
Revue des Deux Mondes Outlets* Fertility of Seine		0.003		0.015
		[0.0383]		[0.0391]
Constant	-1.954***	-0.957	0.471	0.690
	[0.581]	[0.795]	[0.847]	[1.070]
Within R2	0.8	0.81	0.8	0.82
F-stat	117.5	81.6	126.3	87.9
Prob>F-stat	0.00	0.00	0.00	0.00
Overidentification restriction test (p-value)			0.352	0.310
Year-fixed effects	Yes	Yes	Yes	Yes
Department-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	80	80	80	80
Observations	480	480	480	480

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 5: Determinants of the fertility decline in France, 1821-1911: all migrants (Coale Fertility Index)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
	Dependent variable is Fertility(t)					
	1821-1911	1821-1851	1861-1911	1821-1911	1821-1851	1861-1911
Fertility (t-10)				0.562***	0.0190	0.305***
				[0.0399]	[0.0599]	[0.0541]
Emigrants' Residence Norm (t)	0.265***	0.0915*	0.589***	0.157***	0.0440	0.449***
	[0.0768]	[0.0474]	[0.122]	[0.0526]	[0.0734]	[0.108]
Immigrants' Birthplace Norm (t)	0.0786	0.00783	0.130	0.0974*	0.0206	0.139
	[0.0821]	[0.0838]	[0.121]	[0.0574]	[0.0771]	[0.106]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-0.369	-0.458	-1.908***	-0.326	-0.238	-1.695***
	[0.448]	[0.529]	[0.646]	[0.231]	[0.649]	[0.577]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	1.073	0.528	1.446	0.667	0.788	1.512
	[0.857]	[0.769]	[1.026]	[0.504]	[0.912]	[0.940]
Share of Emigrants (t)	-0.742*	-0.669	-3.016***	-0.376	-0.514	-2.412***
	[0.426]	[0.405]	[1.076]	[0.254]	[0.506]	[0.908]
Share of Immigrants (t)	1.937*	0.954	3.387**	1.227*	1.408	3.232**
	[0.982]	[0.812]	[1.388]	[0.619]	[0.969]	[1.247]
Constant	-0.708***	-0.902***	-0.414**	-0.332***	-1.042***	-0.244
	[0.123]	[0.105]	[0.204]	[0.112]	[0.132]	[0.204]
Within R2	0.7	0.5	0.6	0.8	0.5	0.7
F-stat	40.4	22.8	44.1	124.5	17.8	65.0
Prob>F-stat	0.000	0.000	0.000	0.000	0.000	0.000
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	80	80	80	80	80	80
Observations	800	320	480	720	240	480

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 6. Migration in 1861-1911 and lagged fertility in 1811-1861 (Coale Fertility Index)

	(1)	(2)	(3)	(4)
	OLS	OLS	IV	IV
	Dependent variable is Fertility(t-50)			
Emigrants' Residence Norm (t)	-0.00352	-0.149	-0.402	-0.295
	[0.144]	[0.138]	[0.316]	[0.304]
Immigrants' Birthplace Norm (t)	-0.0813	-0.188	0.347	-0.149
	[0.129]	[0.121]	[0.336]	[0.364]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	0.547	0.874	-0.473	-0.227
	[0.936]	[0.871]	[1.165]	[1.217]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	0.0405	0.328	0.429	1.192
	[1.118]	[1.078]	[1.053]	[0.983]
Share of Emigrants (t)	1.151	1.697	-0.522	-0.285
	[1.515]	[1.356]	[1.658]	[1.711]
Share of Immigrants (t)	0.173	0.149	-0.220	0.439
	[1.449]	[1.344]	[1.466]	[1.352]
Life Expectancy Age 15 (t)		0.0252*		0.0279**
		[0.0141]		[0.0138]
Infant Mortality (t)		0.936**		1.067**
		[0.447]		[0.430]
log(Urban) (t)		-0.131		-0.225
		[0.192]		[0.152]
log(Industries) (t)		0.0097		0.0030
		[0.00925]		[0.0101]
log(Professionals) (t)		-0.0093		-0.0101
		[0.0170]		[0.0181]
log(Female Education) (t)		-0.1110		-0.129**
		[0.0672]		[0.0575]
log(Male Education) (t)		-0.0084		-0.0068
		[0.0614]		[0.0554]
log(Share of Girls in Primary Catholic Schools) (t)		-0.0474*		-0.0363
		[0.0280]		[0.0299]
log(Share of Boys in Primary Catholic Schools) (t)		0.0379*		0.0251
		[0.0198]		[0.0206]
log(Revue des Deux Mondes Outlets) (t)		-0.0445		-0.0435
		[0.0443]		[0.0444]
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)		-0.0194		-0.0181
		[0.0279]		[0.0273]
Constant	-1.103***	-2.857***	-1.033***	-3.543***
	[0.231]	[0.810]	[0.291]	[0.968]
Within R2	0.5	0.58	0.6	0.59
F-stat	22.6	22.63	27.9	20.9
Prob>F-stat	0.00	0.00	0.00	0.00
Overidentification restriction test (p-value)			0.440	0.339
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81
Observations	486	486	486	486

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 7: Determinants of the fertility decline in France, 1861-1911: accounting for the lagged dependent variable (Coale Fertility Index)

	(1)	(2)	(3)	(4)
	OLS	OLS	IV	IV
	Dependent variable is Fertility(t)			
Fertility (t-10)	0.187***	0.0945*	0.176***	0.0829
	[0.0605]	[0.0496]	[0.0665]	[0.0586]
Emigrants' Residence Norm (t)	0.500***	0.334***	0.630**	0.899***
	[0.140]	[0.107]	[0.285]	[0.257]
Immigrants' Birthplace Norm (t)	0.174	-0.0766	0.913***	0.342
	[0.133]	[0.119]	[0.332]	[0.315]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.668**	-0.862	-2.612***	-2.477***
	[0.831]	[0.603]	[0.969]	[0.848]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	0.736	2.090**	-1.252	-0.106
	[1.169]	[0.974]	[0.780]	[0.687]
Share of Emigrants (t)	-2.573*	-1.076	-3.673**	-3.228**
	[1.335]	[0.963]	[1.499]	[1.277]
Share of Immigrants (t)	2.407	3.860***	-0.281	0.450
	[1.481]	[1.347]	[1.030]	[1.041]
Life Expectancy Age 15 (t)		-0.0195**		-0.0179*
		[0.0092]		[0.0099]
Infant Mortality (t)		0.627**		0.574*
		[0.292]		[0.322]
log(Urban) (t)		0.270		0.485*
		[0.320]		[0.256]
log(Industries) (t)		-0.0077		0.0013
		[0.0065]		[0.0062]
log(Professionals) (t)		-0.0105		-0.00328
		[0.0123]		[0.0113]
log(Female Education (t))		-0.0535		-0.0133
		[0.0498]		[0.0464]
log(Male Education (t))		-0.00987		-0.00238
		[0.0507]		[0.0539]
log(Share of Girls in Primary Catholic Schools) (t)		0.0118		0.0185
		[0.0175]		[0.0201]
log(Share of Boys in Primary Catholic Schools) (t)		-0.0244		-0.0177
		[0.0153]		[0.0148]
Revue des Deux Mondes Outlets (t)		0.0534		-0.0177
		[0.0447]		[0.0463]
Revue des Deux Mondes Outlets (t)* Fertility of Seine (t)		0.0372		-0.0016
		[0.0295]		[0.0313]
Constant	-0.345	-0.499	0.800**	0.838
	[0.249]	[0.518]	[0.314]	[0.598]
Within R2	0.60	0.74	0.70	0.76
F-stat	41.90	52.41	39.80	75.16
Prob>F-stat	0.000	0.000	0.000	0.000
Overidentification restriction test (p-value)			0.279	0.326
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81
Observations	405	405	405	405

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 8: Determinants of the fertility decline in France, 1861-1911: accounting for the lagged dependent variable (Crude Birth Rate)

	(1)	(2)	(3)	(4)
	OLS	OLS	IV	IV
	Dependent variable is Fertility(t)			
Fertility (t-10)	0.120	0.0355	0.101	0.0567
	[0.150]	[0.145]	[0.162]	[0.155]
Emigrants' Residence Norm (t)	0.299**	0.147	-1.239**	-0.928**
	[0.136]	[0.129]	[0.487]	[0.422]
Immigrants' Birthplace Norm (t)	0.183	0.0502	2.246***	1.697***
	[0.123]	[0.102]	[0.481]	[0.445]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-0.328	0.0112	0.0851	0.118
	[0.361]	[0.483]	[0.440]	[0.495]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	0.286	1.078**	-0.477	0.168
	[0.493]	[0.462]	[0.696]	[0.666]
Share of Emigrants (t)	-2.198	-0.808	0.361	0.418
	[1.378]	[1.807]	[1.777]	[1.974]
Share of Immigrants (t)	2.288	5.088***	-1.468	0.763
	[1.895]	[1.792]	[2.812]	[2.644]
Life Expectancy Age 15 (t)		-0.0431***		-0.0219*
		[0.0126]		[0.0123]
Infant Mortality (t)		-1.053***		-0.266
		[0.387]		[0.386]
log(Urban) (t)		0.0473		0.209
		[0.141]		[0.160]
log(Industries) (t)		-0.00132		0.00282
		[0.00537]		[0.00546]
log(Professionals) (t)		-0.00343		-0.00570
		[0.0120]		[0.0111]
log(Female Education (t))		-0.0712**		-0.0281
		[0.0354]		[0.0457]
log(Male Education (t))		0.00757		-0.00343
		[0.0475]		[0.0429]
log(Share of Girls in Primary Catholic Schools) (t)		-0.00285		-0.0147
		[0.0153]		[0.0145]
log(Share of Boys in Primary Catholic Schools) (t)		0.0355**		0.0299**
		[0.0140]		[0.0124]
Revue des Deux Mondes Outlets (t)		0.0586		0.0521
		[0.143]		[0.128]
Revue des Deux Mondes Outlets (t)* Fertility of Seine (t)		0.0164		0.0182
		[0.0361]		[0.0332]
Constant	-1.447*	-0.626	0.351	0.323
	[0.765]	[0.829]	[0.874]	[0.918]
Within R2	0.80	0.83	0.80	0.83
F-stat	155.10	136.28	140.60	109.73
Prob>F-stat	0.000	0.000	0.000	0.000
Overidentification restriction test (p-value)			0.319	0.294
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	80	80	80	80
Observations	400	400	400	400

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 9: Determinants of the fertility decline in France, 1861-1911, accounting for lagged variables (Coale Fertility Index)

