THE CULTURAL DIFFUSION OF THE FERTILITY TRANSITION: INTERNAL MIGRATIONS IN 19TH CENTURY FRANCE*

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Abstract

The early decline in French fertility remains a perennial puzzle to economists as France was a relative laggard in urbanization, mortality decline, education and social convergence in fertility rates between 1861 and 1911. We compute bilateral migration rates over time, as opposed to the overall migration rate, and examine the effect of fertility in the resident and birthplace districts on fertility in respectively the birthplace of emigrants and the residence of immigrants. We use bilateral travel costs as an instrumental variable to solve for the endogeneity of migration choices. Our results suggest a role for the transmission of fertility norm in explaining the convergence of fertility rates in France.

Keywords: 19th century France, Demographic transition, internal migrations, diffusion of cultural norms

JEL Codes: J13, N33, O15

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1. Introduction

Whether the decline in fertility rates is linked to a country's shift from a so-called "Malthusian" economy to a modern economy characterized by sustained growth is still debated (see, e.g, (Lee 2003), (Oded Galor 2005a), (Oded Galor 2005b), (Oded Galor 2012) for a discussion). This is because there is no agreement on the causes of the demographic transition, which first occurred in France from the late 18th century (see, e.g., (Guinnane 2011), (Weir 1994)). In fact, this early decline in French fertility remains a perennial puzzle to economists as France was a relative laggard in urbanisation, mortality decline, education and social insurance vis-a-vis England and the Netherlands. As Murphy (Murphy 2010) notes, the French fertility decline is usually treated as an anomaly by economists, e.g., (O. Galor and Moav 2002), (Oded Galor 2005b)). It was used by studies from the Princeton Project on the Decline of Fertility in Europe (see http://www.opr.princeton.edu/archive/pefp/, (Coale and Watkins 1986), to argue that economic factors played a limited role in the demographic transition. But while recent studies have questioned the Princeton Project's conclusions by emphasizing the impact of economic changes during the demographic transition in Prussia ((Galloway, Hammel, and Lee 1994), in Bavaria ((Brown and Guinnane 2002), and in Sweden (Dribe 2009), there is still no conclusive evidence on the determinants of the fertility decline in France. In fact, Gonzalez-Bailon and Murphy (2008) suggests that the spread of cultural norms, along with economic factors, may have had an influence on the fertility decline in France during the 19th century.[1] In this respect, an unsubstantiated explanation is that it might have stemmed from the quick diffusion of the contraceptive techniques criticized by the moralists of the day (Bergues et al. 1960).

If anything, the French economy grew at a slower rate during the 19th century than England or Germany (Maddison 2001) but the French fertility rate continued to decline quickly. The average Coale Fertility Index (see *infra*) of the French *départements*[2] was indeed 0.403 in 1811, 0.333 in 1851 and 0.243 in 1911 (Bonneuil 1997; J. Dupâquier 1988). This contrasts with other European countries such as

[1] In contrast, Gonzalez-Bailon and Murphy suggest that there is very little evidence that a spatial diffusion of norms may explain the changes in the fertility rates in 19th century England (Gonzalez-Bailon and Murphy 2008).

[2] *Départements* are administrative divisions of the French territory created in 1790.

England and Wales, Germany and Italy, where the decline started later as can be seen in Figure 11 the Appendix.

At the start of the 19th century, there were substantial differences in the fertility rates of the various *départements* with only two areas of low fertility in France: the valleys of the Seine (around Paris) and of the Garonne (in the South West). It was only in the course of the 19th century that these differences disappeared: the standard deviation of the Coale Fertility Index across the French *départements* decreased from 0.106 (27% of the mean) in 1811 to 0.074 (24% of the mean) in 1851 and 0.038 (11% of the mean) in 1911 (Bonneuil 1997; J. Dupâquier 1988). As we show below in Table 4, France was exceptional in that it experienced a fertility convergence rather than a simple fertility decline.

This paper proffers an explanation for the decline and convergence of the fertility rates in France by taking into account the specific patterns of migrations of the French population during the 19th century. Internal migration may indeed have contributed to the convergence in the *départements*' fertility rates by spreading cultural norms about family size found, for example, in Paris and other large cities. Cultural norms are defined as by conveying preferences and beliefs which impact current economic behavior although they were developed in a different time and place ((Fernandez 2007), (Blau, Kahn, and Papps 2011)). This conjecture is grounded into two well-known features of 19th century France. First, it was only in the course of the 19th century that France progressively became a fully integrated country from a cultural point of view ((Weber 1976)). Beforehand, a substantial share of the population still 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 (Braudel 1986), vol. 1, pp 88-94). Second, unlike the inhabitants of other European countries, e.g., Great Britain, Ireland, Sweden or Norway, French did not migrate to high-fertility America and other European offshoots (see (T. J Hatton 2010) and the references therein). The annual mean French gross emigration rate from 1860 to 1913 was only 0.18 emigrants per 1000 population, compared to 9.25 for Italy, 4.61 for Great-Britain and 1.5 for Germany (see (Timothy J. Hatton and Williamson 1998)). Instead, most French migration during the 19th century took place within France. Internal long-distance migrations were dominated, as in Britain and elsewhere, by movement from the countryside to cities and industrial areas ((Cairncross 1949), (Baines and Woods 2004)).[3] It seems plausible that the effect of French cultural unification was not counterbalanced by the influence of high-fertility New World destinations, as internal migration was, relative to all migrations, more important in France than in other European countries.

So far, research on the impact of migration movements in 19th century France has focused on the role of migrant networks on marriages (e.g. (Bonneuil, Bringé, and Rosental 2008)) or wealth transmission (e.g. (Jérôme Bourdieu et al. 2000)) but it has not analyzed the possibility that internal migration may have contributed to the convergence in the fertility rates by conveying cultural norms. As such this study is related to theoretical studies that have analyzed how social interaction might have spread social norms and contributed to the demographic transition ((Casterline 2001; Kohler 2000; Kohler 2001). It is also related to research by (David and Sanderson 1987), (Munshi and Myaux 2006) and (Chong, Duryea, and La Ferrara 2008) that focus on the role played by cultural and social norms about family size in the fertility transition currently taking place in developing countries.

As such this study builds on different strands of the literature on migration. Research on migration and diaspora networks has not only shown that they can explain part of migration patterns between countries and regions (McKenzie and Rapoport 2007), but that they also reduce information costs and ease transactions between the migrants' host and home countries through the diffusion of technology, ideas and institutions, like democracy (Spilimbergo 2009) ((Chauvet and Mercier) or fertility behaviours (Bertoli and Marchetta 2012) (See a full literature review in (Beine, Docquier, and Schiff 2012)). Addition studies by (Fernandez and Fogli 2006) and Blau et al, 2011) among others have shown that the norms of the source countries affect the behaviour of second-generation immigrants, notably in matters of fertility. Still, this study provides a different perspective by examining to what extent migration networks might have channelled the norms of the destination regions back to the source regions so as to contribute to the decline in the fertility rates throughout

[3] French international immigration, as well as immigration to the French colonies and in particular to Algeria, overall remained negligible so that it does not make much sense to investigate which emigrants moved within the country and which emigrants left the country, as might be the case for emigration studies for countries like Sweden or Great Britain. On the determinants of internal migration, see the surveys by (Greenwood 1997) and (Lucas 1997). On the determinants of international migration until 1913, see notably (T. J Hatton and Williamson 1994). See also (Greenwood 2007) (Greenwood 2008) and (Ulyses Balderas and Greenwood 2010) on the characteristics of 19th century immigrants to the New World.

the country. Hence, this study is closely related to (Beine, Docquier, and Schiff 2008) and (Beine, Docquier, and Schiff 2012) that examine a cross-section of developing and developed countries during the 20th century and suggests that fertility choices in migrant-sending countries are influenced by the transfer of fertility norms prevailing in the host countries.

This paper uses data on bilateral migrations from 1861 to 1911 from the TRA dataset, also known as the *Enquête des 3000 familles* (Survey of the 3000 Families) which provides information based on parish registers on the place of birth and death of all the individuals whose last name starts by the three letters "T", "R" and "A" ((Bertoli and Marchetta 2012), (Bourdelais 2004), (J. Bourdieu and others 2004), (Jacques Dupâquier 2004)). It combines these data with information from the French Census on fertility and other socio-economic variables to assess the role played by cultural and social norms about family size in the fertility transition in France.

To establish a causal relationship from the fertility norm of the destination *département* to the fertility norm of the source departement, this study uses exogenous variations in the bilateral travel costs between departments. This is because the French railroad network was developed by the French state to connect Paris to the main economic centres of the country and independently from cultural diffusion and migration choices. The development of the railroad network entailed a time-varying decrease in travel costs that had a positive effect on migration and decreased the stocks of migrants.

Our results suggest that the decline in fertility in 19th century France can be traced to the transmission of cultural norms. In addition, our results show that urbanization and industrialization did not have any impact in lowering fertility. They also suggest that the potential returns from education had a limited effect on the fertility decline, since only the increase in life expectancy, which lengthens the working life and hence provides incentives to invest in human capital, is found to depress fertility.

The rest of this article is as follows. Section 2 presents the data. Section 3 discusses the empirical strategy. Section 4 presents the results. Section 5 concludes.

2. Data

This section presents our data. Table 1, Table 2 and Table 3 provide definitions and descriptive statistics for our variables. To ease the interpretation of the coefficients in the log-linear regression, we also report in these tables the standard deviation of the logarithm of the variables.

Table 1: Descriptive statistics of Fertility Norms (see Table 5) and Share of Migrants

Variable Name	Mean	Std dev	Std dev of the log	Min	Max
Dependent variable					
Inhabitants' Residence Norm	0.274	0.059	0.204	0.158	0.566
Fertility Norms and Share of Migrants					
Emigrants' Residence Norm	0.257	0.038	0.146	0.169	0.390
Male Emigrants' Residence Norm	0.259	0.041	0.156	0.172	0.469
Female Emigrants' Residence Norm	0.255	0.038	0.150	0.158	0.361
Immigrants' Birthplace Norm	0.325	0.045	0.135	0.230	0.536
Male Immigrants' Birthplace Norm	0.325	0.051	0.153	0.191	0.511
Female Immigrants' Birthplace Norm	0.326	0.050	0.147	0.227	0.591
Natives' Residence Norm	0.271	0.054	0.190	0.166	0.500
Male Natives' Residence Norm	0.271	0.054	0.189	0.165	0.494
Female Natives' Residence Norm	0.271	0.055	0.191	0.166	0.506
Inhabitants' Birthplace Norm	0.326	0.079	0.224	0.191	0.728
Male Inhabitants' Birthplace Norm	0.326	0.079	0.224	0.188	0.724
Female Inhabitants' Birthplace Norm	0.326	0.080	0.225	0.193	0.731
Emigrants' Residence Norm * Share of Emigrants	0.813	0.082	0.105	0.510	0.969
Male Emigrants' Residence Norm * Share of Male Emigrants	0.806	0.084	0.110	0.485	0.966
Female Emigrants' Residence Norm * Share of Female Emigrants	0.820	0.083	0.105	0.534	0.975
Immigrants' Birthplace Norm*Share of Immigrants	0.887	0.061	0.072	0.648	0.994
Male Immigrants' Birthplace Norm*Share of Male Immigrants	0.880	0.061	0.073	0.641	0.991
Female Immigrants' Birthplace Norm*Share of Female Immigrants	0.893	0.062	0.073	0.650	0.998
Share of Emigrants	0.151	0.067	0.463	0.030	0.453
Share of Male Emigrants	0.145	0.067	0.453	0.021	0.431
Share of Female Emigrants	0.159	0.071	0.492	0.037	0.479
Share of Immigrants	0.106	0.058	0.561	0.006	0.357
Share of Male Immigrants	0.113	0.058	0.533	0.009	0.368
Share of Female Immigrants	0.100	0.058	0.630	0.002	0.349

Note: there are 486 observations for each variable.

Table 2: Descriptive statistics of Fertility Norms (see Table 5) and Share of Migrants, instrumented

Emigrants' Residence Norm, Instrumented	0.256	0.033	0.127	0.163	0.345
Male Emigrants' Residence Norm, Instrumented	0.257	0.033	0.126	0.163	0.346
Female Emigrants' Residence Norm, Instrumented	0.255	0.033	0.128	0.163	0.344
Immigrants' Birthplace Norm, Instrumented	0.330	0.040	0.119	0.229	0.455
Male Immigrants' Birthplace Norm, Instrumented	0.331	0.041	0.121	0.229	0.460
Female Immigrants' Birthplace Norm, Instrumented	0.329	0.039	0.117	0.228	0.449
Natives' Residence Norm, Instrumented	0.326	0.079	0.223	0.193	0.720
Male Natives' Residence Norm, Instrumented	0.326	0.079	0.222	0.194	0.717
Female Natives' Residence Norm, Instrumented	0.326	0.080	0.224	0.192	0.723
Inhabitants' Birthplace Norm, Instrumented	0.271	0.054	0.189	0.162	0.509
Male Inhabitants' Birthplace Norm, Instrumented	0.271	0.054	0.188	0.162	0.507
Female Inhabitants' Birthplace Norm, Instrumented	0.271	0.054	0.190	0.162	0.512
Emigrants' Residence Norm, Instrumented * Share of Emigrants	0.813	0.083	0.109	0.468	0.949
Male Emigrants' Residence Norm, Instrumented * Share of Male Emigrants	0.806	0.083	0.112	0.430	0.942
Female Emigrants' Residence Norm, Instrumented * Share of Female Emigrants	0.820	0.084	0.110	0.487	0.957
Immigrants' Birthplace Norm, Instrumented*Share of Immigrants	0.888	0.062	0.073	0.650	0.982
Male Immigrants' Birthplace Norm, Instrumented*Share of Male Immigrants	0.882	0.062	0.073	0.646	0.974
Female Immigrants' Birthplace Norm, Instrumented*Share of Female Immigrants	0.894	0.062	0.073	0.654	0.989
Share of Emigrants, Instrumented	0.152	0.069	0.439	0.044	0.501
Share of Male Emigrants, Instrumented	0.159	0.072	0.425	0.051	0.553
Share of Female Emigrants, Instrumented	0.145	0.069	0.464	0.037	0.474
Share of Immigrants, Instrumented	0.106	0.058	0.532	0.019	0.366
Share of Male Immigrants, Instrumented	0.112	0.058	0.500	0.026	0.369
Share of Female Immigrants, Instrumented	0.100	0.059	0.581	0.012	0.362

Note: there are 486 observations for each variable.

