Institutions, culture and the onset of the demographic transition

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Abstract

This paper uses new estimates of the dates on which different countries experienced their demographic transition to examine the main historical determinants of these transitions. We provide evidence that both formal institutions and informal ones, the latter being proxied by genetic distance to the UK (and the US) as in Spolaore and Wacziarg (2009), have been two crucial factors in explaining the timing of the demographic transition across countries. The analysis supports a twofold role of genetic distance on fertility transitions: an indirect effect consistent with the process of technology diffusion as in Spolaore and Wacziarg (2009) and a direct effect on fertility choice. Our results are robust to endogeneity issues, measurement error, and alternative specifications.

JEL classification: J10, N10, O18

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1 Introduction

The transformation of an economy from a regime of Malthusian stagnation to one of sustained growth has often been linked in the literature to the process of the demographic transition. By turning to negative the relation between income and fertility, this transition plays a key role in fostering human-capital investment and thus income growth (e.g. Galor and Weil, 1999; 2000). As

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a consequence, one would expect that countries that first experienced the onset of demographic transition would be relatively richer than those that experienced it later on or that have not yet experienced it. Figure 1 shows a scatterplot of per-capita income in the year 2000 and the year at which each country experienced its demographic transition. These dates have been estimated by Reher (2004) and identify permanent declines in total fertility rates,[1] assigning the year 2000 as the transition date for countries that had not yet experienced the onset.[2] The relation between these two variables is strongly negative, which is consistent with the importance of experiencing a demographic transition to enter the sustained growth regime.[3]

FIGURE 1 HERE

At the same time, however, the literature on comparative economic development has emphasized the role of institutions, both formal and informal, in explaining cross-country differences in per-capita income (e.g. Hall and Jones, 1999; Acemoglu et al., 2001; Spolaore and Wacziarg, 2009). Acemoglu et al. (2001) argue that the various environments faced by European colonizers are key in explaining their colonization policies in different territories. In colonies where settlers faced high mortality rates, they tended to establish extractive institutions that hindered economic development and long-run growth. In places where conditions for settlement were more favourable, colonizers settled in large numbers, introducing institutions that protected property rights, inducing innovation and technological progress and thereby economic development. The channel identified by these authors works from early institutions (at the time of colonization) to current institutions and on current levels of current per-capita gross domestic product (GDP).

Although it is possible that early institutions might have had an effect on current per-capita GDP levels through other channels, in this paper, we investigate the importance of historical institutions and cultural factors as determinants of the timing of demographic transitions. The importance of historical institutions is closely related to the logic of Acemoglu et al. (2001). In countries where settler mortality was high, European colonizers introduced extractive institutions, and as a result, most economic activities became labour intensive (e.g. large plantations and extraction of natural resources). Arguably, these economic regimes were conducive to neither technological progress nor a high demand for human capital. Conversely, European settlers developed private-property institutions–similar in spirit to their home country institutions–where they settled in large numbers; in these colonies, entrepreneurial economic activity stimulated both technological progress and human-capital accumulation. These different incentives to innovate and acquire education were, in turn, crucial factors in explaining the onset of demographic transitions. As Galor and Weil (2000) explain, increasing technological progress boosts the demand for human capital and, because of the higher return to education, households eventually trade quantity for quality of children. When a significant fraction of families decides to have fewer and more educated children, the onset of demographic transition takes place. Therefore, institutions, by affecting incentives to innovate and accumulate human capital, might have shaped the timing of demographic transitions and,

[1] These data has been recently used and cited in several papers like for instance Galor (2011) and Andersen et al. (2010).

[2] He assigns the transition year 2000 to countries that have not yet experienced the onset. We drop these 12 observations to avoid arbitrariness.