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) IV	(6) IV	(7) IV	(8) IV
	Dependent variable is Fertility(t)							
Emigrants' Residence Norm (t)	0.475**		0.319*		0.440		0.845**	
	[0.213]		[0.177]		[0.311]		[0.322]	
Immigrants' Birthplace Norm (t)	0.154		-0.0118		0.735**		0.145	
	[0.136]		[0.119]		[0.291]		[0.285]	
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.521		-0.865		-1.116		-1.811	
	[1.344]		[1.130]		[1.443]		[1.303]	
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	-0.0131		0.586		-1.062		-0.302	
	[1.203]		[0.909]		[0.907]		[0.733]	
Share of Emigrants (t)	-2.802		-1.115		-1.417		-2.328	
	[2.061]		[1.846]		[2.039]		[1.852]	
Share of Immigrants (t)	1.180		1.824		-0.535		-0.160	
	[1.581]		[1.258]		[1.197]		[1.179]	
Emigrants' Residence Norm (t-10)	0.182	0.567***	0.0441	0.379***	0.811**	1.091***	0.426	1.036***
	[0.209]	[0.144]	[0.181]	[0.139]	[0.350]	[0.279]	[0.275]	[0.243]
Immigrants' Birthplace Norm (t-10)	0.0683	0.198*	-0.0440	-0.0169	-0.0366	0.219	-0.238	-0.247
	[0.113]	[0.118]	[0.0944]	[0.117]	[0.302]	[0.319]	[0.259]	[0.333]
Emigrants' Residence Norm (t-10) * Share of Emigrants (t-10)	-0.170	-2.306**	0.111	-1.731*	-3.283**	-4.979***	-1.645	-4.397***
	[1.701]	[1.085]	[1.482]	[1.033]	[1.362]	[1.025]	[1.488]	[1.147]
Immigrants' Birthplace Norm (t-10) * Share of Immigrants (t-10)	1.475	1.131	1.720**	1.895*	1.580**	1.078	1.588**	1.813**
	[1.009]	[1.097]	[0.701]	[0.982]	[0.665]	[0.686]	[0.638]	[0.863]
Share of Emigrants (t-10)	0.246	-3.096*	0.213	-2.286	-4.859***	-6.803***	-2.460	-6.028***
	[2.468]	[1.622]	[2.222]	[1.450]	[1.828]	[1.525]	[2.017]	[1.680]
Share of Immigrants (t-10)	2.534*	2.786**	2.474**	3.601***	3.595***	3.728***	3.069***	4.160***
	[1.354]	[1.346]	[0.988]	[1.226]	[0.861]	[1.040]	[0.817]	[1.160]
Life Expectancy Age 15 (t)			-0.016				-0.015	
			[0.0103]				[0.00931]	
Infant Mortality (t)			0.712**				0.635**	
			[0.331]				[0.312]	
log(Urban) (t)			0.417**				0.629***	
			[0.185]				[0.139]	
log(Industries) (t)			-0.012				-0.001	
			[0.007]				[0.0073]	
log(Professionals) (t)			-0.014				-0.003	
			[0.0138]				[0.0120]	
log(Female Education) (t-10)			-0.053				-0.038	
			[0.0533]				[0.0487]	
log(Male Education) (t-10)			-0.009				0.013	
			[0.0525]				[0.0521]	
log(Share of Girls in Primary Catholic Schools) (t-10)			0.030				0.0327*	
			[0.0196]				[0.0196]	
log(Share of Boys in Primary Catholic Schools) (t-10)			-0.029				-0.014	
			[0.0174]				[0.0152]	
log(Revue des Deux Mondes Outlets) (t)			0.036				-0.021	
			[0.0376]				[0.0376]	
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)			0.027				-0.002	
			[0.0226]				[0.0230]	
Life Expectancy Age 15 (t-10)			-0.019	0.022			-0.021	0.019
			[0.0145]	[0.0153]			[0.0148]	[0.0163]
Infant Mortality (t-10)			-0.511	1.260**			-0.555	1.028*
			[0.514]	[0.513]			[0.501]	[0.557]
log(Urban) (t-10)			-	-			-0.282*	-0.253*
			[0.129]	[0.137]			[0.147]	[0.141]
log(Industries) (t-10)			-0.004	-0.005			0.001	0.008
			[0.0088]	[0.0105]			[0.0071]	[0.0094]
log(Professionals) (t-10)			-	-0.025			-0.0191*	-0.0260*
			[0.0127]	[0.0160]			[0.0103]	[0.0154]
log(Female Education (t-10)			0.104**	0.008			0.112**	0.018
			[0.0482]	[0.0459]			[0.0441]	[0.0438]
log(Male Education (t-10)			-	-			-	-0.178***
			[0.0577]	[0.0621]			[0.0524]	[0.0532]
log(Share of Girls in Primary Catholic Schools) (t-10)			0.005	0.013			0.003	0.039
			[0.0317]	[0.0370]			[0.0347]	[0.0420]
log(Share of Boys in Primary Catholic Schools) (t-10)			-0.006	-0.027			-0.002	-0.021
			[0.0127]	[0.0184]			[0.0115]	[0.0171]
Revue des Deux Mondes Outlets (t-10)			0.0759**	0.0830*			0.0732**	0.049
			[0.0333]	[0.0429]			[0.0346]	[0.0423]
Revue des Deux Mondes Outlets* Fertility of Seine (t-10)			0.0523**	0.0562*			0.0489**	0.028
			[0.0240]	[0.0301]			[0.0241]	[0.0303]
Constant	-0.372	-0.549**	0.114	-	1.024***	0.0953	1.504	-1.716*
	[0.297]	[0.257]	[0.946]	[0.878]	[0.373]	[0.247]	[1.060]	[0.957]
Within R2	0.61	0.566	0.781	0.66	0.674	0.617	0.806	0.686
F-stat	29.18	36.85	38.49	38.32	38.40	41.11	78.83	40.99
Prob>F-stat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Overidentification restriction test (p-value)					0.516	0.827	0.438	0.754
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81	81	81	81	81
Observations	405	405	405	405	405	405	405	405

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 10: Determinants of the fertility decline in France, 1861-1911, accounting for lagged variables (Crude Birth Rate)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	IV	IV	IV	IV
	Dependent variable is Fertility(t)							
Emigrants' Residence Norm (t)	0.244		0.0809		-1.025***		-0.741*	
	[0.147]		[0.124]		[0.360]		[0.372]	
Immigrants' Birthplace Norm (t)	0.216*		0.0439		1.461***		0.976**	
	[0.128]		[0.108]		[0.422]		[0.428]	
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-0.308		-0.0259		0.779		0.502	
	[0.598]		[0.603]		[0.626]		[0.547]	
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	0.261		1.238**		1.084		1.463	
	[0.628]		[0.579]		[1.190]		[1.101]	
Share of Emigrants (t)	-1.962		-0.322		3.227		2.114	
	[2.294]		[2.415]		[2.365]		[2.153]	
Share of Immigrants (t)	1.979		5.428**		3.338		4.457	
	[2.328]		[2.127]		[4.274]		[4.165]	
Emigrants' Residence Norm (t-10)	0.272*	0.437**	0.148	0.228	-0.329	-1.326***	-0.136	-1.346***
	[0.155]	[0.173]	[0.140]	[0.177]	[0.550]	[0.456]	[0.508]	[0.499]
Immigrants' Birthplace Norm (t-10)	-0.0990	0.113	-0.187*	-0.117	1.104**	2.360***	0.438	1.758***
	[0.0944]	[0.109]	[0.107]	[0.0971]	[0.512]	[0.413]	[0.355]	[0.438]
Emigrants' Residence Norm (t-10) * Share of Emigrants (t-10)	-0.360	-1.149	-0.182	-0.503	-1.669*	-0.435	-0.871	0.160
	[1.027]	[0.758]	[0.834]	[0.958]	[0.993]	[0.835]	[1.024]	[1.015]
Immigrants' Birthplace Norm (t-10) * Share of Immigrants (t-10)	0.667	0.530	0.811	1.760**	-2.375**	-1.703*	-1.194	-0.511
	[0.917]	[0.804]	[0.783]	[0.783]	[1.167]	[0.886]	[0.980]	[0.913]
Share of Emigrants (t-10)	-1.680	-5.327*	-1.494	-2.945	-6.135*	-1.234	-3.354	0.933
	[3.843]	[2.851]	[2.997]	[3.466]	[3.555]	[3.155]	[3.687]	[3.732]
Share of Immigrants (t-10)	3.017	2.916	3.487	7.156**	-7.225*	-5.377	-2.829	-1.448
	[3.288]	[2.950]	[2.814]	[2.915]	[3.827]	[3.355]	[3.511]	[3.445]
Life Expectancy Age 15 (t)			-0.040***				-0.0201	
			[0.0106]				[0.0122]	
Infant Mortality (t)			-1.111***				-0.401	
			[0.370]				[0.435]	
log(Urban) (t)			0.0378				0.129	
			[0.186]				[0.166]	
log(Industries) (t)			-0.00720				0.000355	
			[0.00666]				[0.00771]	
log(Professionals) (t)			-0.00271				-0.0136	
			[0.0138]				[0.0124]	
log(Female Education) (t-10)			0.0704				0.0832	
			[0.0751]				[0.0775]	
log(Male Education) (t-10)			0.0231				0.0111	
			[0.0503]				[0.0476]	
log(Share of Girls in Primary Catholic Schools) (t-10)			-0.0211				-0.0305	
			[0.0272]				[0.0327]	
log(Share of Boys in Primary Catholic Schools) (t-10)			0.0334**				0.0280*	
			[0.0140]				[0.0152]	
log(Revue des Deux Mondes Outlets) (t)			0.100				0.131	
			[0.155]				[0.131]	
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)			0.0279				0.0400	
			[0.0407]				[0.0347]	
Life Expectancy Age 15 (t-10)			0.00747	0.00210			0.00365	0.00549
			[0.0117]	[0.0134]			[0.0152]	[0.0165]
Infant Mortality (t-10)			0.479	0.344			0.334	0.423
			[0.421]	[0.467]			[0.513]	[0.541]
log(Urban) (t-10)			-0.0199	-0.147			0.0681	0.00956
			[0.125]	[0.132]			[0.145]	[0.149]
log(Industries) (t-10)			-0.0181**	-0.0183**			-0.00575	-0.00916
			[0.00755]	[0.00820]			[0.00739]	[0.00803]
log(Professionals) (t-10)			0.00471	0.00475			-0.00278	-0.00445
			[0.0133]	[0.0120]			[0.0110]	[0.0101]
log(Female Education (t-10)			-0.111**	-0.104***			-0.0720	-0.0561*
			[0.0515]	[0.0234]			[0.0497]	[0.0324]
log(Male Education (t-10)			-0.0396	-0.0289			-0.0687**	-0.0482
			[0.0308]	[0.0290]			[0.0325]	[0.0307]
log(Share of Girls in Primary Catholic Schools) (t-10)			0.0585	0.0485			0.0635	0.0509
			[0.0527]	[0.0393]			[0.0599]	[0.0418]
log(Share of Boys in Primary Catholic Schools) (t-10)			-0.0214	-0.00774			-0.0127	0.00409
			[0.0245]	[0.0248]			[0.0217]	[0.0230]
Revue des Deux Mondes Outlets (t-10)			0.103	0.226			0.0848	0.153
			[0.338]	[0.283]			[0.308]	[0.299]
Revue des Deux Mondes Outlets* Fertility of Seine (t-10)			0.0264	0.0594			0.0203	0.0413
			[0.0908]	[0.0741]			[0.0824]	[0.0787]
Constant	-1.349*	-1.587**	-1.836	-3.475***	0.678	0.0654	-1.139	-2.635**
	[0.735]	[0.709]	[1.241]	[1.167]	[1.098]	[0.799]	[1.907]	[1.257]
Within R2	0.813	0.792	0.848	0.825	0.822	0.806	0.846	0.824
F-stat	100.41	111.58	145.39	131.25	129.80	120.26	119.03	92.55
Prob>F-stat	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Overidentification restriction test (p-value)					0.284	0.252	0.203	0.274
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	80	80	80	80	80	80	80	80
Observations	400	400	400	400	400	400	400	400

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 11. Migration and the fertility decline, 1861-1911, accounting for periodicals and new religious buildings in each département (Coale Fertility Index)