Table 3: Descriptive statistics of education, wealth and the workforce

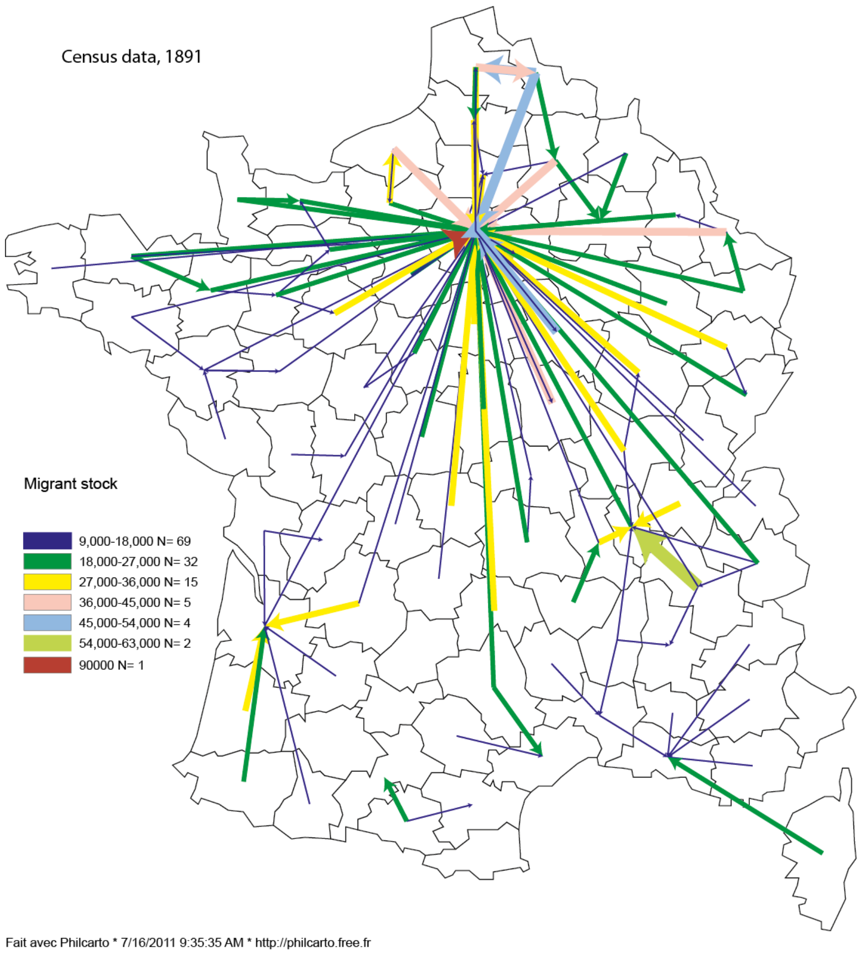
Life Expectancy at Age 15	48.724	7.553	0.144	34.759	65.915
Infant Mortality (under age 1, in %)	1.249	0.137	0.108	1.019	1.871
Urban (% residents living in municipalities with more than 2,000 inhabitants)	0.343	0.259	0.162	0.085	0.718
Industries (% of the working population in the industrial sector)	0.211	0.134	1.271	0.001	0.677
Professionals (% of professionals (e.g. lawyers, doctors...) in the working population)	0.027	0.016	0.603	0.001	0.160
Female Education (% 5-19 year old females in primary and secondary schools)	0.499	0.136	0.355	0.075	0.792
Male Education (% 5-19 year old males in primary and secondary schools)	0.528	0.129	0.284	0.149	1.000
Share of girls in Catholic primary schools (in %, out of the number of girls in Catholic and secular primary schools)	0.437	0.182	0.520	0.026	0.939
Share of boys in Catholic primary schools (in %, out of the number of boys in Catholic and secular primary schools)	0.166	0.122	0.716	0.010	0.727

Note: there are 486 observations for each variable.

2.1. Migration in 19th century France

The issues of the French census in 1891, 1901 and 1911 provide the *département* of birth for all the inhabitants of each French *département*.[4] As an illustration, Figure 1 maps these data in 1891 over the French territory. This map shows that the Seine (Paris) is the main destination for internal migrants in France, along with Gironde (Bordeaux) in the South-West, Rhône (Lyon) and Bouches-du-Rhône (Marseilles). The 1911 and 1901 census also provide migration matrices by gender.

Figure 1: Bilateral migrant stocks, Census data, 1891



Note: 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*).

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[4] See (Béaur and Marin 2011) for a presentation of the French census. The issues of the census can be accessed through the following website: http://acrh.revues.org/index2890.html.

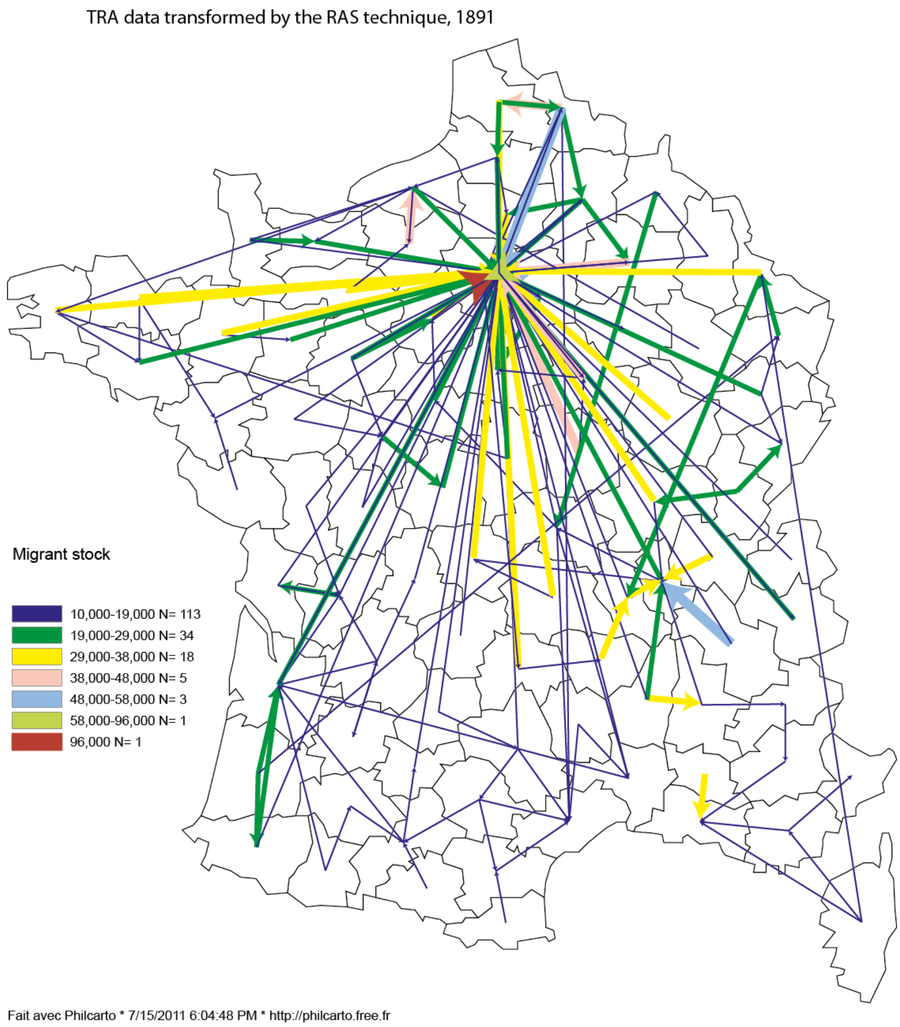
To extend our dataset so as include information from 1861 onwards, we use data on bilateral migrations from the TRA dataset, also known as the *Enquête des 3000 familles* (Survey of the 3000 Families). By relying on parish registers, the TRA dataset provides information on the place of birth and death of all the individuals whose names starts by the three letters "T", "R" and "A" ((Jacques Dupâquier and Kessler 1992), (Bourdelais 2004), (Jacques Dupâquier 2004)).

The "TRA" data are not necessarily representative of the movements of the French population as a whole at the *département* level (Blanchet and Kessler 1992).[5] However, using both the TRA data and the census data, we can reconstruct the geography of internal migration in France (see Appendix A).

These transformed TRA data are our main measure of bilateral migration for all the years in our sample. They quite closely match the actual data from the census for the three years – 1891, 1901 and 1911 – where we can make the comparison. This can be seen when we compare Figure 1, with the 1891 census data, to Figure 2, where we map the 1891 transformed TRA data.

[5] Studies by (Abramitzky, Delavande, and Vasconcelos 2011; Bonneuil, Bringé, and Rosental 2008) discuss the validity of the TRA data at the *département* level and employ them to assess patterns of migrations, fertility and nuptiality in France.

Figure 2: Bilateral migrant stocks, TRA data transformed by the RAS technique, 1891 [À REFAIRE AVEC LES NOUVEAUX CHIFFRES]



2.2. Fertility rates in France

2.2.1. The Coale Fertility Index

We measure fertility rates in each French *département* every decade between 1861 and 1911 with the (Coale 1969)'s Fertility Index which is a standardized contribution of the nuptiality pattern to fertility levels. It is based on the fertility levels of the Hutterites, a strict religious group in the North of the USA with a high level of fertility so that a childless population would have a Coale Fertility Index equal to 0 and a population with the fertility rates of the Hutterites would have a Coale Fertility Index equal to 1.

We use data from (Bonneuil 1997)'s study which provides values of the Coale Fertility Index in each *département* between 1806 to 1906 and which we extend to 1911 using data from the 1911 French census[6]

$$f = \frac{\sum_{k=1}^{K} F_k^L . W_k^L}{\sum_{k=1}^{K} H_k . W_k^L} . \frac{\sum_{k=1}^{K} H_k . W_k^L}{\sum_{k=1}^{K} H_k . W_k} = I_g . I_m$$

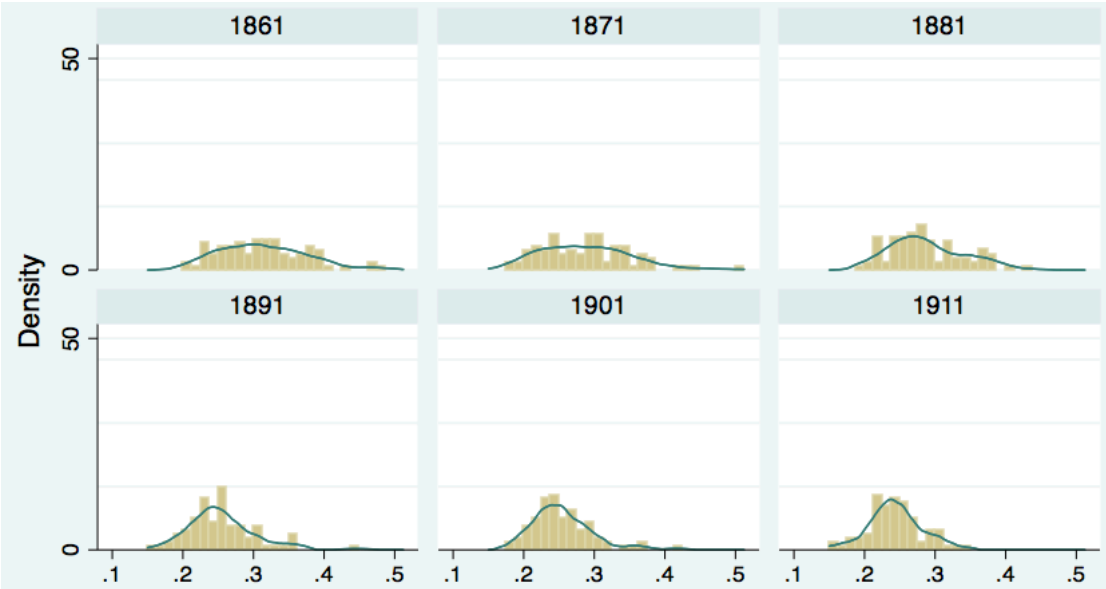
where f is the Coale Fertility Index, W_k is the age distribution of the female population, W_k^L is the number of women in age group k, F_k^L is the rate of childbearing among women in the k^{th} age interval, H_k represents the fertility rates observed for the Hutterites, I_g is the index of fertility, i.e., the ratio of the number of births to the number that would occur if all women had Hutterite fertility and I_m is the index which indicates the impact of the nuptiality pattern.

As an illustration, we provide in Figure 3 a histogram of the distribution of the Coale Fertility Index between 1861 and 1911 in France. It shows that during this period, the average fertility rate in France decreased as can be seen from the shift to the left of the mode, of the mean and of the median of the distribution. But interestingly enough, Figure 3 also shows that the standard deviation of the distribution progressively declined: there was thus a convergence in the fertility levels of the French *départements* throughout the period[7]. This is in contrast to what happened in other European countries (see Figure 12, Figure 13, and Figure 14 in the appendix).

[6] The Coale Fertility Index in this study includes the fertility of all women and is therefore a modified version of the traditional Coale Fertility Index which is usually restricted to the fertility of married women.

[7] This convergence is not explained by a general decline of fertility bounded by 0 and can still be observed when the logarithm of the fertility rate is considered.

Figure 3: Fertility distribution among French *départements*, 1861-1911



This convergence in the fertility levels is confirmed by a simple unconditional convergence test where we regress $(f_{i,t+10} - f_{i,t})/(f_{i,t})$, the decadal rate of change in fertility, on the log of f_t the fertility rate in year *t* while controlling for national decadal trends. The results of this regression are reported in Table 2 for France, England, Italy and Germany. They show that convergence of fertility rate is a specific French feature.[8]

Table 4: Unconditional convergence test of fertility

Dependent variable is $(f_{i,t+10} - f_{i,t})/(f_{i,t})$

	France (1851-1911)	England and Wales (1851-1911)	Germany (1871-1910)	Italy (1871-1910)
$\ln(f_{i,t})$	-0.16***	0.06**	0.06*	0.18
	[0.02]	[0.03]	[0.03]	[0.11]
Year= c. 1861	-0.02	-0.03***		
	[0.01]	[0.01]		
Year= c. 1871	0.08***	-0.07***		
	[0.01]	[0.01]		
Year= c. 1881	-0.07***	-0.17***	-0.08***	-0.00
	[0.01]	[0.01]	[0.01]	[0.02]
Year= c. 1891	0.03**	-0.16***	-0.05***	0.00
	[0.01]	[0.01]	[0.01]	[0.02]
Year= c. 1901	-0.01	-0.19***	-0.17***	-0.02
	[0.01]	[0.01]	[0.01]	[0.02]
Constant	-0.25***	0.10***	-0.08***	-0.15
	[0.2]	[0.03]	[0.03]	[0.10]
Observations	514	276	284	64
R^2	0.34	0.82	0.59	0.09

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

[8] In contrast, (González-Bailón and Murphy 2011) finds no convergence for France.

2.2.2. Fertility rates of Emigrants, Immigrants and Natives

While our dependent variable represents the fertility of all the inhabitants of a *département* in a given year, our explanatory variables are designed to account for the two potential channels of the cultural transmission of fertility norms through migration. First, emigrants may transmit the cultural norms about family size of their destination *département* to the inhabitants of their native *département*. Second, immigrants may have an effect on the fertility of the *département* where they reside because they keep the fertility norm of their native *département* and affect the behaviour of the *département*'s native inhabitants.

These two potential channels may be tested in two different ways, thus yielding four potential explanatory variables. On the one hand, it could be that the residence (respectively, birthplace) fertility norm of emigrants (immigrants) has an effect on the fertility norm of the *département*'s native inhabitants. In that case, we would expect that this effect is more substantial when the shares of emigrants and of immigrants in the population are larger: thus we include in the regressions interaction variables between the shares of emigrants and immigrants and the fertility norms of emigrants and immigrants. On the other hand, it could be that the residence (respectively, birthplace) fertility norm of emigrants (immigrants) has the same effect as the fertility norm of the *département*'s native inhabitants. If so, we include in our regressions the average of the residence fertility norm of emigrants (respectively, birthplace fertility norm of immigrants) with the fertility norm of the *département*'s natives (inhabitants) weighted by the respective shares of emigrants (immigrants) and natives (inhabitants).

Table 5 summarizes the potential effects of these four explanatory variables. For simplicity we also report the explained variable in this table and provide formal definitions.