[3] Another channel through which the demographic transition may spur a country's per-capita income is the so-called demographic gift, by which a lower population-growth rate decreases the dependency rate through its effect on the population age structure (Bloom and Williamson, 1998).

consequently, the current distribution of income across countries throughout the world.[4] However, settlers mortality might not capture different institutional frameworks but different stocks of human capital. That is, European settlers brought their human capital where they settled in large numbers, thus fostering technological progress, growth and better institutions (Glaeser et al., 2004). Hence, even if an effect of settler mortality is found, ambiguity remains over what it is really capturing and what is the direction of causality.

Our second contribution relates to a recent strand of the literature that highlights the role of culture in explaining economic development across countries (Guiso et al., 2006; Spolaore and Warcziarg, 2009). Spolaore and Warcziarg (2009) explain a significant fraction of the income differences across countries using their genetic distance (relative to the technological frontier), which, according to their view, should measure barriers to the adoption and diffusion of new technology from this frontier. Their measure of genetic distance captures the general relatedness between populations: the closer two populations are in terms of genetic distance, the smaller their differences in traits and social norms (e.g., beliefs, habits, biases, etc.). Following Spolaore and Warcziarg (2009), we use genetic distance to the United Kingdom (UK) and the United States (US) as a proxy for cultural relatedness. We show below that genetic distance to the UK (US) has been a crucial factor of the timing of the fertility transition. Its role is consistent with an indirect channel working through technology diffusion as in Spolaore and Wacziarg (2009). Delayed technology adoption would lower productivity and the demand for human capital, consequently leading to a late onset of the fertility transition. We also identify a direct effect of culture on net reproduction rates (NRR) by controlling for direct determinants of fertility choice. One possible explanation of this direct effect is that genetic distance to the UK (US) might capture biases in households' preferences for quality vs quantity of children, although we cannot rule out other possible explanations. We use the UK as the reference country in our analysis since it was the technological leader until the early twentieth century. However, given that most of the demographic transitions in our sample took place after 1950, we also consider using the US as the reference country.[5] The timing of the demographic transition differs widely across countries, as shown in Table 1 and Figure 2, which list the years at which the different countries reached their demographic transition as estimated in Reher (2004) and plot a histogram of these dates, respectively. As the data show, most of the countries that experienced the transition in the late 19th and early 20th centuries, were located in Western Europe and North America. In contrast, most countries belonging to Asia, Africa, and Latin America experienced a late transition (that is, after 1950).

In this paper we exploit this cross-country variation to shed light on the determinants of the demographic transition around the world. Several mechanisms have been proposed to explain the fertility (or demographic) transition: a rise in income during industrialization (Becker and Lewis, 1973; Becker, 1981), a reduction in child and infant mortality rates (Coale, 1973; van de Walle, 1986; Sah, 1991; Galloway et al., 1998; Eckstein et al., 1999; Kalemli-Ozcan, 2002), and a rise in the demand for human capital (Galor and Weil, 2000). While we do not deny the importance of these variables as triggers of the demographic transition, we explore the independent contribution

[4] A recent paper related to our discussion is Galor et al. (2009). They argue that inequality in the distribution of landownership adversely affected the emergence of human-capital promoting institutions (e.g., public schooling) and the transition from an agricultural to an industrial economy, thus determining the divergence in per-capita incomes across countries.

[5] In our largest sample 23 out of 124 countries experienced the onset of the transition before 1950, excluding the countries assigned a transition in the year 2000.

of historical variables like a country's institutional environment and its cultural heritage. Our main measure of formal institutions is settler mortality rates in colonized countries, from Acemoglu et al. (2001). As stated above, variations in these rates are meant to measure the different types of institutions introduced by Europeans at the time of colonization, even if they might as well account for human capital levels brought by European settlers. Figure 3 displays the raw correlation between the demographic transition dates and settler mortality. As the correlation indicates, the relation between the two variables is clearly positive, conforming to our intuition. Additionally we test whether there is a significant relation between informal institutions (or culture) and the onset of a country's demographic transition. It might well be the case that some countries experienced similar patterns of fertility decline not (only) because of similar formal institutions but because of cultural relatedness. Figure 4 shows a strong positive correlation between the demographic transition years and genetic distance to the UK. In our first exercise, we correlate demographic transition dates with historical formal and informal institutions, as well as other covariates that we describe in detail in the next section. Next, we use a bilateral approach similar to the one proposed in Spolaore and Warcziarg (2009), in which countries are considered by pair, to fully exploit the genetic distance data.