	(1) OLS	(2) IV	(3) OLS	(4) IV
	Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.361***	0.758**	0.381***	1.056***
	[0.101]	[0.297]	[0.102]	[0.271]
Immigrants' Birthplace Norm (t)	-0.0722	0.449	-0.100	0.192
	[0.0945]	[0.293]	[0.0916]	[0.279]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.211**	-2.949***	-1.239**	-3.277***
	[0.604]	[0.819]	[0.590]	[0.831]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	2.640***	0.815	2.768***	1.014
	[0.729]	[0.811]	[0.729]	[0.863]
Share of Emigrants (t)	-1.853**	-3.932***	-1.896**	-4.469***
	[0.908]	[1.237]	[0.882]	[1.260]
Share of Immigrants (t)	4.451***	1.520	4.609***	1.886
	[0.980]	[0.998]	[0.988]	[1.134]
Life Expectancy Age 15 (t)	-0.0091	-0.0086	-0.0079	-0.0093
	[0.00923]	[0.0103]	[0.00925]	[0.0101]
Infant Mortality (t)	0.704**	0.650*	0.741**	0.631*
	[0.297]	[0.330]	[0.301]	[0.327]
log(Urban) (t)	0.0123	0.2270	-0.0034	0.2240
	[0.298]	[0.286]	[0.294]	[0.280]
log(Industries) (t)	-0.0125*	-0.0025	-0.0154*	-0.0070
	[0.0075]	[0.007]	[0.0081]	[0.0075]
log(Professionals) (t)	-0.0115	-0.0040	-0.0145	-0.0046
	[0.0130]	[0.0123]	[0.0132]	[0.0121]
log(Female Education) (t-10)	-0.0390	-0.0208	-0.0322	-0.0211
	[0.0393]	[0.0385]	[0.0388]	[0.0393]
log(Male Education) (t-10)	0.0127	0.0068	0.0114	0.0126
	[0.0467]	[0.0481]	[0.0479]	[0.0517]
log(Share of Girls in Primary Catholic Schools) (t-10)	0.0144	0.0182	0.0092	0.0127
	[0.0179]	[0.0214]	[0.0182]	[0.0205]
log(Share of Boys in Primary Catholic Schools) (t-10)	-0.0012	0.0027	0.0034	0.0063
	[0.0157]	[0.0153]	[0.0161]	[0.0156]
log(Revue des Deux Mondes Outlets) (t)	0.0546	0.0090	0.0572	0.0088
	[0.0356]	[0.0391]	[0.0360]	[0.0393]
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)	0.0386	0.0137	0.0397	0.0133
	[0.0240]	[0.0271]	[0.0244]	[0.0274]
Total Number of Periodicals	-0.0220	-0.0237		
	[0.0161]	[0.0146]		
New Catholic Church			-0.0050	-0.0004
			[0.0065]	[0.0053]
New Orthodox Church			-0.169***	-0.260***
			[0.0247]	[0.0423]
New Protestant Temple			0.0198	0.0238
			[0.0155]	[0.0232]
Constant	-0.753	0.756	-0.861	0.795
	[0.528]	[0.750]	[0.530]	[0.739]
Within R2	0.756	0.769	0.761	0.777
Overidentification restriction test (p-value)		0.302		0.406
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81
Observations	486	486	486	486

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 12 Migration and the fertility decline, 1861-1911, accounting for out-of-wedlock births and age at marriage (Coale Fertility Index)

	(1) OLS	(2) IV	(3) OLS	(4) IV
	Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.365***	0.749**	0.369***	0.734**
	[0.104]	[0.296]	[0.101]	[0.287]
Immigrants' Birthplace Norm (t)	-0.0973	0.442	-0.103	0.430
	[0.0941]	[0.290]	[0.0975]	[0.292]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.206**	-2.918***	-1.189**	-2.836***
	[0.598]	[0.832]	[0.579]	[0.804]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	2.809***	0.971	2.957***	1.095
	[0.727]	[0.872]	[0.810]	[0.844]
Share of Emigrants (t)	-1.853**	-3.868***	-1.809**	-3.736***
	[0.903]	[1.255]	[0.861]	[1.213]
Share of Immigrants (t)	4.674***	1.722	4.915***	1.827*
	[0.982]	[1.098]	[1.098]	[1.054]
Life Expectancy Age 15 (t)	-0.009	-0.009	-0.010	-0.009
	[0.0091]	[0.0103]	[0.0094]	[0.0102]
Infant Mortality (t)	0.712**	0.651*	0.667**	0.623*
	[0.295]	[0.332]	[0.304]	[0.328]
log(Urban) (t)	-0.025	0.187	-0.016	0.199
	[0.301]	[0.294]	[0.310]	[0.294]
log(Industries) (t)	-0.012	-0.002	-0.012	-0.003
	[0.0076	[0.0070]	[0.0075]	[0.0072]
log(Professionals) (t)	-0.014	-0.007	-0.013	-0.005
	[0.0133]	[0.0123]	[0.0126]	[0.0120]
log(Female Education) (t-10)	-0.039	-0.020	-0.044	-0.029
	[0.0398]	[0.0395]	[0.0404]	[0.0400]
log(Male Education) (t-10)	0.013	0.008	0.017	0.011
	[0.0476]	[0.0495]	[0.0474]	[0.0490]
log(Share of Girls in Primary Catholic Schools) (t-10)	0.012	0.016	0.017	0.019
	[0.0181]	[0.0210]	[0.0179]	[0.0201]
log(Share of Boys in Primary Catholic Schools) (t-10)	0.001	0.005	-0.001	0.004
	[0.0160]	[0.0151]	[0.0157]	[0.0152]
log(Revue des Deux Mondes Outlets) (t)	0.056	0.010	0.056	0.009
	[0.0365]	[0.0404]	[0.0364]	[0.0408]
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)	0.039	0.014	0.041	0.014
	[0.0247]	[0.0280]	[0.0247]	[0.0282]
Share of Children Born out of Wedlock	-0.075	-0.0986*		
out of the Total Number of Births (t)	[0.0558]	[0.0507]		
Share of Not Legitimised Children	-0.005	-0.026		
out of Those who were Born out of Wedlock (t)	[0.0468]	[0.0396]		
Share of Married Men Age 20-24 (t)			0.153	0.0276
			[0.153]	[0.152]
Share of Married Women Age 20-24 (t)			0.0361	0.0681
			[0.143]	[0.131]
Share of Married Men Age 25-29 (t)			-0.0174	-0.0409
			[0.124]	[0.126]
Share of Married Women Age 25-29 (t)			0.0671	0.102
			[0.178]	[0.166]
Share of Married Men Age 30-34 (t)			-0.0939	-0.114
			[0.113]	[0.128]
Share of Married Women Age 30-34 (t)			-0.213	-0.139
			[0.215]	[0.195]
Constant	-0.812	0.664	-0.705	0.712
	[0.522]	[0.751]	[0.558]	[0.741]
Within R2	0.755	0.768	0.757	0.769
Overidentification restriction test (p-value)		0.391		0.403
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81
Observations	486	486	486	486

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 13. Migration and the fertility decline, 1861-1911, accounting for the quantity of mineral fuels consumed by mineral industries and wheat prices (Coale Fertility Index)

	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
	Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.368***	0.766**	0.386***	0.959***
	[0.100]	[0.291]	[0.102]	[0.241]
Immigrants' Birthplace Norm (t)	-0.0846	0.389	-0.103	0.199
	[0.0919]	[0.289]	[0.0938]	[0.268]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.241**	-2.974***	-1.289**	-3.160***
	[0.580]	[0.810]	[0.610]	[0.825]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	2.697***	0.995	2.881***	1.172
	[0.724]	[0.830]	[0.722]	[0.911]
Share of Emigrants (t)	-1.844**	-3.961***	-1.927**	-4.263***
	[0.870]	[1.239]	[0.924]	[1.253]
Share of Immigrants (t)	4.493***	1.788*	4.802***	2.198*
	[0.983]	[1.046]	[0.980]	[1.246]
Life Expectancy Age 15 (t)	-0.0102	-0.00984	-0.0107	-0.0110
	[0.00918]	[0.0101]	[0.0101]	[0.0104]
Infant Mortality (t)	0.685**	0.624*	0.644*	0.566*
	[0.296]	[0.327]	[0.336]	[0.338]
log(Urban) (t)	-0.0217	0.182	-0.00935	0.216
	[0.297]	[0.286]	[0.298]	[0.288]
log(Industries) (t)	-0.0125*	-0.00268	-0.00941	0.00139
	[0.00745]	[0.00693]	[0.00760]	[0.0076]
log(Professionals) (t)	-0.0122	-0.00501	-0.0146	-0.0071
	[0.0129]	[0.0123]	[0.0131]	[0.0124]
log(Female Education) (t-10)	-0.0426	-0.0260	-0.0323	-0.0154
	[0.0408]	[0.0410]	[0.0391]	[0.0380]
log(Male Education) (t-10)	0.0122	0.00716	0.0165	0.0106
	[0.0477]	[0.0495]	[0.0475]	[0.0492]
log(Share of Girls in Primary Catholic Schools) (t-10)	0.0113	0.0168	0.00782	0.0132
	[0.0175]	[0.0199]	[0.0181]	[0.0200]
log(Share of Boys in Primary Catholic Schools) (t-10)	-0.00197	0.00155	0.00295	0.00835
	[0.0158]	[0.0148]	[0.0158]	[0.0150]
log(Revue des Deux Mondes Outlets) (t)	0.0536	0.00920	0.0584	0.0120
	[0.0365]	[0.0404]	[0.0353]	[0.0396]
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)	0.0375	0.0131	0.0411*	0.0150
	[0.0247]	[0.0278]	[0.0239]	[0.0275]
Quantity of Mineral Fuels Consumed by Mineral Industries (t)	0.0132*	0.0146**		
	[0.0070]	[0.0065]		
Wheat Prices (t)			-0.142*	-0.111
			[0.0736]	[0.0684]
Constant	-0.923*	0.161	-0.246	0.797
	[0.526]	[0.616]	[0.728]	[0.683]
Within R2	0.757	0.770	0.763	0.777
Overidentification restriction test (p-value)		0.352		0.411
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81
Observations	486	486	485	485

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 14: Determinants of the fertility decline in France, 1861-1911: accounting for spatial autocorrelation (Coale Fertility Index)

	(1) OLS	(2) OLS	(3) IV	(4) IV
	Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.504***	0.336***	0.398***	0.607***
	[0.0937]	[0.0985]	[0.122]	[0.177]
Immigrants' Birthplace Norm (t)	0.0864	-0.0813	0.814***	0.258
	[0.110]	[0.0883]	[0.193]	[0.194]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.982***	-1.318**	-1.902***	-2.786***
	[0.532]	[0.589]	[0.634]	[0.791]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	1.413	2.154***	0.0960	0.688
	[0.934]	[0.734]	[1.310]	[0.710]
Share of Emigrants (t)	-3.149***	-1.742**	-2.607***	-3.583***
	[0.857]	[0.869]	[0.978]	[1.168]
Share of Immigrants (t)	3.184**	4.055***	1.066	1.637*
	[1.270]	[0.982]	[1.883]	[0.912]
Life Expectancy Age 15 (t)		0.0135***		0.0098***
		[0.0021]		[0.0025]
Infant Mortality (t)		1.369***		1.180***
		[0.160]		[0.189]
log(Urban) (t)		0.0778		0.345*
		[0.232]		[0.206]
log(Industries) (t)		-0.0092***		-0.0048
		[0.0035]		[0.0033]
log(Professionals) (t)		0.0127*		0.0078
		[0.0071]		[0.0097]
log(Female Education) (t-10)		-0.0316		-0.0126
		[0.0318]		[0.0339]
log(Male Education) (t-10)		0.0240		0.0398
		[0.0387]		[0.0435]
log(Share of Girls in Primary Catholic Schools) (t-10)		0.0021		0.0167
		[0.0162]		[0.0193]
log(Share of Boys in Primary Catholic Schools) (t-10)		-0.0017		0.0039
		[0.0158]		[0.0143]
log(Revue des Deux Mondes Outlets) (t)		0.0725**		0.0234
		[0.0346]		[0.0375]
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)		0.0494**		0.0192
		[0.0239]		[0.0264]
ρ	2.722***	2.608***	1.142*	1.794***
	[0.253]	[0.289]	[0.609]	[0.528]
σ^2	0.0046***	0.0033***	0.0047***	0.0032***
	[0.00053]	[0.00034]	[0.00052]	[0.00033]
Within R2	0.6	0.8	0.6	0.8
Log-pseudolikelihood	612.6	698.9	613.5	701.7
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81
Observations	486	486	486	486