Table 5: Fertility norm variables

	Residence Fertility Norm	Birthplace Fertility Norm
Inhabitants	Dependent variable $Inhabitants'\ residence\ norm_{i,t} = f_{i,t}$ = Fertility rate in *départment i* at time *t*	$Inhabitants'\ birthplace\ norm_{i,t} = \frac{\sum_j m_{ji,t} \cdot f_{j,t-30}}{\sum_j m_{ji,t}} = HBN_{i,t}$
Emigrants	$Emigrants'\ residence\ norm_{i,t} = \frac{\sum_{j \neq i} m_{ij,t} \cdot f_{j,t}}{\sum_{j \neq i} m_{ij,t}} = ERN_{i,t}$	
Natives	$Natives'\ residence\ norm_{i,t} = \frac{\sum_j m_{ij,t} \cdot f_{j,t}}{\sum_j m_{ij,t}} = NRN_{i,t}$	
Immigrants		$Immigrants'\ birthplace\ norm_{i,t} = \frac{\sum_{j \neq i} m_{ji,t} \cdot f_{j,t-30}}{\sum_{j \neq i} m_{ji,t}} = IBN_{i,t}$

Note: we use the following notations

$p_{i,t}$ *Population of départment i at time t*

$m_{ij,t}$ *Stock of migrants born in départment i living in départment j at time t*

2.3. Education, health and the workforce

Our empirical analysis takes into account the socio-economic factors which might have contributed to the convergence of fertility rates in France between 1851 and 1911. It has notably suggested that the decline in infant and child mortality could have triggered the demographic transition (see, e.g., (Bhattacharya and Chakraborty 2012), (Eckstein, Mira, and Wolpin 1999), and (Doepke 2005) , for a different view). It has also been argued that the decline in fertility rates could be explained by the rise in the demand for human capital since it occurred during the second Industrial Revolution (see, e.g., (Oded Galor and Weil 2000) and (O. Galor and Moav 2002)). Parents thus faced a quantity-quality trade-off which led them to invest in the education of their children. In this context, (Oded Galor 2012) suggests that the rise in life expectancy may have reinforced the negative effects of the demand for human capital on fertility. Still (Hazan 2009) used data on cohorts of U.S. men born in the late 19th century, as well as circumstantial evidence on Western European counties, including France, to argue that increased life expectancy did not have any impact on the length of the working life and as such, could not have provided substantial incentive to invest in human capital.

In this study, we rely on (Bonneuil 1997)'s computations of life expectancy at age 15 for the individuals living in each *départment* 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 for each *département* a measure of infant mortality, which assesses the share of children who died before age 1, and measures of education, which assess the share of the male and female population age 5 to 19 who attended primary or secondary schools.[9]

Moreover we use the successive issues of the French census to compute measures of economic development. We thus compute for each *département* the shares of the workforce in the industrial and service sectors as well as the share of the population living in urban areas.

3. Empirical methodology

3.1. Baseline model

The baseline model estimates the log-linear relation between the fertility of the inhabitants of a *département* and the fertility norms of immigrants and emigrants, controlled by socio-economic variables. It thus accounts for the fertility norms of the emigrants' residence and of the immigrants' birthplace. It also includes interaction terms between these fertility norms and the shares of emigrants and immigrants as it is possible that the effects of the emigrants and immigrants' fertility norms are larger when they are more numerous. Once this interaction variable is introduced, the shares of emigrants and immigrants must also be included in the regression so as to compute the marginal effects of the emigrants' residence fertility norm and of the immigrants' birthplace fertility norm

$$\log(f_{i,t}) =$$
$$a_1.\log(ERN_{i,t}) + a_2.log\left(\frac{\sum_{i\neq j} m_{ji,t}}{\sum_i m_{ji,t}}\right) + a_3.log\left(\frac{\sum_{i\neq j} m_{ji,t}}{\sum_i m_{ji,t}}\right).\log(ERN_{i,t}) +$$
$$a_4.\log(IBN_{i,t}) + a_5.log\left(\frac{\sum_{j\neq i} m_{ji,t}}{\sum_j m_{ji,t}}\right) + a_6.log\left(\frac{\sum_{j\neq i} m_{ji,t}}{\sum_j m_{ji,t}}\right).\log(IBN_{i,t}) +$$
$$b_1.Socioeconomic\ variables_{i,t} + département\ and\ time\ fixed\ effects + \varepsilon \quad (1)$$

with $f_{i,t}$ the inhabitants' residence norm, i.e., the fertility rate in *département i* in year *t*, $ERN_{i,t}$, the emigrants' birthplace norm, $IBN_{i,t}$, the immigrants' birthplace norm.

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[9] In 1881, primary school attendance until the age of 14 became mandatory in France. Therefore to get a better sense of educational achievement in France during the period, we also consider secondary school attendance until age 19.

$\frac{\sum_{i\neq j} m_{ji,t}}{\sum_i m_{ji,t}}$ the share of emigrants among natives of *département* j and $\frac{\sum_{j\neq i} m_{ji,t}}{\sum_j m_{ji,t}}$ the share of immigrants among inhabitants of *département* i, where $m_{ij,t}$ is the stock of migrants born in *départment i* living in *départment j* at time *t*.

We also consider a version of Equation (1) which includes both the lagged dependent and independent variables. This is because we cannot know a priori whether the migrants' fertility norms and the socio-economic variables have an immediate and/or a delayed effect on the fertility of each *département*.

$$\log(f_{i,t}) =$$
$$a_0 \log(f_{i,t-1}) + a_1.\log(ERN_{i,t}) + a_2.log\left(\frac{\sum_{i\neq j} m_{ji,t}}{\sum_i m_{ji,t}}\right) +$$
$$a_3.log\left(\frac{\sum_{i\neq j} m_{ji,t}}{\sum_i m_{ji,t}}\right).\log(ERN_{i,t}) + a_4.\log(ERN_{i,t-1}) + a_5.log\left(\frac{\sum_{i\neq j} m_{ji,t-1}}{\sum_i m_{ji,t-1}}\right) +$$
$$a_6.log\left(\frac{\sum_{i\neq j} m_{ji,t-1}}{\sum_i m_{ji,t-1}}\right).\log(ERN_{i,t-1}) + a_7.\log(IBN_{i,t}) +$$
$$a_8.log\left(\frac{\sum_{j\neq i} m_{ji,t}}{\sum_j m_{ji,t}}\right) + a_9.log\left(\frac{\sum_{j\neq i} m_{ji,t}}{\sum_j m_{ji,t}}\right).\log(IBN_{i,t}) +$$
$$a_{10}.\log(IBN_{i,t-1}) + a_{11} log\left(\frac{\sum_{j\neq i} m_{ji,t-1}}{\sum_j m_{ji,t-1}}\right) + a_{12}.\left(\frac{\sum_{j\neq i} m_{ji,t-1}}{\sum_j m_{ji,t-1}}\right).\log(IBN_{i,t-1}) +$$
$$b_1.Socioeconomic\ variables_{i,t} + b_2.Socioeconomic\ variables_{i,t-1} +$$
$$département\ and\ time\ fixed\ effects + \varepsilon \qquad (2)$$

As a robustness check, we use an alternative specification to Equation (1) and Equation (2) where we hypothesize that the effects of the emigrants and immigrants' fertility norms on the total fertility of each *département* are of the same nature as the native inhabitants' fertility norm. We thus compute two explanatory variables: the average of the residence fertility norm of emigrants and of the fertility norm of the *département*'s natives weighted by the respective shares of emigrants and natives, and the average of the immigrants' birthplace fertility norm and of the fertility norm of the *département*'s other inhabitants weighted by the respective shares of immigrants and of other inhabitants. We thus write

$$\log(f_{i,t}) =$$
$$a_1.\log(NRN_{i,t}) + a_2.\log(HBN_{i,t}) + b_1.Socioeconomic\ variables_{i,t} +$$
$$+département\ and\ time\ fixed\ effects + \varepsilon \qquad (3)$$

and

$$\log(f_{i,t}) =$$

$$a_0 \log(f_{i,t-1}) + a_1.\log(NRN_{i,t}) + a_2.\log(NRN_{i,t-1}) + a_3.\log(HBN_{i,t}) + a_4.\log(HBN_{i,t-1}) + b_1.Socioeconomic\ variables_{i,t} + b_2.Socioeconomic\ variables_{i,t-1} + département\ and\ time\ fixed\ effects + \varepsilon \quad (4)$$

with $HBN_{i,t}$ the inhabitants' birthplace norm and $NRN_{i,t}$ the natives' residence norm.

It must be noted that in Equation (3) and in Equation (4), the constructions of the natives' residence fertility norm and of the inhabitants' birthplace fertility norm variables are such that the interaction variables are not needed since the shares of emigrants and immigrants are already taken into account in the computation of the fertility norms.

At this stage, a few remarks on the specifications of both Equation (1) and Equation (2) are in order. Our approach exploits census data at a regional level and is therefore reminiscent of the Princeton Project on the Decline of Fertility in Europe which begun in the 1960s (see http://www.opr.princeton.edu/archive/pefp/, (Coale and Watkins 1986)). However its conclusions, which downplayed the role of socio-economic variables in the European fertility decline, have been criticized by economists, e.g., ((Brown and Guinnane 2007) and (Guinnane 2011)). Our approach takes these criticisms into account in our econometric specification.

First, our empirical analysis relies on aggregated data. If the underlying disaggregated data are heterogeneous, which is not a priori certain at the *département* level, this approach may reduce the efficiency of the estimator because "grouping observations discards information" (Brown and Guinnane 2007), p. 581)). However this strategy does not bias the estimator. Nonetheless, when analyzing our results, we pay attention not only to the statistical significance of our explanatory variables, but also to the size of the coefficients by constructing a counter-factual.

Second our model estimates fertility change by estimating a balanced panel using time- and *département*- fixed effects which corrects for unobserved heterogeneity between *départements*.[10] Taking these fixed effects as given, we could either use a model in growth rates or in level. It is indeed unclear whether the growth rates of explanatory variables have a relation with the growth rate in fertility or if the levels of

[10] (Brown and Guinnane 2007), p. 588) recommend that approach which studies from the Princeton Project did not usually employ.

the explanatory variables have a relation with the level of fertility (see (Brown and Guinnane 2007) for a discussion). Since we do not want to constrain the model a priori, we check the functional forms in Equations (2) and (4). If the actual model is in growth rates, then we should find in Equation (2) that a_0=1, a_1=-a_2 and a_3=-a_4, where a_0 is the coefficient associated with the lagged dependent variable, a_1 and a_2 are the coefficients associated with the Emigrants' Residence Norm at time t and t-1, while a_3 and a4 are the coefficients associated with the Immigrants' Birthplace Norm at time t and t-1. Similarly, if the model is in growth rates, we should find in Equation (4) that a_0=1, a_1=-a_2 and a_3=-a_4, where a_0 is the coefficient associated with the lagged dependent variable, a_1 and a_2 are the coefficients associated with the Natives' Residence Norm at time periods t and t-1, while a_3 and a_4 are the coefficients associated with the Inhabitants' Birthplace Norm.

Whether this is the case is checked in Table 11 in the Appendix. The coefficient of the lagged explained variable is different from zero in both specification, suggesting indeed that the relationship between the fertility rate and the explanatory variables is in level.

An additional issue is the fact that migrants might be selected on their fertility, and the norms they transmit are not the norms of the *département* they inhabit. This might lead to a mismeasurement error. However, it would bias downward our coefficients. The fact that we still find an effect despite this reinforces our argument that the transmission of norms explains the fertility convergence.

3.2. Migration and transport costs

Our equations can be estimated with OLS, which rests on the assumption that all covariates are independent of the error term. However, endogeneity might be an issue because migration can be influenced by cultural proximity as measured by fertility norms. In that case, the emigrants' residence fertility norm will be linked to the explained variable in a way unrelated to cultural diffusion.

We solve for endogeneity using travel costs as instrumental variables. The underlying logic of this approach is that a decrease in travel costs would have a positive effect on migration, and would decrease the stocks of migrants that are measured in the TRA dataset. In addition, this approach takes advantage of the fact that in our sample, travel costs are time-varying because the railroad network and the passenger price ratio between the railroad and the road networks evolve throughout the century[11].

It is worth noting that the French railroad network was developed independently of cultural diffusion and migration. From the 1840s onwards, the French state influenced the design of the railroad network in order to connect Paris to the main economic centres of the country. This design, which originally comprised 7 lines, was named *L'Etoile de Legrand* (Legrand's star) after the name of the then under-secretary of public works (Caron 1997). As such, it is unlikely that travel costs in France between 1851 and 1911 were linked to factors of cultural diffusion, such as newspaper and books.[12] Indeed, these were high value-to-weight goods so that their diffusion should not have been influenced by the railroads.

To illustrate our point, we graph in Figure 15 the Coale Fertility Index of each *département*. For each *département*, we graph a vertical line that indicates with a 15-year lag when the *département* was linked to Paris via the railroad (the 15-year lag is chosen because it enables us to account for the delay in the impact of the transmission of fertility norms). Figure 14 shows that the introduction of the railroad was indeed not linked to the decline in fertility; however for some *départements*, such as *Alpes-Maritimes*, *Finistère* and *Loire*, the connection to Paris via the railroad network was associated with a decline of fertility.

In order to compute the predicted migration stocks, we first assess the travel costs between each *département* through a three-stage procedure. First, we use (Caron 1997)'s rail network map to determine the available travel (railroad, road, sea) links between adjacent *départements*.[13] Second, we compute the great-circle distance between the towns (chef-lieu) which serve as the administrative centres of each of these adjacent *départements*. Since rail prices were regulated by the State (see (Toutain 1967), p. 277) so that there was a constant road or rail price per kilometer throughout France, this strategy provides the travel cost between adjacent

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[11] Transport costs were large enough to have an effect. In 1901, a train ticket in third class between Paris and Lyon (approx. 450 km) cost 3 days of a Parisian worker's wages and 5 days of a provincial one. A road ticket was three times as expensive. In 1872, these numbers would have been 6 and 10.5 days (Today, the cheapest ticket goes for 5 hours of the minimum net wage).

[12] 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).

[13] The railroad network between the main administrative towns (*chef-lieu*) of each *département* was completed during the 1880s.

départements. Third, we apply a short-route finding algorithm taken from the UCINET network analysis program to compute the cheapest route and hence the travel costs between each *département* ((Borgatti, Everett, and Freeman 2006)).

We then use twenty and thirty-year lagged travel costs and départements fixed effects to estimate a panel theoretical gravity model.[14]

$$\log(m_{ij,t}) = a + b.\log(transport\ costs_{t-20}) + c.\log(transport\ costs_{t-30}) + \text{year, departure and arrival } \textit{départements} \text{ fixed effect} + \varepsilon \quad (5)$$

This equation is estimated according to the standard Poisson Pseudo Maximum Likelihood to solve for the existence of zero migrant stocks and heteroskedasticity (Silva and Tenreyro 2006). This approach yields predicted migration stocks whose descriptive statistics are presented in Table 1**.** In Figure 4, we provide a graph of these predicted bilateral migrants stocks in 1891, which closely match the migrants stocks that were mapped in Figure 2 and Figure 3.[15]

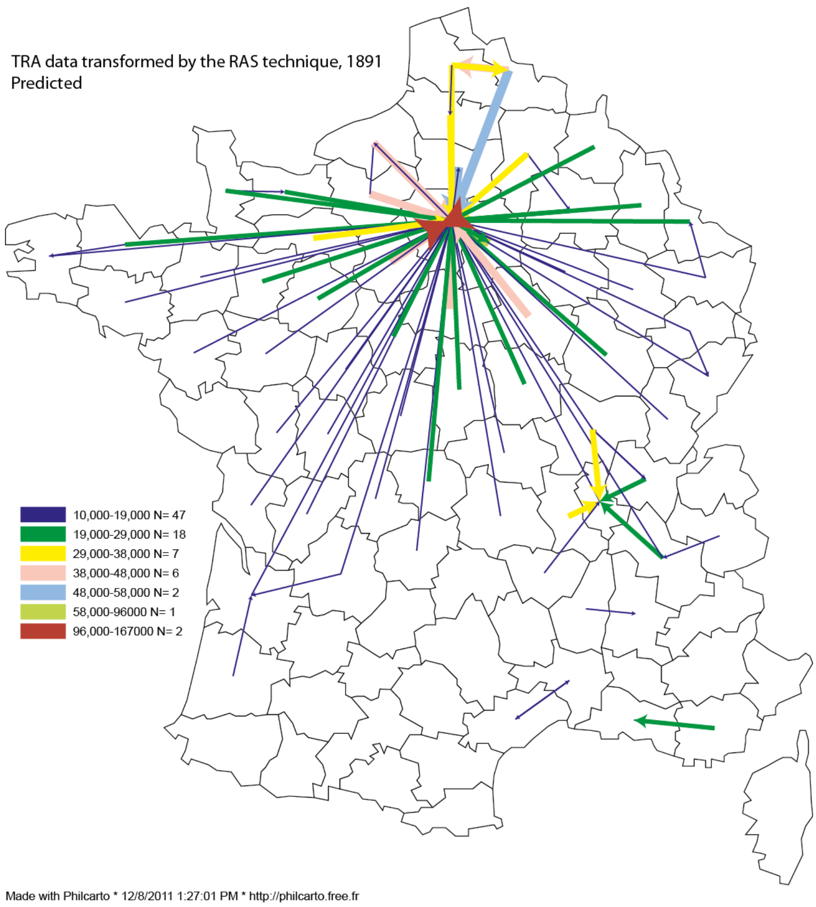
Our method to overcome endogeneity follows Spilimbergo's approach to estimate the diffusion of cultural norms (Spilimbergo 2007). This procedure does not however correspond to the standard two stage least square regression, as the instrumental variable, i.e., the predicted migration stocks, is computed over *n x (n-1)* observations, instead of *n* like the variable of interest.