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 15: The fertility decline in France, 1861-1911: only male migration (Coale Fertility Index)

	(1)	(2)	(3)	(4)
	OLS	OLS	IV	IV
	Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.450***	0.319***	0.396	0.806***
	[0.111]	[0.0932]	[0.318]	[0.292]
Immigrants' Birthplace Norm (t)	0.0574	-0.108	1.279***	0.356
	[0.0945]	[0.0712]	[0.260]	[0.278]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.266**	-0.953*	-2.905***	-2.773***
	[0.531]	[0.505]	[0.791]	[0.770]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	1.020	1.994***	-0.308	0.876
	[0.820]	[0.581]	[1.336]	[0.843]
Share of Emigrants (t)	-2.132**	-1.489**	-3.999***	-3.711***
	[0.820]	[0.697]	[1.227]	[1.164]
Share of Immigrants (t)	2.405**	3.367***	0.693	1.558
	[1.145]	[0.779]	[1.877]	[1.087]
Life Expectancy Age 15 (t)		-0.0058		-0.0098
		[0.00889]		[0.0103]
Infant Mortality (t)		0.836***		0.613*
		[0.294]		[0.334]
log(Urban) (t)		-0.0526		0.1670
		[0.298]		[0.299]
log(Industries) (t)		-0.0137*		-0.0030
		[0.00763]		[0.00711]
log(Professionals) (t)		-0.0164		-0.0052
		[0.0132]		[0.0126]
log(Female Education) (t-10)		-0.0335		-0.0333
		[0.0396]		[0.0389]
log(Male Education) (t-10)		0.0029		0.0115
		[0.0448]		[0.0493]
log(Share of Girls in Primary Catholic Schools) (t-10)		0.0097		0.0106
		[0.0176]		[0.0202]
log(Share of Boys in Primary Catholic Schools) (t-10)		0.0003		0.0082
		[0.0162]		[0.0148]
log(Revue des Deux Mondes Outlets) (t)		0.0535		0.0141
		[0.0370]		[0.0413]
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)		0.0376		0.0167
		[0.0253]		[0.0287]
Constant	-0.621***	-1.061**	0.747**	0.703
	[0.191]	[0.502]	[0.331]	[0.753]
Within R2	0.6	0.75	0.70	0.77
F-stat	40.8	51.14	38.70	54.49
Prob>F-stat	0.00	0.00	0.00	0.00
Overidentification restriction test (p-value)			0.410	0.384
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81
Observations	486	486	486	486

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 16: The fertility decline in France, 1861-1911: only female migration (Coale Fertility Index)

	(1)	(2)	(3)	(4)
	OLS	OLS	IV	IV
	Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.502***	0.250***	0.237	0.663**
	[0.100]	[0.0898]	[0.321]	[0.302]
Immigrants' Birthplace Norm (t)	0.0352	-0.127	1.377***	0.516*
	[0.101]	[0.0775]	[0.278]	[0.299]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-2.163***	-1.057*	-2.917***	-2.817***
	[0.645]	[0.608]	[0.912]	[0.830]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	1.914*	2.719***	0.426	1.376*
	[0.993]	[0.685]	[1.321]	[0.770]
Share of Emigrants (t)	-3.470***	-1.611	-4.033***	-3.708***
	[1.117]	[0.981]	[1.411]	[1.251]
Share of Immigrants (t)	3.676***	4.232***	1.724	2.093**
	[1.321]	[0.929]	[1.780]	[0.950]
Life Expectancy Age 15 (t)		-0.0056		-0.0064
		[0.0106]		[0.0104]
Infant Mortality (t)		0.847**		0.758**
		[0.335]		[0.333]
log(Urban) (t)		-0.0681		0.2030
		[0.325]		[0.288]
log(Industries) (t)		-0.0131		-0.0049
		[0.0080]		[0.0071]
log(Professionals) (t)		-0.0081		-0.0046
		[0.0148]		[0.0123]
log(Female Education) (t-10)		-0.0666		-0.0155
		[0.0424]		[0.0403]
log(Male Education) (t-10)		0.0201		0.0089
		[0.0534]		[0.0499]
log(Share of Girls in Primary Catholic Schools) (t-10)		-0.0042		0.0184
		[0.0188]		[0.0217]
log(Share of Boys in Primary Catholic Schools) (t-10)		0.0132		0.0024
		[0.0164]		[0.0154]
log(Revue des Deux Mondes Outlets) (t)		0.0719*		0.0113
		[0.0389]		[0.0404]
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)		0.0488*		0.0156
		[0.0261]		[0.0279]
Constant	-0.563***	-1.143*	0.668**	0.500
	[0.168]	[0.591]	[0.313]	[0.757]
Within R2	0.6	0.74	0.7	0.77
F-stat	41.3	52.20	41.5	66.91
Prob>F-stat	0.00	0.00	0.00	0.00
Overidentification restriction test (p-value)			0.405	0.318
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81
Observations	486	486	486	486

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 17: The fertility decline in France, 1861-1911, excluding migration to and from Seine (Paris and suburbs) (Coale Fertility Index)

	(1) OLS	(2) OLS	(3) IV	(4) IV
	Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.335***	0.229***	0.844*	0.469
	[0.0963]	[0.0856]	[0.439]	[0.401]
Immigrants' Birthplace Norm (t)	0.172	-0.109	0.625	0.503
	[0.132]	[0.0982]	[0.413]	[0.394]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	0.0258	-0.191	-2.594	-2.629*
	[0.759]	[0.658]	[1.711]	[1.545]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	1.450	2.859***	1.554	2.073*
	[1.264]	[0.863]	[1.565]	[1.152]
Share of Emigrants (t)	-0.103	-0.270	-3.716	-3.606
	[1.137]	[0.912]	[2.681]	[2.380]
Share of Immigrants (t)	3.037*	4.585***	3.892	3.687**
	[1.744]	[1.231]	[2.340]	[1.795]
Life Expectancy Age 15 (t)		-0.0020		-0.0030
		[0.0100]		[0.0100]
Infant Mortality (t)		0.923***		0.787**
		[0.313]		[0.332]
log(Urban) (t)		-0.0490		0.0596
		[0.312]		[0.329]
log(Industries) (t)		-0.0124		-0.0054
		[0.0084]		[0.0080]
log(Professionals) (t)		-0.0177		-0.0114
		[0.0128]		[0.0126]
log(Female Education) (t-10)		-0.0428		-0.0177
		[0.0406]		[0.0408]
log(Male Education) (t-10)		0.0020		-0.0011
		[0.0490]		[0.0515]
log(Share of Girls in Primary Catholic Schools) (t-10)		0.0017		0.0014
		[0.0184]		[0.0194]
log(Share of Boys in Primary Catholic Schools) (t-10)		0.0035		0.0097
		[0.0165]		[0.0151]
log(Revue des Deux Mondes Outlets) (t)		0.0868**		0.0538
		[0.0363]		[0.0373]
log(Revue des Deux Mondes Outlets) (t) * log(Fertility of Seine) (t)		0.0570**		0.0390
		[0.0246]		[0.0255]
Constant	-0.671***	-1.417**	0.460	-0.0767
	[0.210]	[0.592]	[0.425]	[0.833]
Within R2	0.6	0.746	0.7	0.752
F-stat	39.5	44.60	47.80	48.12
Prob>F-stat	0.00	0.00	0.00	0.00
Overidentification restriction test (p-value)			0.405	0.318
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Number of clusters	80	80	80	80
Observations	480	480	480	480

Note: All the variables are in logarithms. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table 18. Actual, predicted and counterfactual fertility rates in France, 1861-1911 (Coale Fertility Index)

	OLS						IV					
	1861	1871	1881	1891	1901	1911	1861	1871	1881	1891	1901	1911
	No Changes in Migration after 1861						No Change in Migration after 1861					
Actual Data	0.3105	0.2871	0.2930	0.2537	0.2536	0.2437	0.3105	0.2871	0.2930	0.2537	0.2536	0.2437
	[0.061]	[0.063]	[0.065]	[0.049]	[0.043]	[0.037]	[0.061]	[0.063]	[0.065]	[0.049]	[0.043]	[0.037]
Basic Model (Predicted Values)	0.3083	0.2826	0.2886	0.2503	0.2511	0.2412	0.3079	0.2826	0.2886	0.2505	0.2512	0.2414
	[0.049]	[0.035]	[0.034]	[0.022]	[0.020]	[0.011]	[0.045]	[0.035]	[0.034]	[0.025]	[0.023]	[0.014]
Counterfactual fertility in France	0.3083	0.2954	0.2941	0.2691	0.2701	0.2675	0.3079	0.3172	0.3138	0.3035	0.3027	0.2970
under no changes in migration after 1861	[0.049]	[0.040]	[0.042]	[0.035]	[0.034]	[0.028]	[0.045]	[0.038]	[0.041]	[0.036]	[0.033]	[0.027]
Counterfactual fertility in France	0.3083	0.2976	0.3018	0.2716	0.2766	0.2720	0.3079	0.3055	0.3055	0.2759	0.2775	0.2682
under no changes in immigration after 1861	[0.049]	[0.037]	[0.038]	[0.028]	[0.026]	[0.018]	[0.045]	[0.037]	[0.037]	[0.030]	[0.028]	[0.019]
Counterfactual fertility in France	0.3083	0.2830	0.2832	0.2520	0.2501	0.2441	0.3079	0.2943	0.2972	0.2771	0.2760	0.2699
under no changes in emigration after 1861	[0.049]	[0.039]	[0.039]	[0.032]	[0.030]	[0.023]	[0.045]	[0.037]	[0.037]	[0.030]	[0.027]	[0.018]
Pearson χ^2	0.593	0.887	0.942	0.633	0.644	0.558	0.503	0.764	0.849	0.589	0.565	0.456
	No Changes in Female Migration after 1861						No Changes in Female Migration after 1861					
Basic Model (Predicted Values)	0.3078	0.2821	0.2882	0.2500	0.2508	0.2411	0.3079	0.2825	0.2885	0.2505	0.2512	0.2414
	[0.044]	[0.029]	[0.030]	[0.019]	[0.016]	[0.009]	[0.045]	[0.034]	[0.033]	[0.024]	[0.022]	[0.014]
Counterfactual fertility in France	0.3078	0.2912	0.2918	0.2635	0.2646	0.2607	0.3079	0.3182	0.3147	0.3075	0.3062	0.3012
under no changes in female migration after 1861	[0.044]	[0.033]	[0.035]	[0.028]	[0.026]	[0.021]	[0.045]	[0.037]	[0.040]	[0.035]	[0.032]	[0.026]
Pearson χ^2	0.512	0.747	0.794	0.555	0.553	0.467	0.477	0.723	0.800	0.550	0.526	0.417
	No Changes in Male Migration after 1861						No Changes in Male Migration after 1861					
Basic Model (Predicted Values)	0.3079	0.2823	0.2883	0.2502	0.2509	0.2412	0.3079	0.2826	0.2886	0.2505	0.2512	0.2413
	[0.045]	[0.032]	[0.031]	[0.020]	[0.018]	[0.010]	[0.045]	[0.035]	[0.034]	[0.025]	[0.022]	[0.013]
Counterfactual fertility in France	0.3079	0.2927	0.2936	0.2651	0.2664	0.2627	0.3079	0.3168	0.3137	0.3019	0.3016	0.2972
under no changes in male migration after 1861	[0.045]	[0.036]	[0.037]	[0.030]	[0.028]	[0.022]	[0.045]	[0.037]	[0.040]	[0.035]	[0.033]	[0.027]
Pearson χ^2	0.519	0.817	0.842	0.592	0.594	0.527	0.490	0.734	0.819	0.568	0.546	0.444
	No changes in migration from and to Paris after 1861						No changes in migration from and to Paris after 1861					
Basic Model (Predicted Values)	0.3073	0.2831	0.2883	0.2502	0.2515	0.2424	0.3074	0.2832	0.2886	0.2504	0.2518	0.2425
	[0.041]	[0.029]	[0.026]	[0.018]	[0.015]	[0.009]	[0.043]	[0.030]	[0.030]	[0.022]	[0.020]	[0.012]
Counterfactual fertility in France under no changes	0.3073	0.2898	0.2901	0.2663	0.2662	0.2645	0.3074	0.3031	0.3042	0.2966	0.2920	0.2859
in migration from and to Paris after 1861	[0.041]	[0.032]	[0.034]	[0.029]	[0.027]	[0.023]	[0.043]	[0.035]	[0.037]	[0.034]	[0.031]	[0.026]
Pearson χ^2	0.486	0.719	0.778	0.550	0.514	0.449	0.530	0.742	0.907	0.613	0.561	0.473

Note**:** This table reports the mean and standard deviation at the national level for the actual, predicted and counterfactual values under the assumption that no changes in fertility norms and in the shares of migrants had occurred after 1861 at the national level using the OLS and IV regression results with the control variables in Columns 2 and 4 of Tables 3, 11, 12 and 13**.** The counterfactual values obtained from the IV regression results are graphed in Figures 9 and 11**.**

Table 19. Actual, predicted and counterfactual fertility rates in France, 1861-1911 (Crude Birth Rate)

	OLS						IV					
	1861	1871	1881	1891	1901	1911	1861	1871	1881	1891	1901	1911
	No Changes in Migration after 1861						No Change in Migration after 1861					
Actual Data	0.0262	0.0272	0.0252	0.0226	0.0221	0.0188	0.0262	0.0272	0.0252	0.0226	0.0221	0.0188
	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.003]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.003]
Basic Model (Predicted Values)	0.0260	0.0269	0.0250	0.0222	0.0220	0.0186	0.0260	0.0269	0.0250	0.0222	0.0219	0.0186
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]
Counterfactual fertility in France	0.0260	0.0267	0.0256	0.0237	0.0240	0.0219	0.0260	0.0257	0.0255	0.0257	0.0250	0.0247
under no changes in migration after 1861	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Counterfactual fertility in France	0.0260	0.0272	0.0261	0.0239	0.0244	0.0216	0.0260	0.0282	0.0234	0.0189	0.0176	0.0124
under no changes in immigration after 1861	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Counterfactual fertility in France	0.0260	0.0264	0.0246	0.0221	0.0216	0.0189	0.0260	0.0244	0.0273	0.0307	0.0317	0.0380
under no changes in emigration after 1861	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.003]
Pearson χ^2	0.0333	0.0476	0.0445	0.0569	0.0412	0.0330	0.0278	0.0377	0.0322	0.0415	0.0248	0.0214
	No Changes in Female Migration after 1861						No Changes in Female Migration after 1861					
Basic Model (Predicted Values)	0.0260	0.0269	0.0250	0.0222	0.0219	0.0186	0.0260	0.0269	0.0250	0.0222	0.0219	0.0186
	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]
Counterfactual fertility in France	0.0260	0.0270	0.0258	0.0238	0.0242	0.0218	0.0260	0.0260	0.0257	0.0258	0.0251	0.0246
under no changes in female migration after 1861	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Pearson χ^2	0.0330	0.0423	0.0389	0.0515	0.0367	0.0290	0.0264	0.0361	0.0307	0.0405	0.0237	0.0198
	No Changes in Male Migration after 1861						No Changes in Male Migration after 1861					
Basic Model (Predicted Values)	0.0260	0.0269	0.0250	0.0222	0.0219	0.0186	0.0260	0.0269	0.0250	0.0222	0.0219	0.0186
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]
Counterfactual fertility in France	0.0260	0.0267	0.0254	0.0232	0.0233	0.0208	0.0260	0.0258	0.0257	0.0259	0.0252	0.0250
under no changes in male migration after 1861	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Pearson χ^2	0.0336	0.0465	0.0433	0.0579	0.0402	0.0333	0.0271	0.0382	0.0329	0.0419	0.0254	0.0219
	No changes in migration from and to Paris after 1861						No changes in migration from and to Paris after 1861					
Basic Model (Predicted Values)	0.0259	0.0268	0.0249	0.0221	0.0219	0.0186	0.0259	0.0268	0.0249	0.0222	0.0219	0.0186
	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Counterfactual fertility in France under no changes	0.0259	0.0263	0.0251	0.0232	0.0230	0.0209	0.0259	0.0252	0.0264	0.0275	0.0279	0.0297
in migration from and to Paris after 1861	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Pearson χ^2	0.0302	0.0453	0.0404	0.0515	0.0358	0.0309	0.0287	0.0390	0.0339	0.0430	0.0264	0.0217

Note**:** This table reports the mean and standard deviation at the national level for the actual, predicted and counterfactual values under the assumption that no changes in fertility norms and in the shares of migrants had occurred after 1861 at the national level using the OLS and IV regression results with the control variables**.** The counterfactual values obtained from the IV regression results are graphed in Figures 10 and 12**.**

Table 20. Actual, predicted and counterfactual fertility rates in France, 1891-1911 (Coale Fertility Index) using the Census data

	OLS			IV		
	1891	1901	1911	1891	1901	1911
	No Changes in Migration after 1861			No Changes in Migration after 1861		
Actual Data	0.2538	0.2539	0.2435	0.2538	0.2539	0.2435
	[0.0486]	[0.0427]	[0.0365]	[0.0486]	[0.0427]	[0.0365]
Basic Model (Predicted Values)	0.2544	0.2548	0.2428	0.2537	0.2540	0.2425
	[0.0564]	[0.0515]	[0.0330]	[0.0524]	[0.0466]	[0.0304]
Counterfactual fertility in France	0.2544	0.2515	0.2542	0.2537	0.2508	0.2407
under no changes in migration after 1861	[0.0564]	[0.0517]	[0.0458]	[0.0524]	[0.0479]	[0.0379]
Counterfactual fertility in France	0.2544	0.2514	0.2311	0.2537	0.2557	0.2455
under no changes in immigration after 1861	[0.0564]	[0.0525]	[0.0365]	[0.0524]	[0.0472]	[0.0351]
Counterfactual fertility in France	0.2544	0.2474	0.2395	0.2537	0.2521	0.2424
under no changes in emigration after 1861	[0.0564]	[0.0523]	[0.0462]	[0.0524]	[0.0484]	[0.0424]
Pearson $\chi 2$	1.2102	1.2135	1.0046	1.1644	1.1402	0.9886
	No Changes in Female Migration after 1861			No Changes in Female Migration after 1861		
Basic Model (Predicted Values)		0.2604	0.2522		0.2541	0.246
		[0.0662]	[0.0684]		[0.0401]	[0.045]
Counterfactual fertility in France		0.2604	0.2552		0.2541	0.241
under no changes in female migration after 1861		[0.0062]	[0.0648]		[0.0401]	[0.038]
Pearson $\chi 2$		1.5730	1.3752		0.8776	0.763
	No Changes in Male Migration after 1861			No Changes in Male Migration after 1861		
Basic Model (Predicted Values)		0.2615	0.2534		0.2540	0.2453
		[0.0683]	[0.0717]		[0.0395]	[0.0440]
Counterfactual fertility in France		0.2615	0.2495		0.2540	0.2396
under no changes in male migration after 1861		[0.0683]	[0.0667]		[0.0395]	[0.0373]
Pearson $\chi 2$		2.0573	1.8806		0.8781	0.7705
	No changes in migration from and to Paris after 1861			No changes in migration from and to Paris after 1861		
Basic Model (Predicted Values)	0.2517	0.2529	0.2428	0.2510	0.2523	0.2426
	[0.0336]	[0.0297]	[0.0190]	[0.0275]	[0.0235]	[0.0168]
Counterfactual fertility in France under no changes	0.2517	0.2483	0.2414	0.2510	0.2475	0.2317
in migration from and to Paris after 1861	[0.0336]	[0.0305]	[0.0260]	[0.0275]	[0.0234]	[0.0180]
Pearson $\chi 2$	0.6658	0.6314	0.6213	0.7009	0.6544	0.6165

Note**:** This table reports the mean and standard deviation at the national level for the actual, predicted and counterfactual values under the assumption that no changes in fertility norms and in the shares of migrants had occurred after 1861 at the national level**.**

Table 21. Actual, predicted and counterfactual fertility rates in France, 1861-1911 (Crude Birth Rate) using the Census data

	OLS			IV		
	1891	1901	1911	1891	1901	1911
	No Changes in Migration after 1861			No Changes in Migration after 1861		
Actual Data	0.0224	0.0220	0.0187	0.0224	0.0220	0.0187
	[0.0042]	[0.0034]	[0.0030]	[0.0042]	[0.0034]	[0.0030]
Basic Model (Predicted Values)	0.0227	0.0223	0.0190	0.0222	0.0219	0.0185
	[0.0060]	[0.0058]	[0.0050]	[0.0028]	[0.0026]	[0.0021]
Counterfactual fertility in France	0.0227	0.0224	0.0241	0.0222	0.0217	0.0215
under no changes in migration after 1861	[0.0060]	[0.0063]	[0.0080]	[0.0028]	[0.0028]	[0.0041]
Counterfactual fertility in France	0.0227	0.0230	0.0223	0.0222	0.0213	0.0165
under no changes in immigration after 1861	[0.0060]	[0.0064]	[0.0076]	[0.0028]	[0.0026]	[0.0030]
Counterfactual fertility in France	0.0227	0.0219	0.0215	0.0222	0.0225	0.0251
under no changes in emigration after 1861	[0.0060]	[0.0060]	[0.0072]	[0.0028]	[0.0032]	[0.0053]
Pearson χ2	0.1683	0.1547	0.1321	0.0719	0.0547	0.0472
	No Changes in Female Migration after 1861			No Changes in Female Migration after 1861		
Basic Model (Predicted Values)		0.022	0.0189		0.0220	0.0187
		[0.0052]	[0.0046]		[0.0038]	[0.0033]
Counterfactual fertility in France		0.022	0.0228		0.0220	0.0232
under no changes in female migration after 1861		[0.0052]	[0.0053]		[0.0038]	[0.0042]
Pearson χ2		0.135	0.1139		0.0750	0.0618
	No Changes in Male Migration after 1861			No Changes in Male Migration after 1861		
Basic Model (Predicted Values)		0.0220	0.0187		0.0221	0.0188
		[0.0037]	[0.0034]		[0.0047]	[0.0040]
Counterfactual fertility in France		0.0220	0.0225		0.0221	0.0234
under no changes in male migration after 1861		[0.0037]	[0.0037]		[0.0047]	[0.0051]
Pearson χ2		0.0967	0.0804		0.0954	0.0786
	No changes in migration from and to Paris after 1861			No changes in migration from and to Paris after 1861		
Basic Model (Predicted Values)	0.0222	0.0219	0.0185	0.0221	0.0218	0.0185
	[0.0028]	[0.0026]	[0.0021]	[0.0023]	[0.0021]	[0.0018]
Counterfactual fertility in France under no changes	0.0222	0.0217	0.0215	0.0221	0.0221	0.0228
in migration from and to Paris after 1861	[0.0028]	[0.0028]	[0.0041]	[0.0023]	[0.0025]	[0.0041]
Pearson χ2	0.0719	0.0547	0.0472	0.0630	0.0461	0.0391

Note**:** This table reports the mean and standard deviation at the national level for the actual, predicted and counterfactual values under the assumption that no changes in fertility norms and in the shares of migrants had occurred after 1861 at the national level**.**

For Online Publication -- Appendix

Appendix A.