We cannot use this method to correct for endogeneity in Equation (2) and (4) (with lags). This is because it does not purge the endogeneity from the lagged dependant variable (*Raphaël, je compte sur toi pour expliquer cela mieux que moi !)*. Furthermore, these equations require dropping 1/6th of the sample as we do not have migration data for 1851. We have checked that the model is better specified in levels than in growth rates: as a result, we do not pursue further the Equation (2) and (4).

[14] The mean migrant age was, according to TRA, 38 in 1861, 40 in 1872, 41 in 1881, 43 in 1891, 45 in 1901 and 50 in 1911, i.e. between 20 and 30 years after migration.

[15]

Figure 4: Predicted bilateral migrant stocks, TRA data transformed by the RAS technique, 1891 [À REFAIRE]



4. Results

4.1. Regressions

This section discusses the results of our regressions. Table 6 contains the regression results of the first-stage regressions for the predicted migrant stocks, which we use as our IV to check the robustness of Equations (1) and (2). As could be expected, these first-stage regression results suggest that migrant stocks decline with increasing travel costs. In other words, migrant flows increased as travel costs decreased during the period covered by our sample.

Table 6: Predicted migrant stocks

Dependent variable is $m_{ij,t}$ the stock of migrants born in *départment i* living in *départment j* at time *t*

	All migrants	Male migrants	Female migrants
20-year lagged log(travel costs)	-0.9***	-0.8***	-0.9***
	(0.06)	(0.08)	(0.07)
30-year lagged log(travel costs)	-0.6***	-0.7***	-0.5***
	(0.05)	(0.06)	(0.06)
Year fixed effects	Yes	Yes	Yes
Origin-*département* & destination-*département* fixed effects	Yes	Yes	Yes
Pseudo R2	0.60	0.53	0.55
Number of observations	43,690	43,690	43,690
Number of clusters	7310	7310	7310

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

In Table 7 we explore the impact of migrants on the convergence of the fertility rates in the French *départements*. In Columns 1 and 2 of Table 7, we estimate Equation (1) (using emigrants and immigrants' fertility norms) while we estimate Equation (3) in Columns 3 and 4 (using natives and inhabitants' fertility norms). In Columns 1 and 3, we report the OLS regression results while we report the IV regression results in Columns 2 and 4.

The shaded lines in Table 7, column 2 and 3, are not interpretable directly, as the fertility norms and the share of migrants intervene both directly and indirectly through the interactive variables in the equations. One should look at the marginal effects. reports the marginal effects of the main explanatory variables, i.e., the fertility norms and the share of migrants, in Table 7.

Table 7: Determinants of the fertility decline in France, 1861-1911

	Emigrants and Immigrants' Fertility Norms		Natives and Inhabitants' Fertility Norms	
	(1)	(2)	(3)	(4)
	OLS	"IV"[16]	OLS	"IV"
	Dependent variable is Inhabitants' Residence Norm (t)			
Emigrants' Residence Norm (t)	0.503***	1.227***		
	[0.0967]	[0.182]		
Immigrants' Birthplace Norm (t)	-0.162	-0.0592		
	[0.109]	[0.200]		
Natives' Residence Norm (t)			1.107***	1.113***
			[0.0108]	[0.00722]
Inhabitants' Birthplace Norm (t)			0.00556	0.0139**
			[0.00968]	[0.00682]
Share of Emigrants (t)	-2.487***	-6.104***	0.137**	0.230***
	[0.811]	[1.508]	[0.0671]	[0.0444]
Share of Immigrants (t)	3.735***	2.985*	0.0669	-0.258***
	[0.979]	[1.612]	[0.0539]	[0.0787]
Emigrants' Residence Norm (t) * Share of Emigrants(t)	-1.666***	-4.205***		
	[0.549]	[0.936]		
Immigrants' Birthplace Norm (t) * Share of Immigrants(t)	2.209**	1.307		
	[0.837]	[1.305]		
Life Expectancy Age 15 (t)	-0.0128	-0.0141	-0.00535***	-0.00511***
	[0.00978]	[0.00963]	[0.00201]	[0.00135]
Infant Mortality (t)	0.583*	0.469	-0.180***	-0.177***
	[0.318]	[0.317]	[0.0673]	[0.0460]
Urban (t)	-0.113	0.156	-0.000289	-0.00172
	[0.317]	[0.293]	[0.0209]	[0.0152]
Industries (t)	-0.0142*	-0.00148	0.00251**	0.000699
	[0.00755]	[0.00726]	[0.00109]	[0.000711]
Professionals (t)	-0.0170	-0.00607	-0.00268*	-0.000138
	[0.0141]	[0.0125]	[0.00159]	[0.00119]
Share of Girls in Primary Catholic Schools (t)	0.00637	0.0177	0.000591	-0.00520*
	[0.0179]	[0.0207]	[0.00420]	[0.00304]
Share of Boys in Primary Catholic Schools (t)	0.000692	0.00821	-0.00273	-0.00138
	[0.0155]	[0.0155]	[0.00324]	[0.00200]
Female Education (t)	-0.0490	-0.0325	0.00506	-0.00270
	[0.0376]	[0.0399]	[0.00454]	[0.00298]
Male Education (t)	0.0128	0.0215	0.00732	0.00513
	[0.0457]	[0.0501]	[0.00580]	[0.00316]
Constant	-0.503	0.633	0.403***	0.418***
	[0.519]	[0.595]	[0.108]	[0.0766]
	Marginal Effects of Fertility Norms and Share of Migrants			
Emigrants' Residence Norm (t)	0.271***	0.641***		
	[0.0685]	[0.118]		
Share of Emigrants (t)	-0.207	-0.335		
	[0.268]	[0.355]		
Immigrants' Birthplace Norm (t)	0.0580	0.0709		
	[0.0723]	[0.174]		
Share of Immigrants (t)	1.232***	7.677***		
	[0.367]	[2.079]		
Adjusted R^2	0.732	0.757	0.992	0.996
Within R^2	0.743	0.767	0.993	0.996
F-stat	53.565	58.961	4466.478	10644.766
Prob > F-stat	0.000	0.000	0.000	0.000
Number of clusters	81	81	81	81
Year fixed-effects	Yes	Yes	Yes	Yes
Départements fixed effects	Yes	Yes	Yes	Yes
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.*

[16] Because this is a non-standard IV procedure in which the first stage is not of the same dimension as the second stage, we could not correct the standard errors of the second stage according the standard procedure. We did not pursue the matter further as we know the aggregation biais leads to an inefficient estimator.

Table 8: Determinants of the fertility decline in France, 1861-1911: the impact of male and female migration

	Emigrants and Immigrants' Fertility Norms		Natives and Inhabitants' Fertility Norms	
	(1) OLS	(2) "IV"	(3) OLS	(4) "IV"
	Dependent variable is Inhabitants' Residence Norm (t)			
Male Emigrants' Residence Norm (t)	0.325***	1.946		
	[0.110]	[1.482]		
Female Emigrants' Residence Norm (t)	0.110	-0.864		
	[0.132]	[1.605]		
Male Immigrants' Birthplace Norm (t)	0.0566	3.978**		
	[0.0918]	[1.823]		
Female Immigrants' Birthplace Norm (t)	-0.238***	-4.030**		
	[0.0848]	[1.900]		
Male Natives' Residence Norm (t)			0.335***	0.00425
			[0.0932]	[0.376]
Female Natives' Residence Norm (t)			0.768***	1.101***
			[0.0957]	[0.373]
Male Inhabitants' Birthplace Norm (t)			-0.0161	0.451
			[0.0729]	[0.479]
Female Inhabitants' Birthplace Norm (t)			0.0268	-0.433
			[0.0706]	[0.473]
Share of Male Emigrants (t)	-1.367*	-8.263***	-0.108	-0.135
	[0.748]	[2.536]	[0.104]	[0.100]
Share of Female Emigrants (t)	-0.516	3.745	0.290**	0.361***
	[1.343]	[3.074]	[0.121]	[0.106]
Share of Male Immigrants (t)	0.573	-8.952	-0.0725	-0.587**
	[1.156]	[6.627]	[0.0918]	[0.242]
Share of Female Immigrants (t)	3.154**	11.18*	0.126	0.374
	[1.209]	[6.486]	[0.0839]	[0.233]
Male Emigrants' Residence Norm (t) * Share of Male Emigrants(t)	-0.683	-4.738***		
	[0.647]	[1.373]		
Female Emigrants' Residence Norm (t) * Share of Female Emigrants(t)	-0.646	1.465		
	[0.843]	[1.787]		
Male Immigrants' Birthplace Norm (t) * Share of Male Immigrants(t)	-0.323	-8.484*		
	[0.912]	[4.906]		
Female Immigrants' Birthplace Norm (t) * Share of Female Immigrants(t)	2.550***	9.078*		
	[0.936]	[4.965]		
Life Expectancy Age 15 (t)	-0.0109	-0.00630	-0.00588***	-0.00564***
	[0.0102]	[0.0107]	[0.00185]	[0.00127]
Infant Mortality (t)	0.652**	0.716*	-0.200***	-0.199***
	[0.326]	[0.374]	[0.0647]	[0.0442]
Urban (t)	-0.121	0.145	0.0131	0.00159
	[0.317]	[0.288]	[0.0205]	[0.0146]
Industries (t)	-0.0146*	-0.00157	0.00220**	0.000681
	[0.00776]	[0.00658]	[0.00105]	[0.000669]
Professionals (t)	-0.0135	-0.00202	-0.00240	-0.000997
	[0.0139]	[0.0119]	[0.00159]	[0.00118]
Share of Girls in Primary Catholic Schools (t)	0.00680	0.0351	0.000692	-0.00471
	[0.0196]	[0.0214]	[0.00436]	[0.00300]
Share of Boys in Primary Catholic Schools (t)	-0.000595	0.00437	-0.00236	-0.00173
	[0.0153]	[0.0156]	[0.00300]	[0.00192]
Female Education (t)	-0.0531	-0.00787	0.00292	0.000180
	[0.0385]	[0.0384]	[0.00440]	[0.00312]
Male Education (t)	0.0109	0.0313	0.00796	0.00439
	[0.0452]	[0.0482]	[0.00587]	[0.00317]
Constant	-0.709	0.125	0.431***	0.451***
	[0.536]	[0.646]	[0.103]	[0.0732]
	Marginal Effects of Fertility Norms and Share of Migrants			
Male Emigrants' Residence Norm (t)	0.226***	1.257		
	[0.0570]	[1.457]		
Female Emigrants' Residence Norm (t)	0.0235	-0.668		
	[0.0659]	[1.568]		
Share of Male Emigrants (t)	-0.460	-1.782*		
	[0.333]	[0.906]		
Share of Female Emigrants (t)	0.465	1.729**		
	[0.484]	[0.848]		
Male Immigrants' Birthplace Norm (t)	0.0225	3.086*		
	[0.0625]	[1.660]		
Female Immigrants' Birthplace Norm (t)	0.00103	-3.179*		
	[0.0443]	[1.737]		
Share of Male Immigrants (t)	0.941**	-3.672		
	[0.384]	[7.386]		
Share of Female Immigrants (t)	0.266	9.545		
	[0.400]	[7.643]		
Adjusted R^2	0.735	0.767	0.993	0.997
Within R^2	0.749	0.779	0.993	0.997
F-stat	50.970	67.559	3386.972	8615.922
Prob > F-stat	0.000	0.000	0.000	0.000
Number of clusters	81	81	81	81
Year fixed-effects	Yes	Yes	Yes	Yes
Départements fixed effects	Yes	Yes	Yes	Yes
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.*

The results in Table 7 suggest that socio-economic factors had little or no statistical and economic effect on the convergence of fertility rates in France. Only in the case Natives and Inhabitants' fertility norms are used (column 3 and 4) are life expectancy and infant mortality negatively related to fertility in a statistically significant way, as one would expect. The finding on life expectancy is in line with Galor's argument that increased life expectancy is likely to make human capital more productive over a longer time period, thus leading parents to have fewer children in whom they invest more human capital (Oded Galor 2012).

In addition, the results in the column 2 of Table 7 suggest that the convergence in fertility rates can be explained by the transmission of cultural norms via the emigrants' and immigrants' fertility norms. The most remarkable result is that Emigrants' Residence Norm has, as expected, an overall positive effect on fertility rate (see column 2). In other words, the lower the fertility of the destination *département* of *émigrant,* the lower the fertility of their *département* of origin.

The results are not ideal for our hypothesis, however. For example, (Emigrants' Fertility Norm) * (Share of Emigrants), i.e., the interaction variable between the fertility norm of emigrants and the share of emigrants, has a negative effect on the fertility rate in the emigrants' *département* of origin. This result suggests that there is a selection effect, such that in a given *département*, emigrants with low fertility rates are more likely to move to *départements* with low fertility rates while those who remain behind are more likely to have a high number of children, thereby increasing the fertility rate of the emigrants' *département* of origin.

The marginal effect of immigrants' fertility norms and the interaction between immigrants' fertility norms and immigrants' share, albeit of the right sign, is not statistically significative when endogeneity is controlled for. The share of immigrants by itself, however, as a large positive effect, but that cannot be linked to cultural transmission.

Column 4 of Table 7, however is more supportive to our hypothesis, as it shows that both the Natives's Residence Norm and the Inhabitants' Birthplace Norm have a role in determining fertility. The role the natives is stronger than the role of the inhabitants, confirming results in column 2 that emigrants play a larger role than immigrants.

Table 8 shows the same equations where the role of male and female migrants distinguished. The data are of lesser quality than for the total number of migrants. It is puzzling to notice in column 2 that for a number of variables of interest, the effect of male and female migrant is very often of different sign, even if sometimes of the same magnitude.

4.2. Counterfactual exercise

Because of the aggregation biased underlined by Browne and Guinnane, our regression method is not efficient. Hence, the statistical significance of our results is a poor guide to interpretation. Our results that the convergence in fertility rates in France can be traced to the transmission of cultural norms have to be corroborated. For that, we use a falsification test: we compute the counterfactual values of the fertility rate in each *département* under the assumption that no changes in fertility norms had occurred after 1861. I.e. we keep the fertility norms of emigrants and immigrants in each *département* constant at their 1861 level. This keeps the values of the Emigrants' Residence Norm, Immigrants' Birthplace norm constant and modifies the values of (Immigrants' Birthplace Norm)*(Share of Immigrants) and (Emigrants' Fertility Norm) * (Share of Emigrants).