Appendix Table A1: Descriptive statistics

	Obs.	Mean	Std.Dev	Min	Max
Coale Fertility Index					
Inhabitants' Residence Norm	486	0.274	0.059	0.158	0.566
Inhabitants' Residence Norm (1811-1861)	486	0.360	0.099	0.205	0.871
Fertility Norms and Share of Emigrants - Main Sample					
Emigrants' Residence Norm	486	0.257	0.038	0.168	0.395
Immigrants' Birthplace Norm	486	0.274	0.035	0.207	0.422
Share of Emigrants	486	0.169	0.074	0.031	0.467
Share of Immigrants	486	0.123	0.081	0.006	0.554
Fertility Norms and Share of Emigrants - Female Sample					
Emigrants' Residence Norm	486	0.255	0.039	0.161	0.390
Immigrants' Birthplace Norm	486	0.275	0.040	0.198	0.496
Share of Emigrants	486	0.164	0.076	0.022	0.471
Share of Immigrants	486	0.119	0.087	0.002	0.583
Fertility Norms and Share of Emigrants - Male Sample					
Emigrants' Residence Norm	486	0.259	0.042	0.173	0.484
Immigrants' Birthplace Norm	486	0.273	0.040	0.190	0.459
Share of Emigrants	486	0.182	0.079	0.039	0.519
Share of Immigrants	486	0.136	0.089	0.009	0.616
Fertility Norms and Share of Emigrants - Excluding Paris					
Emigrants' Residence Norm	480	0.266	0.037	0.168	0.437
Immigrants' Birthplace Norm	480	0.276	0.034	0.207	0.422
Share of Emigrants	480	0.127	0.064	0.011	0.467
Share of Immigrants	480	0.111	0.060	0.006	0.372
Fertility Norms and Share of Emigrants - Extended Sample 1821-1911					
Emigrants' Residence Norm	800	0.306	0.084	0.168	0.774
Immigrants' Birthplace Norm	800	0.303	0.053	0.207	0.510
Share of Emigrants	800	0.146	0.096	0.001	1.258
Share of Immigrants	800	0.114	0.093	0.000	1.069
Crude Birth Rate					
Inhabitants' Residence Norm	480	0.024	0.005	0.008	0.038
Fertility Norms and Share of Emigrants - Main Sample					
Emigrants' Residence Norm	480	0.025	0.004	0.015	0.034
Immigrants' Birthplace Norm	480	0.024	0.004	0.016	0.047
Share of Emigrants	480	0.168	0.074	0.031	0.467
Share of Immigrants	480	0.124	0.082	0.006	0.554
Fertility Norms and Share of Emigrants - Female Sample					
Emigrants' Residence Norm	480	0.024	0.004	0.014	0.033
Immigrants' Birthplace Norm	480	0.024	0.004	0.015	0.047
Share of Emigrants	480	0.164	0.076	0.022	0.471
Share of Immigrants	480	0.119	0.087	0.002	0.583
Fertility Norms and Share of Emigrants - Male Sample					
Emigrants' Residence Norm	480	0.025	0.004	0.014	0.038
Immigrants' Birthplace Norm	480	0.024	0.004	0.015	0.053

Share of Emigrants	480	0.182	0.079	0.039	0.518
Share of Immigrants	480	0.136	0.089	0.009	0.616
Fertility Norms and Share of Emigrants - Excluding Paris					
Emigrants' Residence Norm	474	0.024	0.003	0.014	0.035
Immigrants' Birthplace Norm	474	0.024	0.004	0.016	0.047
Share of Emigrants	474	0.127	0.064	0.011	0.467
Share of Immigrants	474	0.112	0.060	0.006	0.372
Instrumental Variable					
Travel Costs					
Education, health and the workforce					
Life Expectancy at Age 15	486	48.72	7.55	34.76	65.91
Infant Mortality (under age 1, in %)	486	0.217	0.108	0.019	0.626
Urban (% residents living in jurisdictions of more than 2,000 inhabitants)	486	0.280	0.162	0.082	1.000
Industries (% of the workforce in the industrial sector)	486	0.211	0.134	0.001	0.677
Professionals (% of professionals, e.g. lawyers, doctors..., in workforce)	486	0.027	0.016	0.001	0.160
Female Education (% 5-19 year old females in primary and secondary schools)	486	0.499	0.136	0.075	0.792
Male Education (% 5-19 year old males in primary and secondary schools)	486	0.528	0.129	0.149	1.071
Share of girls in Catholic primary schools (in %, out of the total number of girls in Catholic and secular primary schools)	486	0.437	0.182	0.026	0.939
Share of boys in Catholic primary schools (in %, out of the total number of boys in Catholic and secular primary schools)	486	0.166	0.122	0.010	0.727
Revue des Deux Mondes Outlets (t)	486	0.597	0.816	0	4
Variables for robustness checks					
Total Number of Periodicals	486	51.31	253.45	2	4021
New Catholic Church	486	0.506	0.990	0	11
New Orthodox Church	486	0.004	0.064	0	1
New Protestant Temple	486	0.029	0.179	0	2
Share of Children Born out of Wedlock out of the Total Number of Births	486	0.063	0.055	0	1
Share of not legitimised Children out of those who were Born out of Wedlock	486	0.664	0.185	0.095	1
Share of Married Men Age 20-24	486	0.119	0.056	0.021	0.431
Share of Married Women Age 20-24	486	0.462	0.142	0.172	0.899
Share of Married Men Age 25-29	486	0.488	0.113	0.072	0.871
Share of Married Women Age 25-29	486	0.699	0.091	0.277	0.868
Share of Married Men Age 30-34	486	0.678	0.132	0.248	0.860
Share of Married Women Age 30-34	486	0.772	0.070	0.472	0.968
Quantity of Mineral Fuels Consumed by Mineral Industries	486	963416.2	2660328	2400	37205100
Wheat Prices	485	21.49	3.54	14.1	28.89

Table A2. The relationship between each underlying regressor and its instrumented counterpart: OLS regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
	Dependent variable is the instrumented value of					
	Emigrants' Residence Norm (t)	Immigrants' Birthplace Norm (t)	Emigrants' Residence Norm(t)* Share of Emigrants(t)	Immigrants' Birthplace Norm (t)* Share of Immigrants(t)	Share of Emigrants(t)	Share of Immigrants (t)
Underlying Regressor						
Emigrants' Residence Norm (t)	0.272					
	[0.023]***					
Immigrants' Birthplace Norm (t)		0.227				
		[0.021]***				
Emigrants' Residence Norm (t) * Share of Emigrants(t)			0.534			
			[0.060]***			
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)				0.443		
				[0.042]***		
Share of Emigrants(t)					0.445	
					[0.065]***	
Share of Immigrants (t)						0.386
						[0.049]***
Adjusted R2	0.94	0.94	0.86	0.95	0.84	0.95
F-stat	1277.29	1057.25	285.1	427.12	184.11	259.38
F-stat p-value	0.000	0.000	0.000	0.000	0.000	0.000
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	486	486	486	486	486	486

Note: These regressions relate the underlying value of the main regressors to their instrumented value in OLS regressions with year- and fixed- effects. All the variables are in logarithms. Standard errors are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Table A3. Migration and the fertility decline, 1861-1911, accounting for the deviation in wheat prices (Coale Fertility Index)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	IV	IV	IV
			Dependent variable is Fertility(t)			
Emigrants' Residence Norm (t)	0.386***	0.367***	0.373***	0.968***	0.929***	0.942***
	[0.101]	[0.101]	[0.101]	[0.240]	[0.239]	[0.241]
Immigrants' Birthplace Norm (t)	-0.101	-0.0964	-0.0995	0.198	0.241	0.238
	[0.0939]	[0.0909]	[0.0917]	[0.268]	[0.268]	[0.273]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.277**	-1.167**	-1.199**	-3.158***	-3.098***	-3.153***
	[0.607]	[0.577]	[0.582]	[0.821]	[0.824]	[0.816]
Immigrants' Birthplace Norm (t)* Share of Immigrants (t)	2.859***	2.812***	2.830***	1.150	1.156	1.167
	[0.726]	[0.724]	[0.728]	[0.901]	[0.927]	[0.921]
Share of Emigrants (t)	-1.909**	-1.768**	-1.811**	-4.262***	-4.209***	-4.286***
	[0.919]	[0.859]	[0.870]	[1.247]	[1.248]	[1.238]
Share of Immigrants (t)	4.780***	4.756***	4.792***	2.168*	2.226*	2.240*
	[0.986]	[0.990]	[0.991]	[1.237]	[1.285]	[1.276]
Life Expectancy Age 15 (t)	-0.0104	-0.00857	-0.00798	-0.0111	-0.00950	-0.00871
	[0.0101]	[0.00944]	[0.00940]	[0.0104]	[0.0103]	[0.0103]
Infant Mortality (t)	0.655*	0.724**	0.745**	0.563	0.618*	0.646*
	[0.337]	[0.307]	[0.305]	[0.339]	[0.333]	[0.332]
log(Urban) (t)	-0.0111	-0.00740	-0.00577	0.213	0.221	0.225
	[0.297]	[0.295]	[0.296]	[0.288]	[0.285]	[0.285]
log(Industries) (t)	-0.00952	-0.0110	-0.0110	0.00151	0.000417	0.000386
	[0.00766]	[0.00770]	[0.00767]	[0.00766]	[0.00766]	[0.00768]
log(Professionals) (t)	-0.0151	-0.0153	-0.0152	-0.00731	-0.00750	-0.00731
	[0.0132]	[0.0133]	[0.0132]	[0.0124]	[0.0123]	[0.0123]
log(Female Education (t))	-0.0328	-0.0262	-0.0277	-0.0162	-0.00856	-0.0110
	[0.0389]	[0.0383]	[0.0383]	[0.0377]	[0.0370]	[0.0374]
log(Male Education (t))	0.0161	0.00774	0.00767	0.0110	0.00347	0.00396
	[0.0472]	[0.0471]	[0.0470]	[0.0489]	[0.0491]	[0.0490]
log(Share of Girls in Primary Catholic Schools) (t)	0.00813	0.00733	0.00773	0.0133	0.0121	0.0129
	[0.0181]	[0.0181]	[0.0181]	[0.0200]	[0.0203]	[0.0203]
log(Share of Boys in Primary Catholic Schools) (t)	0.00277	0.00300	0.00247	0.00828	0.00895	0.00835
	[0.0156]	[0.0156]	[0.0156]	[0.0149]	[0.0151]	[0.0151]
Revue des Deux Mondes Outlets (t)	0.0584	0.0571	0.0573	0.0121	0.0112	0.0112
	[0.0354]	[0.0359]	[0.0360]	[0.0395]	[0.0399]	[0.0399]
Revue des Deux Mondes Outlets (t)* Fertility of Seine (t)	0.0411*	0.0395	0.0397	0.0152	0.0142	0.0142
	[0.0239]	[0.0244]	[0.0245]	[0.0274]	[0.0278]	[0.0278]
Deviation Wheat Prices (t)	-0.00739*			-0.00643*		
	[0.00416]			[0.00364]		
Squared Deviation Wheat Prices (t)		-0.00210			-0.00238	
		[0.00230]			[0.00216]	
Absolute Deviation Wheat Prices (t)			-0.00301			-0.00266
			[0.00647]			[0.00591]
Constant	-0.720	-0.844	-0.875	0.454	0.370	0.336
	[0.596]	[0.548]	[0.544]	[0.627]	[0.619]	[0.620]
Within R2	0.763	0.761	0.761	0.777	0.776	0.776
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	81	81	81	81	81	81
Observations	485	485	485	485	485	485

Note: All the variables are in logarithms, except for the deviation in Wheat Prices defined as Deviation Wheat Prices (t) $= (Wheat\ Prices_{it} - mwp_t)/swp_t$, where $Wheat\ Prices_{it}$ is the price of wheat in département i in year t, mwp_t is the average wheat price in year t and swp_t is the standard deviation of wheat prices in year t. Robust standard errors clustered at the département-level are reported in brackets. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Appendix B. Unconditional convergence in départemental fertility rates

Following our discussion in Section 2, where we discuss the convergence in the fertility levels across the French départements, we run a series of unconditional convergence regressions of the standard form in the growth regression literature (e.g., Barro and Sala-i-Martin, 1992):

$$\log\left(\frac{f_{i,t+10}}{f_{i,t}}\right) = a.\log(f_{i,t}) + \alpha_i + \alpha_t + \varepsilon_{i,t} \quad \text{(B.1)}$$

where $f_{i,t}$ is the fertility rate in département i and year t α_i and α_t are département- and year-fixed effects ε is an error term such that $\varepsilon \longrightarrow \mathcal{N}(0, \sigma^2)$. In line with the literature, we view a negative and significant coefficient associated with $f_{i,t}$ as evidence of unconditional convergence.