We report the results of this counterfactual test in the histograms of the Inhabitants' Residence Norm (i.e. the observed fertility) variable in Figure 5 to Figure 8. In Figure 5 and Figure 6, we graph the predicted values of the Inhabitants' Residence Norm variable in the OLS and IV regressions reported in Columns 1 and 2 of Table 7, while in Figure 7 and Figure 8, we graph their counterfactual values. Figure 9 provides the evolution of fertility for the whole of France.

Table 9 provides the value of the absolute convergence coefficient, i.e. the coefficient attached to log of fertility in the following equation:

$$\frac{f_{i,t+10} - f_{i,t}}{f_{i,t}} = a.\log(f_{i,t}) + time\ fixed\ effects + \varepsilon$$

Table 10 provides the decline in the French trend of fertility from 1861 to 1911 in different scenarios.

In both Figure 5 and Figure 6, the level of fertility predicted by Equations 1 and 2 of Table 7 is shown to diminish but also, and most importantly to progressively converge, just like in Figure 1. Conversely, Figure 7, Figure 8 and Figure 9 show that there is no change in the mean of the counterfactual fertility levels. Figure 8 shows in addition that the counterfactual fertility levels do not converge in the quasi-IV procedure. These are confirmed by Table 9 and Table 10.

In addition, Table 9 and Table 10 show that both emigrants and immigrants contribute to the convergence and the decline of fertility. Women contribute more to the convergence of fertility, but men contribute more to its decline of fertility.

Figure 5: Estimated fertility convergence - OLS, 1861-1911

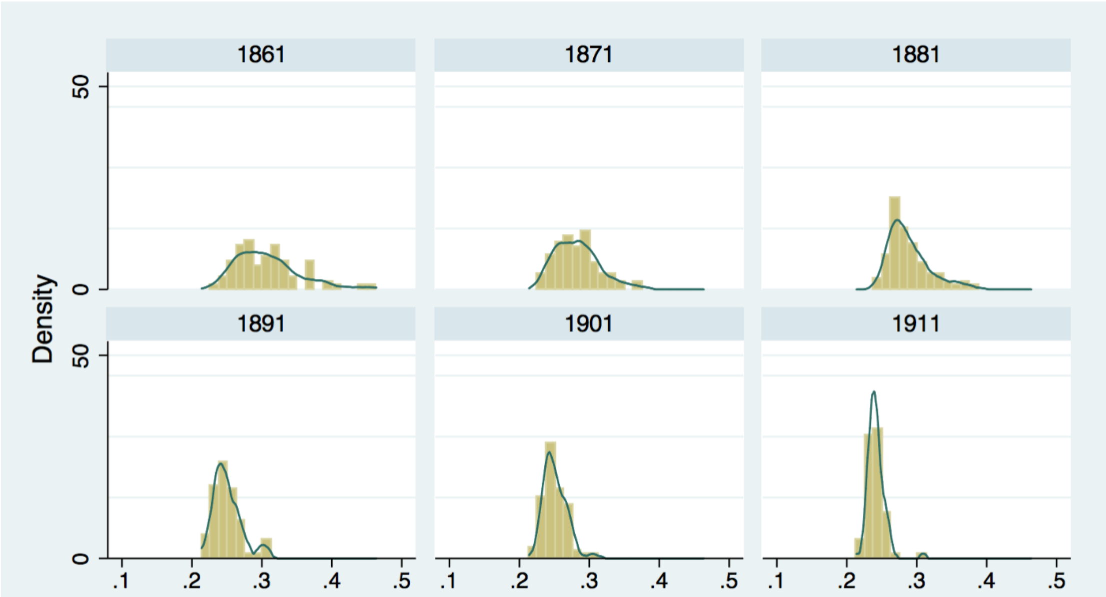


Figure 6: Estimated fertility convergence – IV, 1861-1911

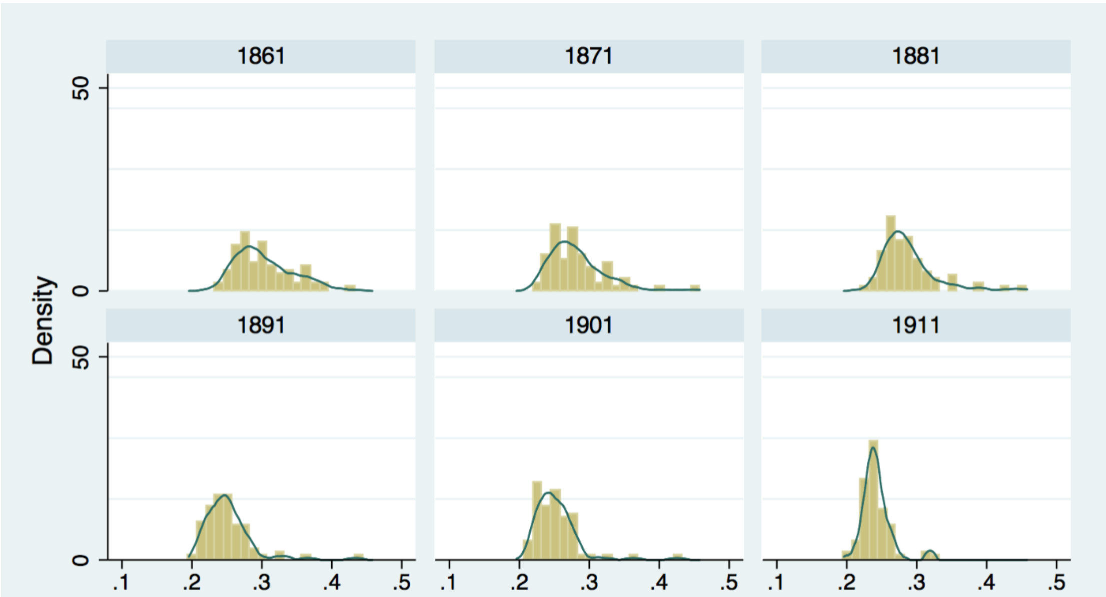


Figure 7: Fertility convergence: a counterfactual without migrations changes OLS, 1861-1911

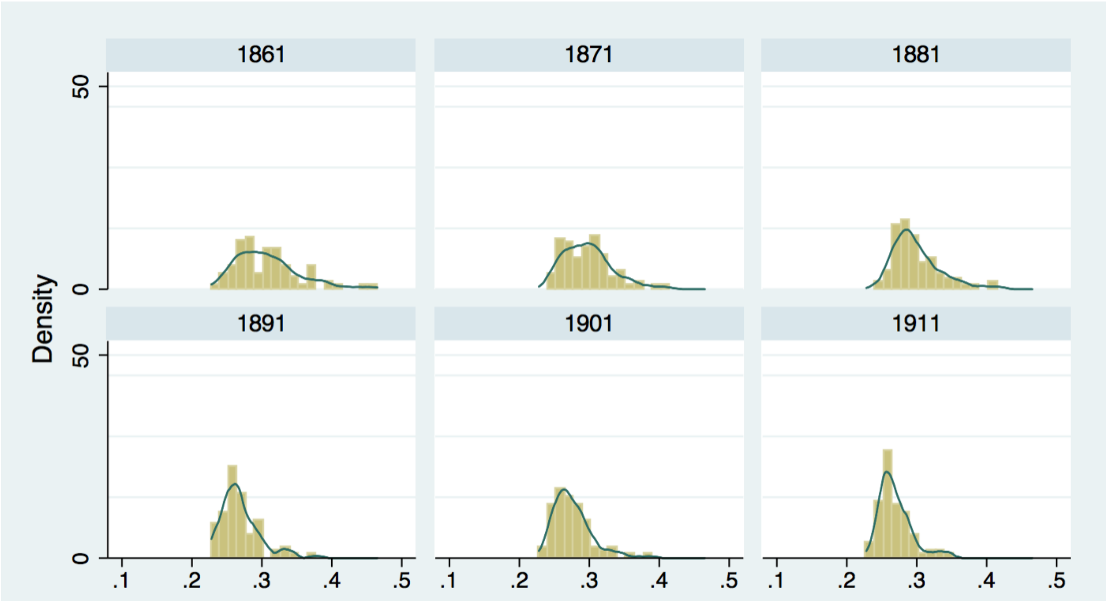


Figure 8: Fertility convergence: a counterfactual without migrations - IV, 1861-1911

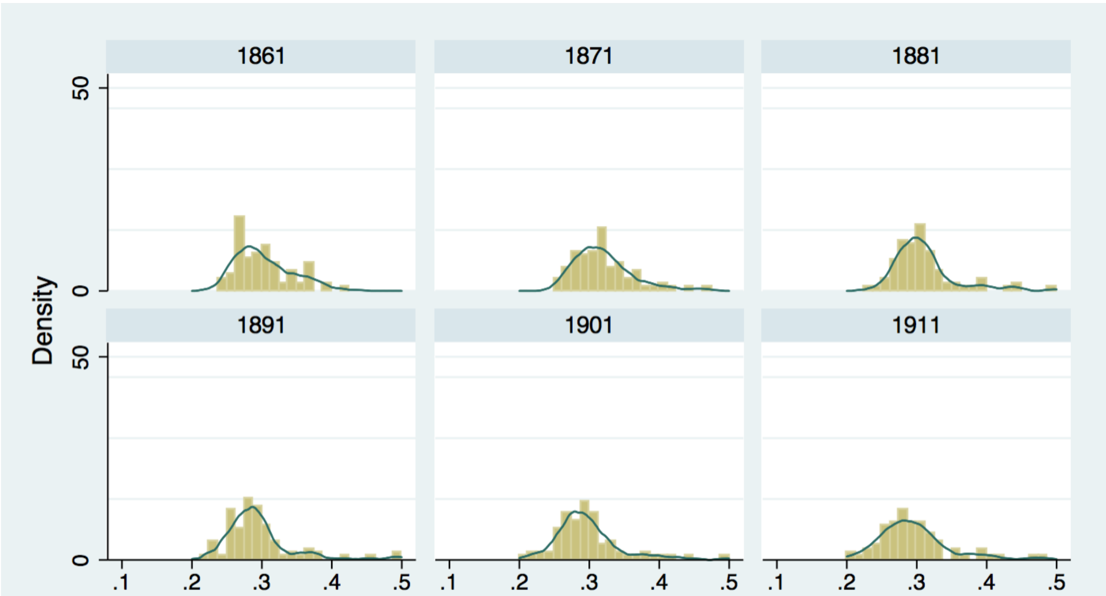


Figure 9: evolution of the French level of fertility

(Counterfactual with fixed norms – including in interactions – at 1861, quasi-IV method)

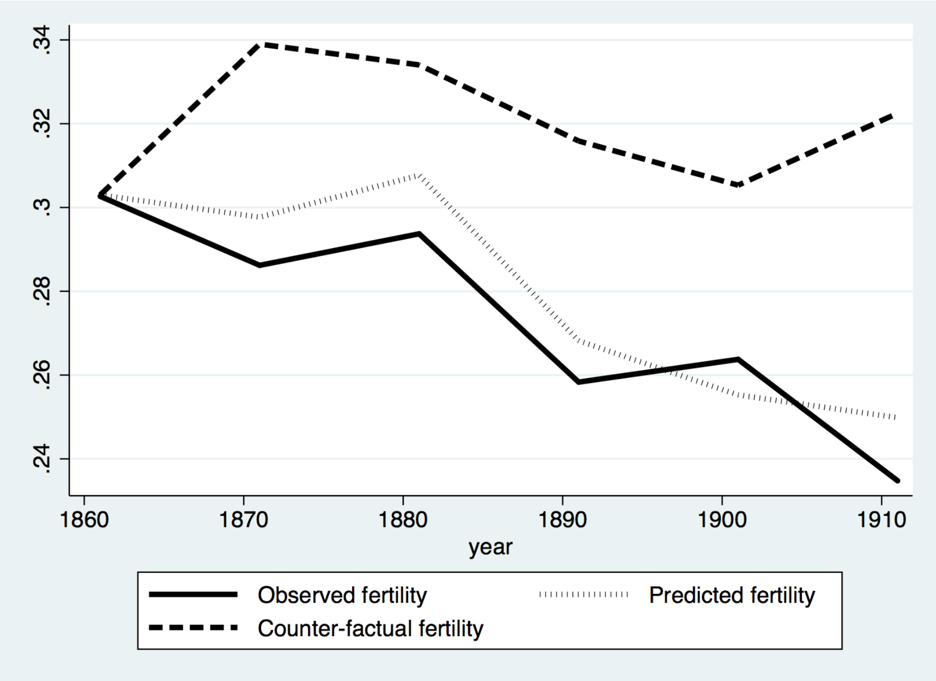


Table 9: Unconditional convergence term (see Table 4) for different scenarios

		TRAR data, 1861-1911					RE data, 1891-1911
		All	Only emigrants	Only immigrants	Only men	Only women	All
Actual		-.15*** (0.02)			-.15*** (0.02)		-.18*** (0.04)
Predicted	OLS	-.29*** (0.02)			-.28*** (0.02)		-0.30*** (0.04)
	IV	-.16*** (0.02)			-.17*** (0.02)		-0.27*** (0.04)
Counterfactual with fixed migration variables	OLS						
	IV						
Counterfactual with fixed norms and interactions	OLS	-.06* (0.03)	-.09*** (0.03)	-.23*** (0.03)	-.23*** (0.02)	-.15*** (0.03)	0.03 (0.05)
	IV	.13*** (0.02)	.12*** (0.02)	-.14*** (0.02)	.05* (0.03)	.02 (0.03)	-0.03 (0.05)
Counterfactual with fixed norms (incl. in the interactions)	OLS	-.20*** (0.03)	-.25*** (0.02)	-.24*** (0.03)	-.28*** (0.02)	-.23*** (0.02)	-.24*** (0.03)
	IV	-.04** (0.02)	-.16*** (0.02)	-.14*** (0.02)	-.12*** (0.04)	-06*** (0.02)	-.23*** (0.03)

Note : Robust standard errors clustered at the département level are used.

Table 10: Time trend of fertility for different scenarios

		TRAR data, 1861-1911					RE data, 1891-1911
		All	Only emigrants	Only immigrants	Only men	Only women	All
Actual		-21%			-21%		-9%
Predicted	OLS	-20%			-20%		-7%
	IV	-20%			-20%		-9%
Counterfactual with fixed migration variables	OLS						
	IV						
Counterfactual with fixed norms and interactions	OLS	-11%	-24%	-12%	-19%	-10%	-17%
	IV	-21%	-28%	-7%	+36%	-43%	-13%
Counterfactual with fixed norms (incl. in the interactions)	OLS	-1%	-13%	-17%	-14%	-17%	+1%
	IV	-0%	-20%	-17%	+95%	-69%	-1%

5. Conclusion

In this study, we analyze how the transmission of cultural norms about family size contributed to the demographic transition. For this purpose, we focus on the convergence in fertility rates within France between 1861 and 1911. We compute migration rates between *départements* over time, as opposed to the overall migration rate, and assess the effects of the fertility norms of emigrants and immigrants in their birthplace and residence *départements*. We solve for the endogeneity of migration choices by using bilateral travel costs as an instrumental variable.

Our results suggest that the transmission of cultural norms via migration explains the convergence of fertility rates in France. They indeed show that the decline in fertility cannot be traced to the sole socio-economic variables, which only had a limited impact, with the exception of the increase in life expectancy which has the effect predicted by theories that consider the rise in the demand for human capital as central to the beginning of the demographic transition.

If similar phenomena are at play nowadays, they might explain the quicker-than-expected decline of fertility in developing countries with a high proportion of migrants to low fertility developed countries in Europe, e.g. North Africa ((Eberstadt and Shah 2011).

Whether migrations cause the diffusion of other norms, such as age at marriage, age gap between spouses, female labour participation, will be an interesting subject for other research.

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Appendix

Appendix A. The TRA data and the total number of emigrants and immigrants at the département level

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.

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.[17] 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=1861, 1872, 1881, 1891, 1901 and 1911) in the TRA dataset.

The second step 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.[18] 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 *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

[17] This is of course an approximation. Using net positive migration rates by age from Bonneuil, we can compute that the mean age at migration was 19.4 years in 1861, 18.6 in 1872, 22.5 in 1881, 21.4 in 1891.

[18] 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.

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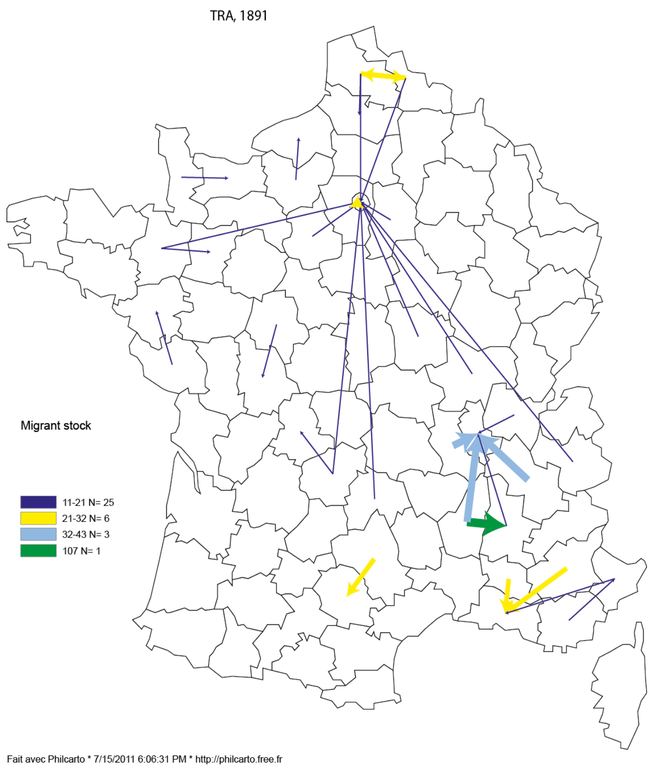
, p. 672-3). For this purpose, we apply a marginal standardization algorithm (see (Smith 1976) and (Cox 2006)'s software).[19] This is meant to reconcile the bilateral matrix composed of $m_{ij,t}^{TRA}$with its margins composed of $m_{i.,t}^{Census}$ and $m_{.j,t}^{Census}$, or find the $m_{ij,t}^{RAS}$ 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.

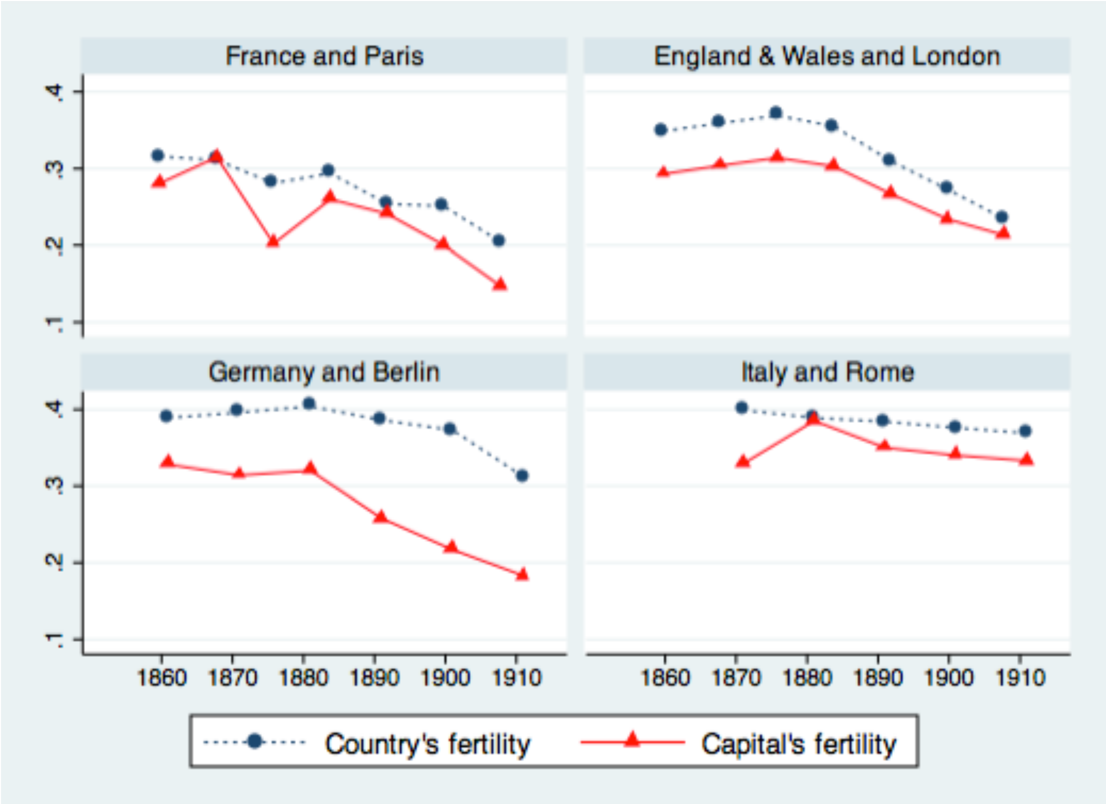
Figure 10: Bilateral migrant stocks > 11, TRA data, 1891



[19] This procedure is also known as biproportional matrices, iterative proportional fitting, raking or the RAS technique.

Appendix C: Fertility rates and fertility convergence in three other European countries: England & Wales, Germany and Italy.

Figure 11: Fertility rates in France, England, Germany and Italy



Notes: This Figure graphs the Fertility Coale Indices of France, England & Wales, Germany and Italy with their respective capitals. In all the countries, the capital's fertility is, maybe unsurprisingly, lower than that of the whole country. The Figure shows that there is a secular decline in fertility in France during the 19th 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.
Sources: See text for France. Princeton Project on the Decline of Fertility in Europe for the other countries.

Figure 12: Fertility distribution in England and Wales, 1861-1911

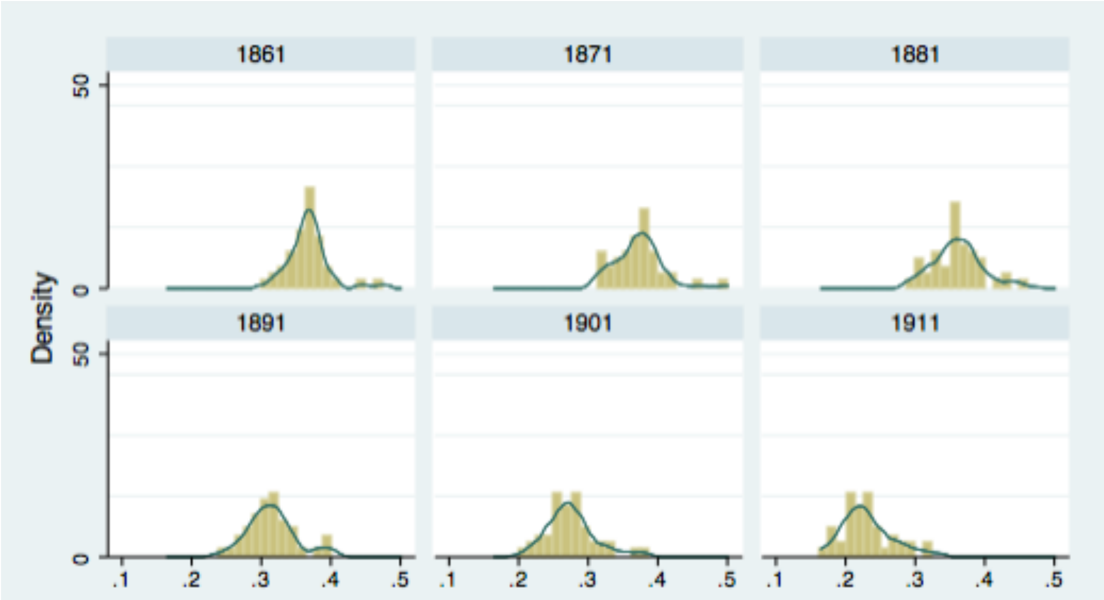


Figure 13: Fertility distribution in Germany, 1871-1910

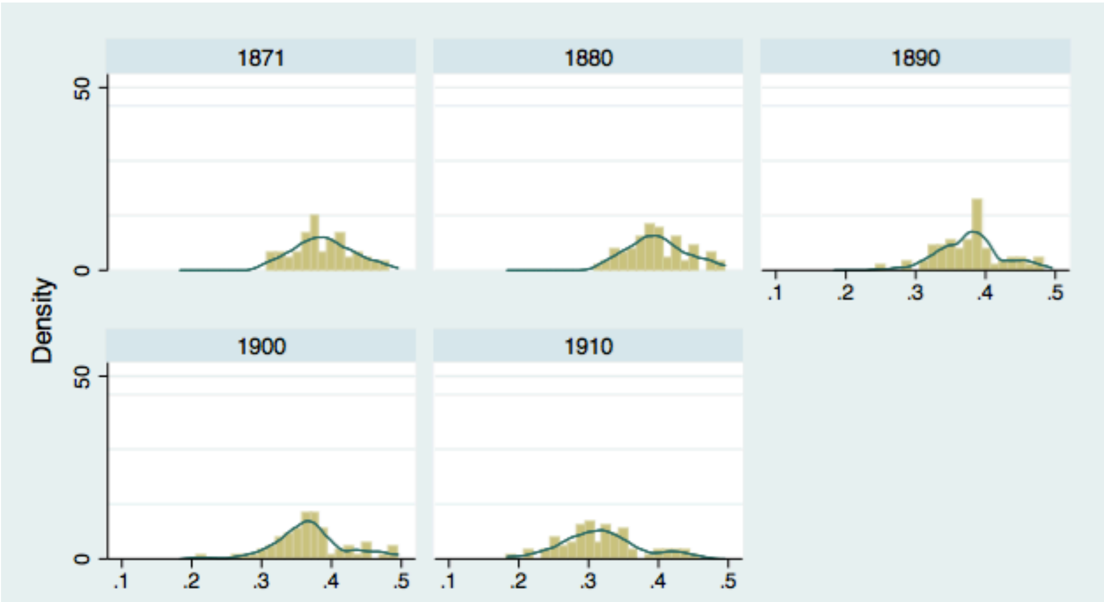
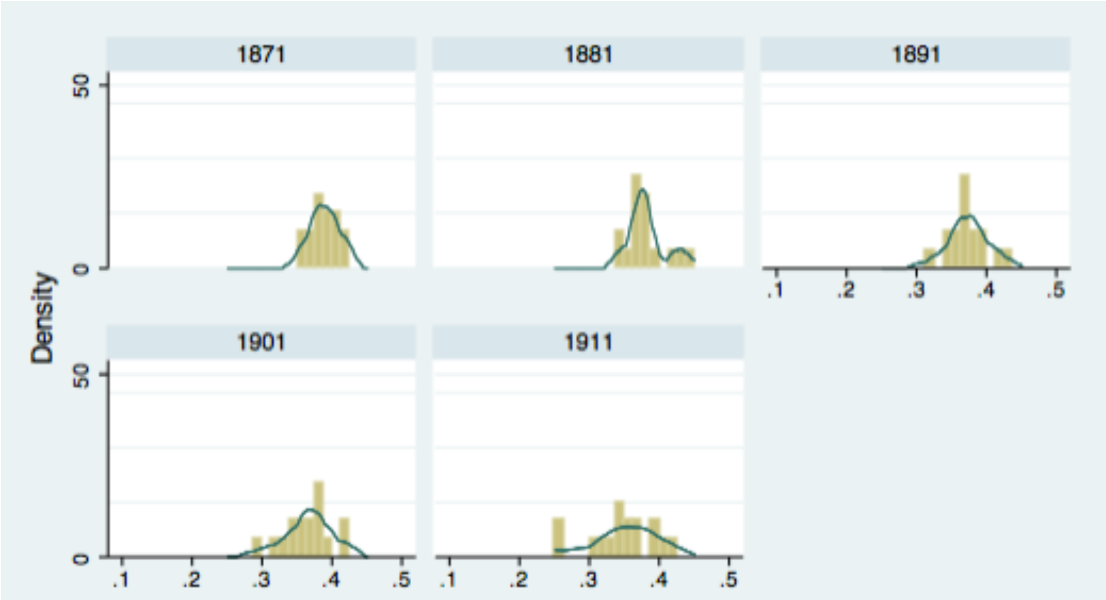
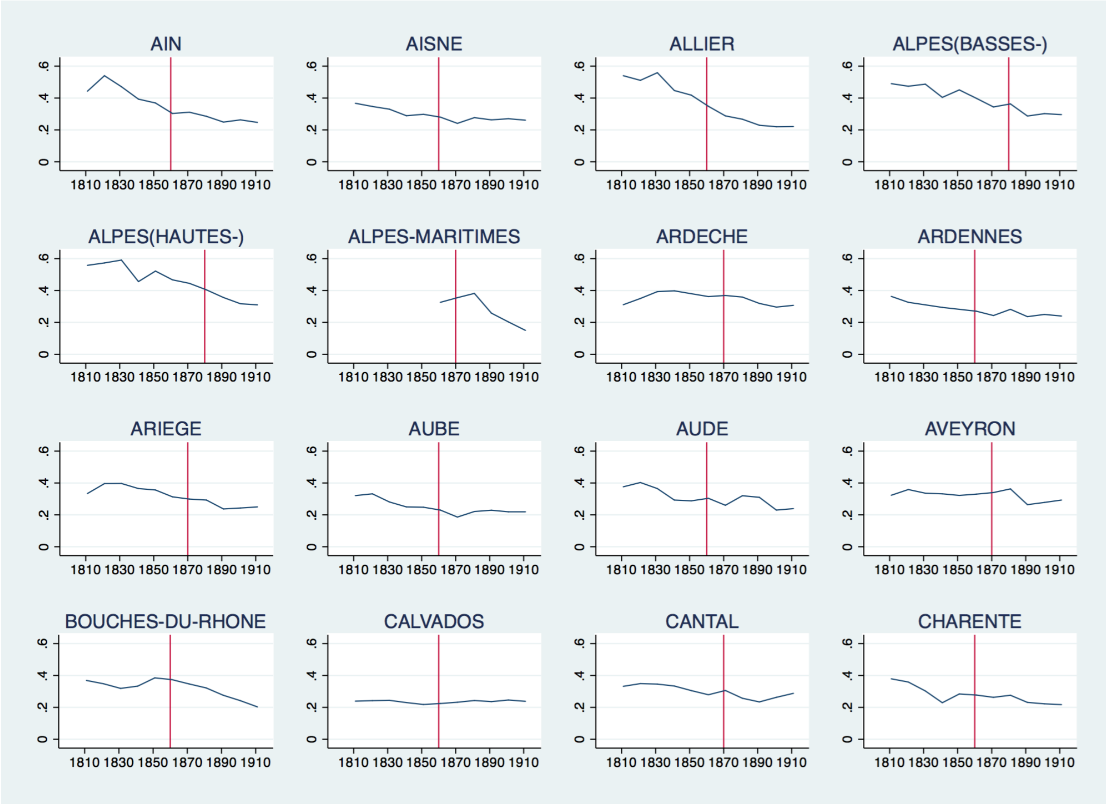