We report in Appendix Table B.1 estimates of Equation (B.1) using the Coale fertility index over our main sample period (1861-1911) as well as over other samples (1821-1911, 1821-1851), as well as the Total Fertility Rate over the 1861-1911 period. In all these regressions, the coefficient associated with the fertility rate is negative and significant, suggesting that there was an unconditional convergence of local fertility rates in France during the nineteenth century.

Appendix Table B.1: Unconditional convergence test of fertility: France before WWI

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
	Dependent variable is Fertility(t+10)/Fertility(t)			
	Coale Fertility Index 1861-1911	Coale Fertility Index 1821-1911	Coale Fertility Index 1821-1851	Total Fertility Rate 1861-1911
Fertility(t)	-0.566***	-0.235***	-0.972***	-0.200***
	[0.0676]	[0.0639]	[0.118]	[0.0389]
Constant	0.338***	0.695***	0.0430	0.267*
	[0.0888]	[0.0889]	[0.129]	[0.140]
Within R2	0.5	0.3	0.4	0.7
Year-fixed effects	Yes	Yes	Yes	Yes
Département-fixed effects	Yes	Yes	Yes	Yes
Clusters	81	80	80	80
Observations	405	720	240	400

Note: All variables are in logarithms. Robust standard errors clustered at the region level are reported. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Estimates of Equation (B.1) are reported in Appendix Table B.2 for England and Wales, Italy and Germany. In these regressions, the coefficient associated with the fertility rate is not negative, thereby suggesting that the unconditional convergence of regional fertility rates is a specific French feature.

Appendix Table B.2: Unconditional convergence test of fertility: England and Wales, Germany, and Italy before WWI

	Dependent variable is $(f_{i,t+10}/f_{i,t})$		
	England and Wales (1851-1911)	Germany (1871-1910)	Italy (1871-1910)
$f_{i.t}$	0.07**	0.07**	0.20
	[0.03]	[0.03]	[0.11]
Year= 1861	-0.03***		
	[0.01]		
Year= 1871	-0.07***		
	[0.01]		
Year= 1881	-0.18***	-0.08***	-0.00
	[0.01]	[0.01]	[0.02]
Year= 1891	-0.17***	-0.05***	0.00
	[0.01]	[0.01]	[0.02]
Year= 1901	-0.20***	-0.18***	-0.02
	[0.01]	[0.01]	[0.02]
Constant	0.11***	-0.09***	-0.17
	[0.03]	[0.03]	[0.11]
Observations	276	284	64
R^2	0.81	0.59	0.09

Note: All variables are in logarithms. Robust standard errors clustered at the region level are reported. Sources: The regressions rely on the Fertility Coale Indices of England & Wales, Germany and Italy. Princeton Project on the Decline of Fertility in Europe for the other countries.

The existence of an unconditional convergence in regional fertility rates in France, and its absence in England & Wales, Germany and Italy, is illustrated in Figure B.1 where we graph the fertility of rates within each country in comparison to the country's capital. It can further be observed in Figures B.2-B4 that there is no convergence in fertility rates in England & Wales, Germany and Italy during the 1861-1911 period.

Figure B1: Fertility rates in France, England, Germany and Italy

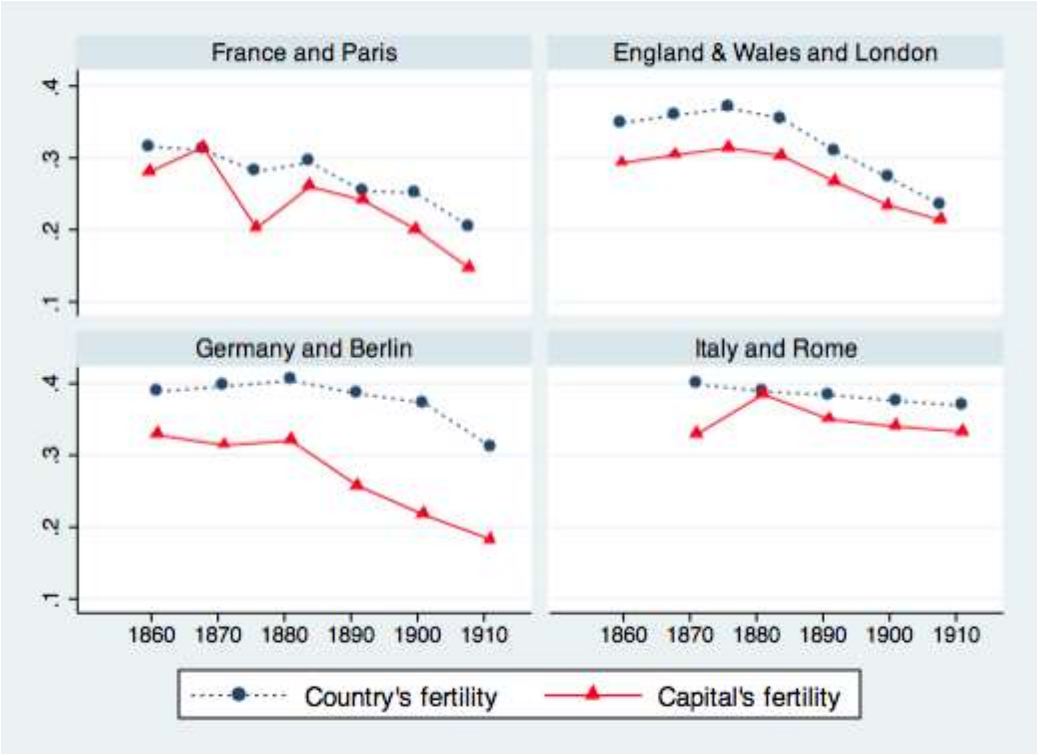


Figure B2: Fertility distribution in England and Wales, 1861-1911

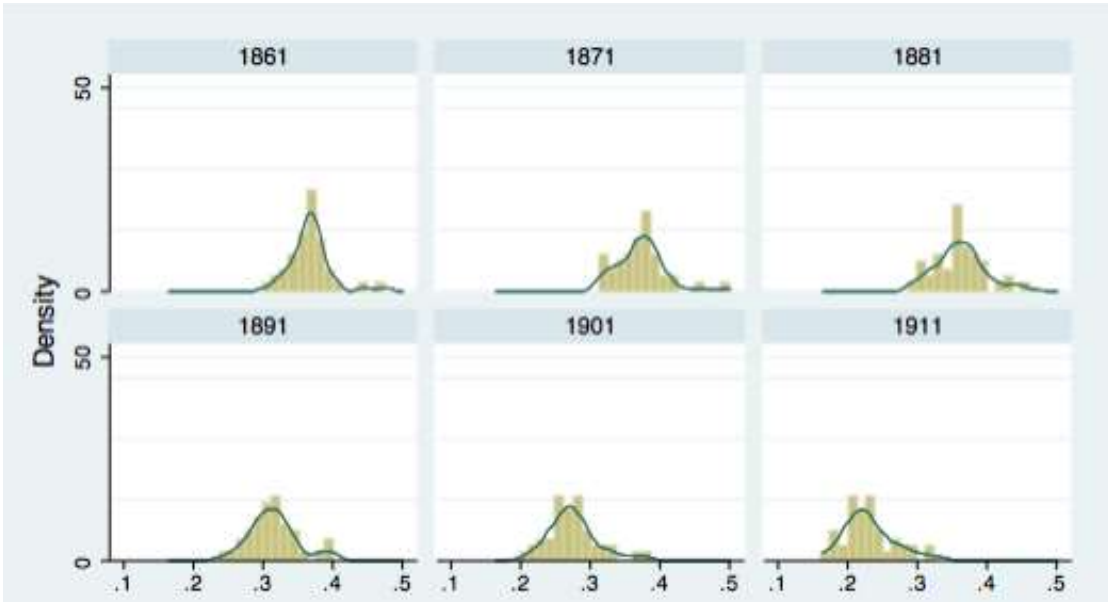


Figure B3: Fertility distribution in Germany, 1871-1910

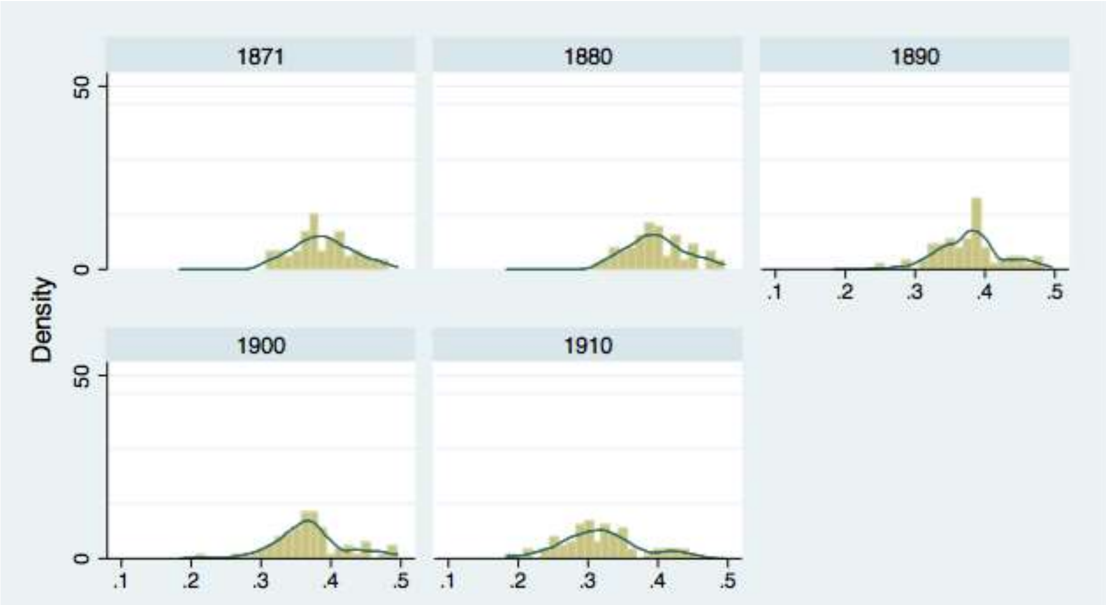
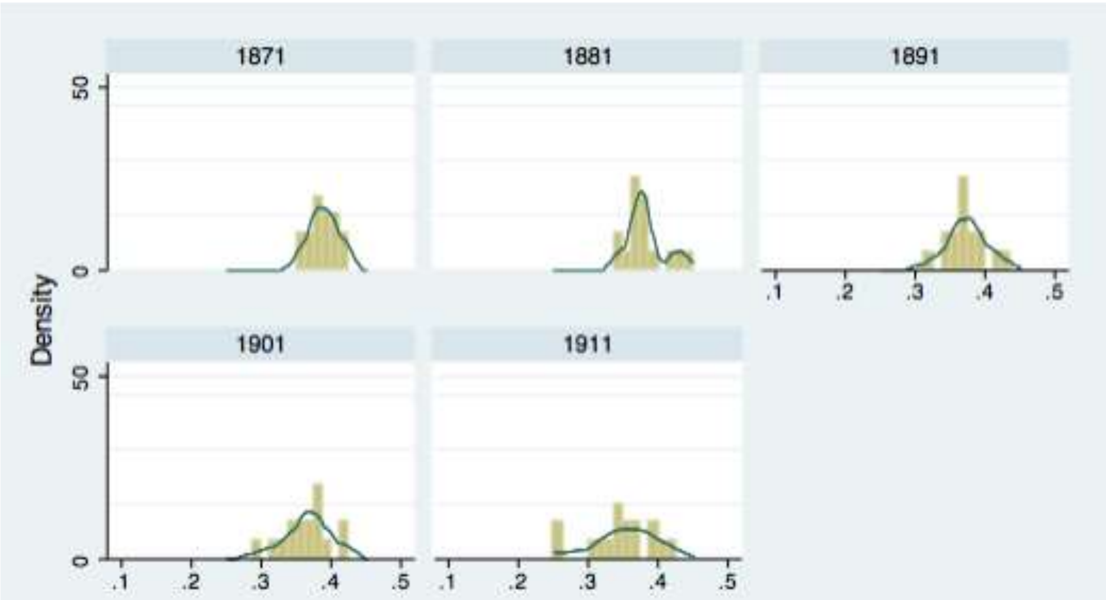