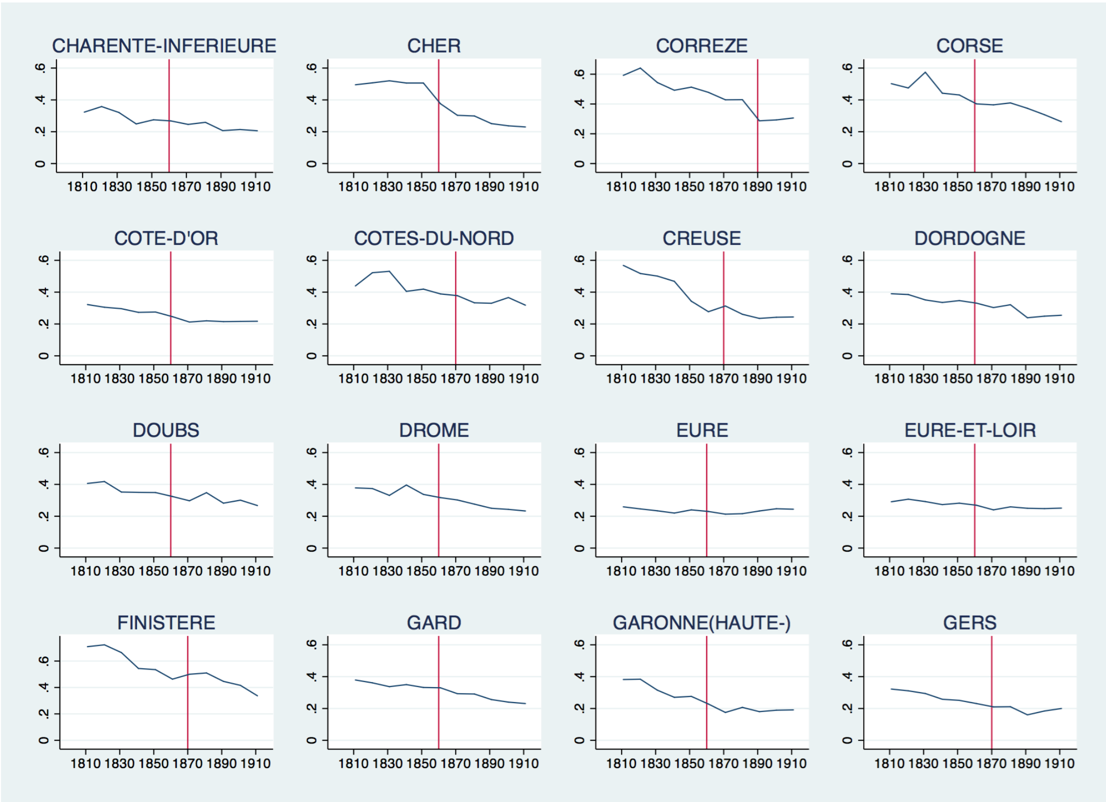
Figure 14: Fertility distribution in Italy, 1871-1910

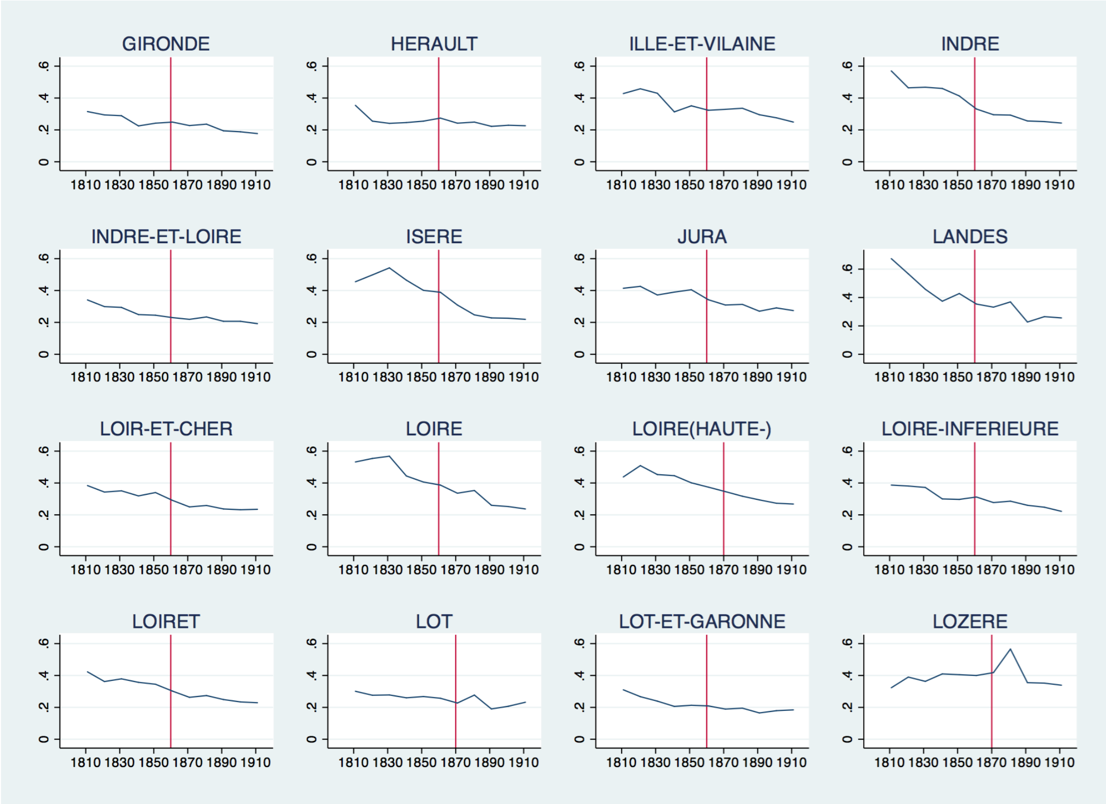


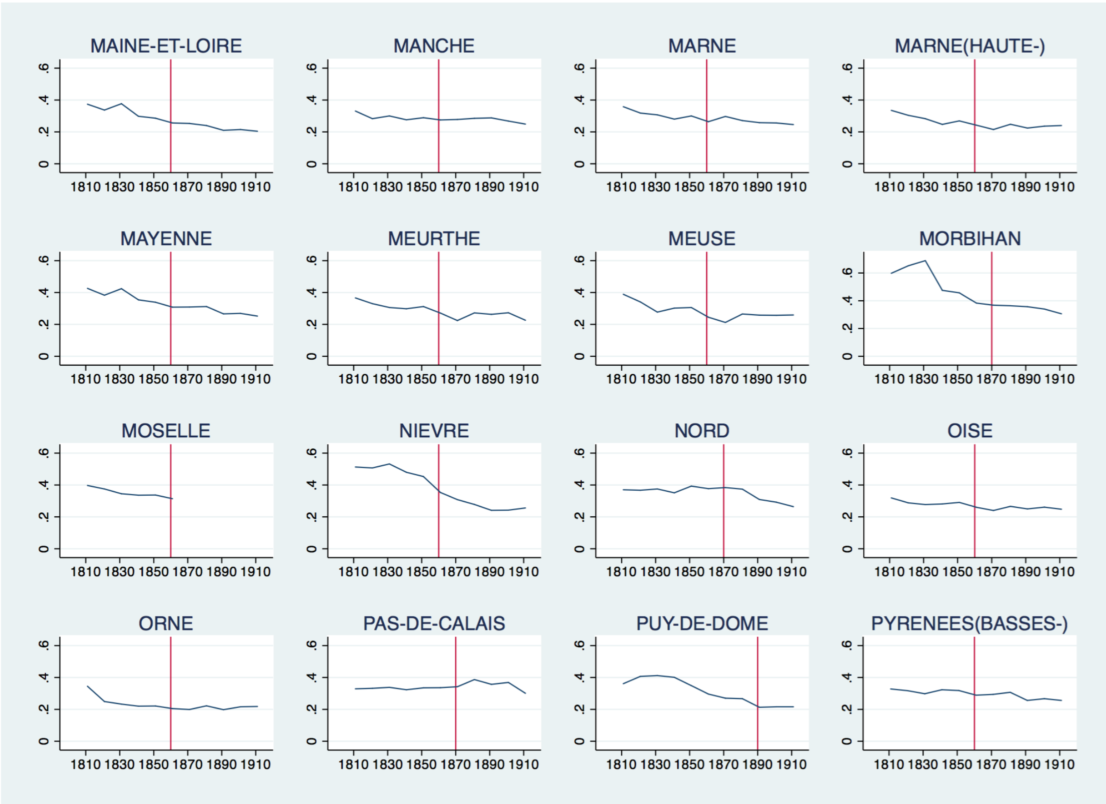
Appendix D: Fertility rates and the railroad network.

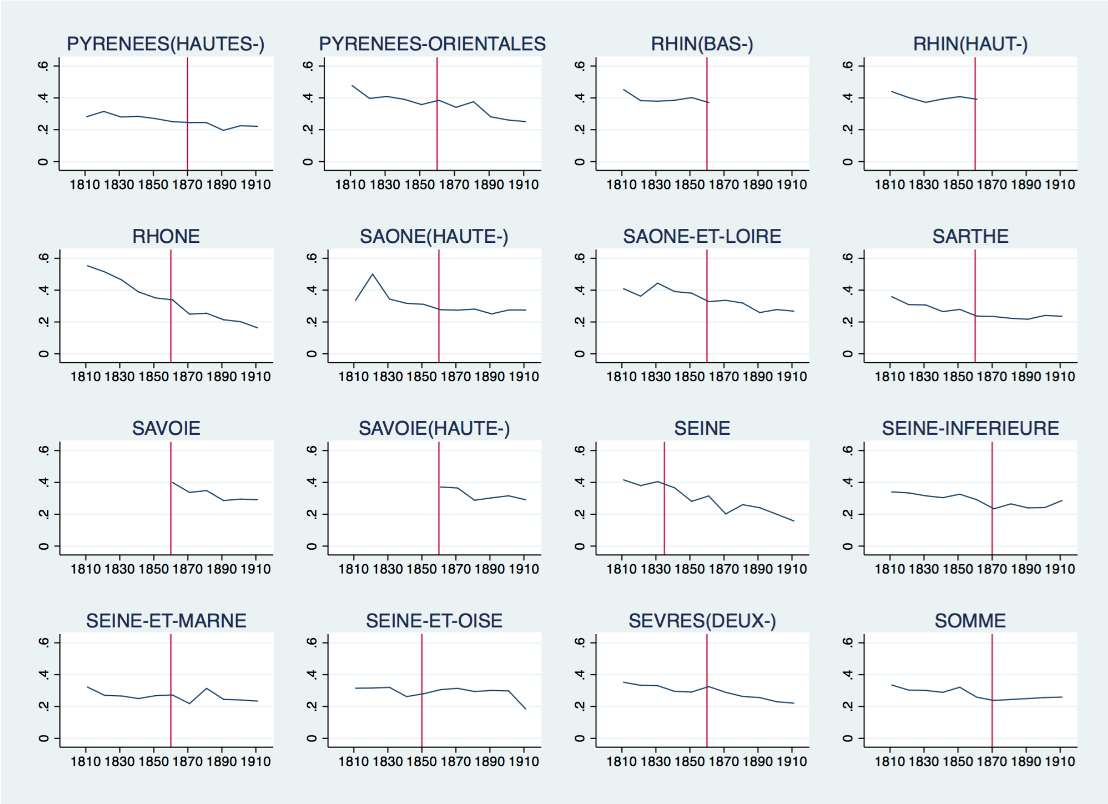
Figure 15: The Coale Fertility Index by *département* and the development of the railroad, 1851-1911

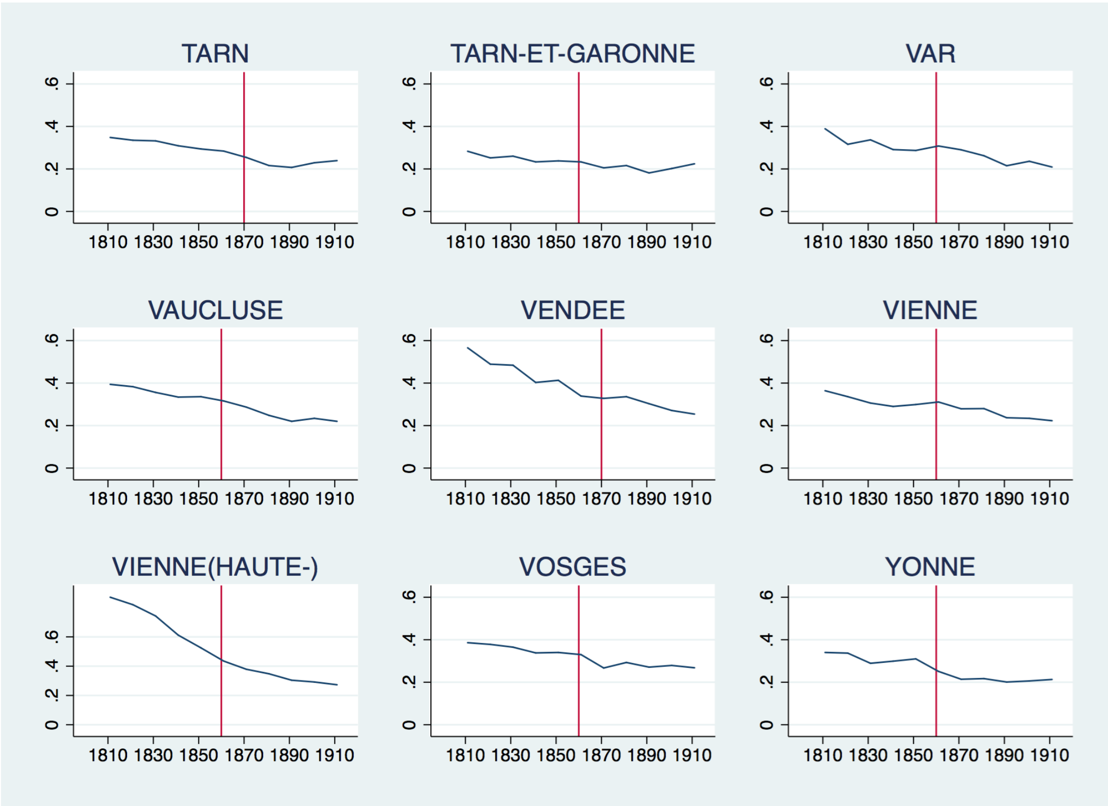

AIN
AISNE
ALLIER
ALPES(BASSES-)
ALPES(HAUTES-)
ALPES-MARITIMES
ARDECHE
ARDENNES
ARIEGE
AUBE
AUDE
AVEYRON
BOUCHES-DU-RHONE
CALVADOS
CANTAL
CHARENTE
0 .2 .4 .6
1810 1830 1850 1870 1890 1910


CHARENTE-INFERIEURE
CHER
CORREZE
CORSE
COTE-D'OR
COTES-DU-NORD
CREUSE
DORDOGNE
DOUBS
DROME
EURE
EURE-ET-LOIR
FINISTERE
GARD
GARONNE(HAUTE-)
GERS
0 .2 .4 .6
1810 1830 1850 1870 1890 1910


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


MAINE-ET-LOIRE
MANCHE
MARNE
MARNE(HAUTE-)
MAYENNE
MEURTHE
MEUSE
MORBIHAN
MOSELLE
NIEVRE
NORD
OISE
ORNE
PAS-DE-CALAIS
PUY-DE-DOME
PYRENEES(BASSES-)





Note: The line corresponds to the year when the *département* was linked to Paris via the railroad network+15 years

Source: For the Fertility Coale Index, see the text. See (Caron 1997) for the rail network.