Figure B4: Fertility distribution in Italy, 1871-1910



Note: These Figures graph the Fertility Coale Indices of France, England & Wales, Germany and Italy with their respective capitals. In all the countries, the capital's fertility is lower than that of the whole country. The Figure shows that there is a secular decline in fertility in France during the nineteenth century. However, the fertility decline in England & Wales and Germany only begins after 1880 while it does not seem to occur in Italy before WWI. Moreover, there was almost no convergence in the fertility rates across the regions of England & Wales, Germany and Italy before WWI

Sources: Bonneuil (1997) and authors' computation for 1911 for France. Princeton Project on the Decline of Fertility in Europe for the other countries.

Finally, it is worth noting that in this study, our main specification follows models of fertility determination and is therefore slightly different from the usual specification of growth regression model in Equation (B.1).

$$\log(f_{i,t}) = a_1.\log(f_{i,t-10}) + \alpha_t + \varepsilon_{i,t} \qquad \text{(B.2)}$$

where all the variables were defined above. Given the difference in specifications between Equations (B.1) and (B.2), there would be evidence of unconditional convergence in Equation (B.2) if the coefficient associated with the lagged fertility rate is below 1.

The estimates of Equation (B.2) reported in Appendix Table B.3 confirm the unconditional convergence of fertility in nineteenth century France.

Appendix Table B.3: Unconditional convergence test of fertility: France before WWI

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
	Dependent variable is Fertility(t)			
	Coale Fertility Index 1861-1911	Coale Fertility Index 1821-1911	Coale Fertility Index 1821-1851	Total Fertility Rate 1861-1911
Fertility(t-10)	0.841***	0.856***	0.886***	0.843***
	[0.0215]	[0.0141]	[0.0166]	[0.0696]
Constant	-0.338***	-0.237***	-0.215***	-0.540**
	[0.0289]	[0.0223]	[0.0185]	[0.255]
Within R2	0.8	0.9	0.9	0.8
Year-fixed effects	Yes	Yes	Yes	Yes
Clusters	81	80	80	80

Note: All variables are in logarithms. Robust standard errors clustered at the region level are reported. *** indicates significance at the 1% level, ** at the 5%-level, * at the 10%-level.

Appendix C. The TRA data and the computation of the total number of emigrants and immigrants at the département level with the Iterative Proportional Fitting Procedure (also known as the RAS algorithm)

This Appendix discusses how the bilateral migration TRA data can be transformed to reflect the total number of emigrants and immigrants at the *département* level with a standard marginalization algorithm known as the RAS algorithm.

The first step is to compute the implied bilateral migrant stocks in any given year from the TRA data. For this purpose, we assume that people who died in a different *département* from their birth *département* migrated at age 20.[39] This provides us with $m_{ij,t}^{TRA}$ which is the number of migrants from *département* i living in département j in each year t (with t= 1821, 1831, 1841, 1851,1861, 1872, 1881, 1891, 1901 and 1911) in the TRA dataset.

The second step for the 1861-1911 period is to gather the number of domestic immigrants and emigrants from each *département* from the census. These data are published in the 1891, 1901 and 1911 issues of the French census. In the issues of the census published in 1861, 1872 and 1881, the number of immigrants is given as the number of individuals in each *département* who were born in another *département*. We can then compute the number of emigrants using information on birth rates, mortality rates, the number of inhabitants and the number of emigrants published in the next issue of the census.[40] This provides us with $m_{i.,t}^{Census}$ and $m_{.j,t}^{Census}$which are respectively the total number domestic emigrants from each *département* i and immigrants in each *département* j for each year.

Our third stage is to transform the TRA dataset so as to obtain a matrix which is defined by the margins coming from the census and the odds ratios (the ratio between, for example, the odds of an immigrant in *département* A to be an emigrant from

[39] This assumption is based on computations of thecourse an approximation. Using net positive migration rates by age using data from (Bonneuil 1997), we computed that the mean age at migration was 19.4 years in 1861, 18.6 in 1872, 22.5 in 1881 and, 21.4 in 1891.

[40] For simplicity we ignore emigration to foreign countries – which was anyway small - and the small number of emigrants from Alsace-Lorraine (which was seized by Germany after 1871) by assuming they were a fixed proportion of emigrants in each *département* throughout the country.

département B instead of being from C and the odds of an immigrant in *département* D to be an emigrant from *département* B instead of being from C) coming from the TRA (See (Smith 1976), p. 672-3). For this purpose, we apply a marginal standardization algorithm known as the RAS algorithm (see Smith (1976) and Cox (1998)).[41] This is meant to reconcile the bilateral matrix composed of $m_{ij,t}^{TRA}$with its margins composed of $m_{i.,t}^{Census}$ and $m_{.j,t}^{Census}$, or find the $m_{ij,t}^{RAS}$ such as $\sum_i m_{ij,t}^{RAS} = m_{.j,t}^{Census}$ and $\sum_j m_{ij,t}^{RAS} = m_{i.,t}^{Census}$ and $m_{ij,t}^{RAS}$ is 'close' to $m_{ij,t}^{TRA}$. The algorithm works by multiplying by a scalar alternatively the lines and the columns of the matrix so that $\sum_i m_{ij,t}^{k^{th}\ iteration} = m_{.j,t}^{Census}$ or $\sum_j m_{ij,t}^{k^{th}\ iteration} = m_{i.,t}^{Census}$. This goes on till the sums of both the lines and column are nearly equal to the pre-defined margins.

These transformed TRA data then become our main measure of bilateral migration. A similar procedure is used to compute male and female migration, except that the gender differentiated margins for 1891 have to be extrapolated from the 1881 and the 1901 census.

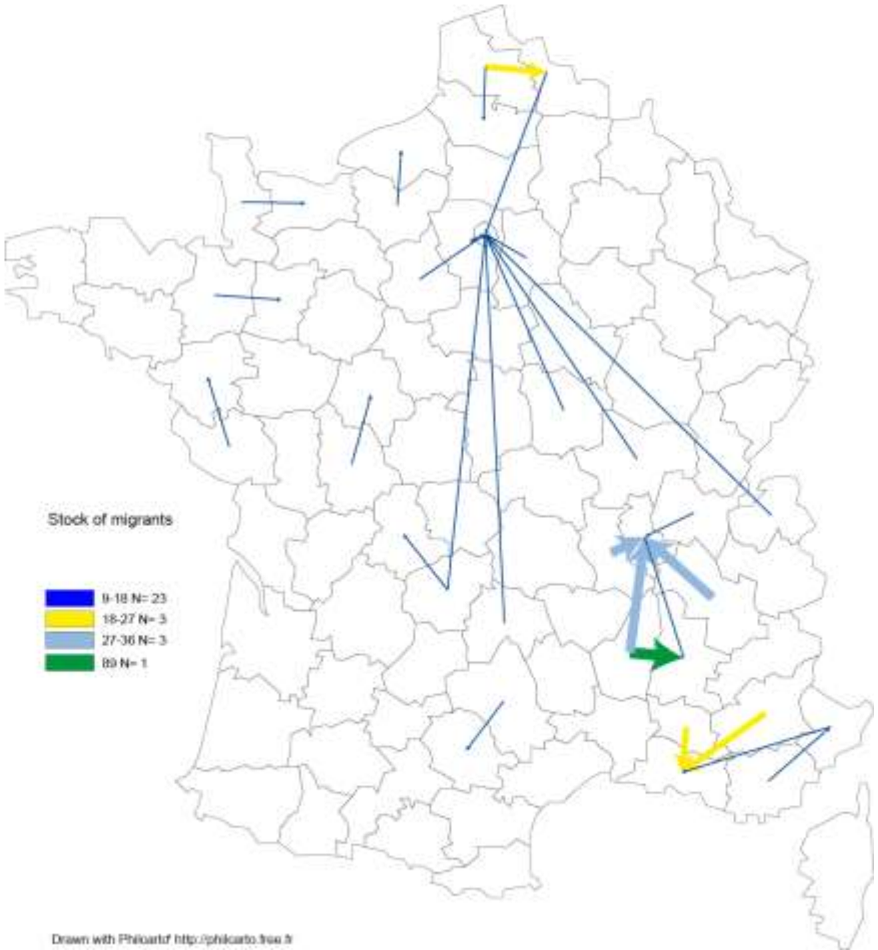
The procedure is different for 1821-1851 because the successive issues of the census for that period only provide the number of residents in each *département* and not the number of individuals in each *département* who were born in another *département.* This implies that we have to compute the number of living natives of each *département*, which is the difference between "living natives" and "native deaths". We compute the number of living natives of each *département* by backward induction, starting from the year t+10 native population and computing the natural increase from year t to year t+10. Native births are by definition the number of births in the *département* and are directly available from the census. Native deaths must however be computed by assuming that all individuals migrate at age 20. They are the sum of the number of deaths of individuals age 0 20 in the *département* and of the number of deaths of natives over 20 years in all *départements*, assuming the same age structure and mortality rates as in each migrant's destination *département*, which we obtain from the age-specific mortality rates in Bonneuil (1997).

We can then proceed to the third stage of the procedure where we match these data to the TRA dataset (one margin is formed by natives, the other one by residents).

[41] This procedure is also known as biproportional matrices, iterative proportional fitting or raking.

The outcome of this procedure is however more uncertain over the 1821-1851 period than for the post-1851 period because we have to compute the number of "stayers" with the Iterative Proportional Fitting Procedure. In contrast, starting 1861, the number of "stayers" is given by the census.

Figure C1: Bilateral migrant stocks > 11, TRA data, 1891



Note: In the legend, the first two numbers represent the bounds of the bracket for the stock of migrants; N represents the number of links between *départements* in each bracket.

Appendix D: The state of the development of the railroad network following "L'étoile de Legrand" .

1850

1860

1870

1891

1910-1930

Source: Caron (1997).