Appendix E: Robustness checks: testing for the delayed effects of economic and cultural changes on fertility

In Table 12, Table 13, Table 15 and Table 16, we report tests of linear restrictions which assess whether each variable and its lagged values have an overall effect which is significantly different from zero. This is because we seek to determine whether the explanatory variables have an overall effect, which may be interpreted as their long-term impact, on the decline and convergence in the fertility rate. This leads us to report in Table 12, Table 13, Table 15 and Table 16 the results of a t-test rather than a F-test for each variable and its lagged value. Of course, both tests are equivalent but the t-test allows for an easier interpretation of the results since it directly provides the positive or negative sign of the overall effect in addition to its level of statistical significance.

Table 11: Determinants of the fertility decline in France, 1861-1911 -- Robustness Check with Lagged Variables

	Emigrants and Immigrants' Fertility Norms	Natives and Inhabitants' Fertility Norms
	(1)	(2)
	OLS	OLS
Inhabitants' Residence Norm (t-1)	0.0310	0.402***
	[0.0594]	[0.0867]
Emigrants' Residence Norm (t)	0.411**	
	[0.156]	
Emigrants' Residence Norm (t-1)	0.0985	
	[0.159]	
Immigrants' Birthplace Norm (t)	0.0830	
	[0.153]	
Immigrants' Birthplace Norm (t-1)	-0.0703	
	[0.155]	
Natives' Residence Norm (t)		1.112***
		[0.0121]
Natives' Residence Norm (t-1)		0.0139
		[0.00882]
Inhabitants' Birthplace Norm (t)		-0.00592
		[0.00994]
Inhabitants' Birthplace Norm (t-1)		-0.458***
		[0.0950]
Share of Emigrants (t)	-2.014	0.163*
	[1.565]	[0.0941]
Share of Emigrants (t-1)	0.376	-0.00784
	[1.971]	[0.0907]
Share of Immigrants (t)	0.854	0.0784
	[1.658]	[0.0530]
Share of Immigrants (t-1)	2.413	-0.0247
	[1.940]	[0.0465]
Emigrants' Residence Norm (t) * Share of Emigrants (t)	-1.355	
	[1.019]	
Emigrants' Residence Norm (t-1) * Share of Emigrants (t-1)	0.0647	
	[1.331]	
Immigrants' Birthplace Norm (t) * Share of Immigrants (t)	-0.518	
	[1.386]	
Immigrants' Birthplace Norm (t-1) * Share of Immigrants (t-1)	1.840	
	[1.709]	
Life Expectancy Age 15 (t)	-0.0228**	-0.00472***
	[0.0114]	[0.00178]
Life Expectancy Age 15 (t-1)	-0.0202	-0.00399
	[0.0165]	[0.00242]
Infant Mortality (t)	0.454	-0.0927
	[0.379]	[0.0595]
Infant Mortality (t-1)	-0.570	-0.133
	[0.591]	[0.0865]
Urban (t)	0.413**	0.0233
	[0.180]	[0.0149]
Urban (t-1)	-0.466***	-0.00131

	[0.128]	[0.0149]
Industries (t)	-0.00881	0.00127
	[0.00717]	[0.00102]
Industries (t-1)	-0.00396	0.00228*
	[0.00988]	[0.00135]
Professionals (t)	-0.0177	-0.00244
	[0.0140]	[0.00191]
Professionals (t-1)	-0.0257**	-0.00626***
	[0.0120]	[0.00203]
Share of Girls in Primary Catholic Schools (t)	0.0296	0.00511
	[0.0189]	[0.00470]
Share of Boys in Primary Catholic Schools (t)	-0.0280*	-0.00195
	[0.0161]	[0.00306]
Share of Girls in Primary Catholic Schools (t-1)	-0.00320	-0.00857
	[0.0345]	[0.00724]
Share of Boys in Primary Catholic Schools (t-1)	-0.00566	-0.000888
	[0.0117]	[0.00286]
Female Education (t)	-0.0510	0.00526
	[0.0579]	[0.00753]
Female Education (t-1)	-0.0181	0.0110*
	[0.0545]	[0.00591]
Male Education (t)	0.104**	-0.00238
	[0.0468]	[0.00646]
Male Education (t-1)	-0.179***	0.00437
	[0.0529]	[0.00655]
Constant	0.846	0.496***
	[0.945]	[0.137]
Emigrants' Residence Norm (t)	0.210***	
	[0.0651]	
Emigrants' Residence Norm (t-1)	0.107	
	[0.0925]	
Share of Emigrants (t)	-0.107	
	[0.388]	
Share of Emigrants (t-1)	0.290	
	[0.473]	
Immigrants' Birthplace Norm (t)	0.0281	
	[0.0814]	
Immigrants' Birthplace Norm (t-1)	0.103	
	[0.0782]	
Share of Immigrants (t)	1.456***	
	[0.434]	
Share of Immigrants (t-1)	0.357	
	[0.369]	
Adjusted R2	0.780	0.993
Within R2	0.759	0.993
F-stat	48.640	4551.537
Prob > F-stat	0.000	0.000
Number of clusters	81	81
Year fixed-effects	Yes	Yes

Départements fixed effects	Yes	Yes
Observations	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 12 Two-period effects of fertility norms (from Table 11)

	Emigrants and Immigrants' Fertility Norms	Natives and Inhabitants' Fertility Norms
	(1)	(2)
	OLS	OLS
H0: Emigrants' residence Norm (t) * (Share of Emigrants)(t) + Emigrants' Residence Norm (t-1) * (Share of Emigrants)(t-1)=0	-1.290	
	[0.853]	
H0: Immigrants' Birthplace Norm (t) * (Share of Immigrants)(t) +Immigrants' Birthplace Norm (t-1) * (Share of Immigrants)(t-1)=0	1.322	
	[1.113]	
H0: Natives' Residence Norm (t)+Native's Residence Norms (t-1)=0		-4.237*
		[2.410]
H0: Inhabitants' Birthplace Norm (t)+Inhabitants' Birthplace Norm (t-1)=0		-0.737
		[1.034]
H0: Female Education (t)+Female Education (t-1)=0	0.0531	0.0674
	[0.0609]	[0.0570]
H0: Male Education (t)+Male Education (t-1)=0	-0.197***	-0.121*
	[0.0699]	[0.0648]
H0: Infant Mortality (t)+Infant Mortality (t-1)=0	-0.117	-0.0807
	[0.558]	[0.521]
H0: Life Expectancy at Age 15 (t)+Life Expectancy at Age 15 (t-1)=0	-0.0430**	-0.0370**
	[0.0183]	[0.0160]
H0: Industries (t)+ Industries (t-1)=0	-0.0128	0.00842
	[0.0147]	[0.0122]
H0: Professionals (t)+Professionals (t-1)=0	-0.0434**	-0.0330
	[0.0215]	[0.0202]
H0: Urban (t)+Urban (t-1)=0	-0.0538	0.234
	[0.282]	[0.285]
H0: Share of Boys in Primary Catholic Schools (t) + Share of Boys in Primary Catholic Schools (t-1)=0	-0.0336*	-0.00701
	[0.0191]	[0.0168]
H0: Share of Girls in Primary Catholic Schools (t) + Share of Girls in Primary Catholic Schools (t-1)=0	0.0264	0.0192
	[0.0312]	[0.0316]

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

Table 13: Two-period marginal effects of fertility norms & shares of migrants (from Table 11)

	Marginal effects in OLS regression
	(Column 1-Table 11)
H0: Emigrants' Residence Norm (t) +Emigrants' Residence Norm (t-1)=0	0.317***
	[0.0980]
H0: Share of Emigrants (t)+ Share of Emigrants (t-1)=0	0.183
	[0.289]
H0: Immigrants' Birthplace Norm (t)+ Immigrants' Birthplace Norm (t-1)=0	0.131
	[0.0929]
H0: Share of immigrants (t)+ Share of immigrants (t-1)=0	1.814***
	[0.410]

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: the impact of male and female migration -- Robustness Check with Lagged Variables

	Emigrants and Immigrants' Fertility Norms	Natives and Inhabitants' Fertility Norms
	(1)	(3)
	OLS	OLS
Male Emigrants' Residence Norm (t)	0.325***	
	[0.110]	
Female Emigrants' Residence Norm (t)	0.110	
	[0.132]	
Male Immigrants' Birthplace Norm (t)	0.0566	
	[0.0918]	
Female Immigrants' Birthplace Norm (t)	-0.238***	
	[0.0848]	
Male Natives' Residence Norm (t)		0.335***
		[0.0932]
Female Natives' Residence Norm (t)		0.768***
		[0.0957]
Male Inhabitants' Birthplace Norm (t)		-0.0161
		[0.0729]
Female Inhabitants' Birthplace Norm (t)		0.0268
		[0.0706]
Share of Male Emigrants (t)	-1.367*	-0.108
	[0.748]	[0.104]
Share of Female Emigrants (t)	-0.516	0.290**
	[1.343]	[0.121]
Share of Male Immigrants (t)	0.573	-0.0725
	[1.156]	[0.0918]
Share of Female Immigrants (t)	3.154**	0.126
	[1.209]	[0.0839]
Male Emigrants' Residence Norm (t) * Share of Male Emigrants(t)	-0.683	
	[0.647]	
Female Emigrants' Residence Norm (t) * Share of Female Emigrants(t)	-0.646	
	[0.843]	
Male Immigrants' Birthplace Norm (t) * Share of Male Immigrants(t)	-0.323	
	[0.912]	
Female Immigrants' Birthplace Norm (t) * Share of Female Immigrants(t)	2.550***	
	[0.936]	
Life Expectancy Age 15 (t)	-0.0109	-0.00588***
	[0.0102]	[0.00185]
Infant Mortality (t)	0.652**	-0.200***
	[0.326]	[0.0647]
Urban (t)	-0.121	0.0131
	[0.317]	[0.0205]
Industries (t)	-0.0146*	0.00220**
	[0.00776]	[0.00105]
Professionals (t)	-0.0135	-0.00240
	[0.0139]	[0.00159]
Share of Girls in Primary Catholic Schools (t)	0.00680	0.000692

	[0.0196]	[0.00436]
Share of Boys in Primary Catholic Schools (t)	-0.000595	-0.00236
	[0.0153]	[0.00300]
Female Education (t)	-0.0531	0.00292
	[0.0385]	[0.00440]
Male Education (t)	0.0109	0.00796
	[0.0452]	[0.00587]
Constant	-0.709	0.431***
	[0.536]	[0.103]
Male Emigrants' Residence Norm (t)	0.226***	
	[0.0570]	
Female Emigrants' Residence Norm (t)	0.0235	
	[0.0659]	
Share of Male Emigrants (t)	-0.460	
	[0.333]	
Share of Female Emigrants (t)	0.465	
	[0.484]	
Male Immigrants' Birthplace Norm (t)	0.0225	
	[0.0625]	
Female Immigrants' Birthplace Norm (t)	0.00103	
	[0.0443]	
Share of Male Immigrants (t)	0.941**	
	[0.384]	
Share of Female Immigrants (t)	0.266	
	[0.400]	
Adjusted R2	0.735	0.993
Within R2	0.749	0.993
F-stat	50.970	3386.972
Prob > F-stat	0.000	0.000
Number of clusters	81	81
Year fixed-effects	Yes	Yes
Départements fixed effects	Yes	Yes
Observations	486	486

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

Table 15. Two-period effects of fertility norms: the differentiated impact of male and female migration (from Table 14)

	Emigrants and Immigrants' Fertility Norms	Natives and Inhabitants' Fertility Norms
	(1)	(2)
	OLS	OLS
H0: Male Emigrants' Residence Norm (t) * (Share of Male Emigrants(t) + Male Emigrants' Residence Norm (t-1) * (Share of Male Emigrants(t-1)=0	-0.356	
	[0.884]	
H0: Female Emigrants' Residence Norm (t) * (Share of Female Emigrants(t) + Female Emigrants' Residence Norm (t-1) * (Share of Female Emigrants(t-1)=0	-1.799	
	[1.315]	
H0: Male Immigrants' Birthplace Norm (t) * (Share of Male Immigrants(t) +Male Immigrants' Birthplace Norm (t-1) * (Share of Male Immigrants(t-1)=0	-0.0245	
	[1.045]	
H0: Female Immigrants' Birthplace Norm (t) * (Share of Female Immigrants(t)' +Female Immigrants' Birthplace Norm (t-1) * (Share of Female Immigrants(t-1)=0	1.980*	
	[1.006]	
H0: Male Natives' Residence Norm (t) + Male Natives' Residence Norm (t-1)=0		0.529
		[4.674]
H0: Female Natives' Residence Norm (t) + Female Natives' Residence Norm (t-1)=0		0.331
		[5.034]
H0: Male Inhabitants' Birthplace Norm (t) + Male Inhabitants' Birthplace Norm (t-1)=0		0.829
		[6.164]
H0: Female Inhabitants' Birthplace Norm (t) + Female Inhabitants' Birthplace Norm (t-1)=0		-0.806
		[6.537]
H0: Female Education (t)+Female Education (t-1)=0	0.0343	0.0776
	[0.0590]	[0.0560]
H0: Male Education (t)+Male Education (t-1)=0	-0.174**	-0.122*
	[0.0684]	[0.0615]
H0: Infant Mortality (t)+Infant Mortality (t-1)=0	-0.0721	-0.0248
	[0.578]	[0.543]
H0: Life Expectancy at Age 15 (t)+Life Expectancy at Age 15 (t-1)=0	-0.0409**	-0.0357**
	[0.0192]	[0.0162]
H0: Industries (t)+Industries (t-1)=0	-0.0146	0.00590
	[0.0153]	[0.0130]
H0: Professionals (t)+Professionals (t-1)=0	-0.0386	-0.0304
	[0.0232]	[0.0230]
H0: Urban (t)+Urban (t-1)=0	-0.0524	0.187
	[0.296]	[0.302]
H0: Share of Boys in Primary Catholic Schools (t) + Share of Boys in Primary Catholic Schools (t-1)=0	-0.0353*	-0.0114
	[0.0201]	[0.0191]
H0: Share of Girls in Primary Catholic Schools (t) + Share of Girls in Primary Catholic Schools (t-1)=0	0.0187	0.00702
	[0.0331]	[0.0343]

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

Table 16. Two-Period Marginal Effects of Fertility Norms & Shares of Migrants: Tests of linear restrictions -- the impact of male and female migration (from Table 14)

	Marginal effects in OLS regression
	(Column 1-Table 14)
H0: Male Emigrants' Residence Norm (t) +Male Emigrants' Residence Norm (t-1)=0	0.110
	[0.0778]
H0: Female Emigrants' Residence Norm (t) +Female Emigrants' Residence Norm (t-1)=0	0.221**
	[0.0933]
H0: Share of Male Emigrants (t)+ Share of Male Emigrants (t-1)=0	0.426
	[0.438]
H0: Share of Female Emigrants (t)+ Share of Female Emigrants (t-1)=0	-0.445
	[0.700]
H0: Male Immigrants' Birthplace Norm (t)+ Male Immigrants' Birthplace Norm (t-1)=0	0.0636
	[0.0797]
H0: Female Immigrants' Birthplace Norm (t)+ Female Immigrants' Birthplace Norm (t-1)=0	0.0195
	[0.0631]
H0: Share of Male Immigrants (t)+ Share of Male Immigrants (t-1)=0	1.150*
	[0.635]
H0: Share of Female Immigrants (t)+ Share of Female Immigrants (t-1)=0	0.849
	[0.661]

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