The main findings of our paper are the following. The pure cross-sectional exercise suggests that colonies with high rates of settler mortality experienced a demographic transition later on than similar territories with low mortality rates. We also find that a large genetic distance with respect to the UK (US) delays the demographic transition. Interestingly, we find evidence in favour of a direct and an indirect channel of causality. Findings from the bilateral approach are consistent with the importance of genetic distance as a determinant of the demographic transition: the larger the genetic distance between two countries relative to the UK (US), the larger the lag between their transition dates and the difference in net reproduction rates (NRR).

The paper is organized as follows. Section 2 summarizes the sparse empirical literature that has attempted to isolate different triggers of demographic transitions across countries. Section 3 describes the data and methodology used in both the cross-section and bilateral approaches. Section 4 presents the results from the cross-section analysis, and those related to the bilateral analysis are discussed in Section 5. Finally, Section 6 concludes.

FIGURE 2 HERE

FIGURE 3 HERE

FIGURE 4 HERE

2 Literature Review

Since our contribution is purely empirical, in this section we limit ourselves to discussing the empirical papers that examine the cross-country correlation between fertility and income and those that directly analyze possible triggers of demographic transitions.[6] In the tradition of the so-called

[6]The literature review in in Galor (2011) also includes theoretical papers. Schultz (2008) provides a summary of the studies on the children's quantity-quality trade-off.

"demographic transition theory" (Notestein, 1945), the Princeton European Fertility Project (e.g., see Coale and Watkins, 1986) was one of the first comprehensive studies that used data from the 19th century to document different episodes of demographic transitions in Europe and analyze their possible triggers. The emphasis in this project, however, was mainly on cultural and sociological explanations, ignoring potential economic factors. Much more recently, the development of unified growth theories that seek to explain economic growth in the very long run has spurred interest in identifying the role of different economic factors in triggering demographic transitions. The first–and most common–approach has been to study the correlation between fertility and income during different time periods. For instance, using a sample of countries in the 1960-1999 period, Lehr (2009) examines the existence of different regimes in terms of fertility dynamics. She finds that, at early stages of development, increases in productivity and primary schooling-enrolment are typically associated with increases in fertility. In contrast, at higher levels of development, productivity and education are shown to be negatively associated with fertility, whereas the level of parents' human capital has a somewhat positive effect. In all periods, increases in secondary-schooling enrolment are correlated with drops in fertility rates. Murtin (2009) uses data for a large panel of countries since 1870 and concludes that education is the main trigger of changes in the birth rate and that the effect of health improvements are of second order. Other papers focus on the experiences of specific countries. Becker et al. (2009), for example, use data on Prussian counties in 1849 and identify a positive relation between child quantity and education in a context in which the demographic transition has not yet taken place. Another finding of their study is that the initial level of education is a good predictor of the demographic transition that occurred in Prussia during the 1880-1905 period. Murphy (2009) analyzes historical French département data and finds that both economic and cultural factors had an effect on different fertility patterns across these geographical units. In particular, education, measured as female literacy and child enrolment in primary schools, has a negative impact on fertility, whereas wealth is correlated with larger family sizes. The degree of religiosity–a possible proxy for culture–is also found to be an important determinant of fertility rates.[7]

A different approach is to use information on the years of the onset of demographic transitions in different countries to directly identify their main historical determinants. Andersen et al. (2010) use this strategy to analyze the effect of cataract incidence on cross-country differences in labour productivity. They argue that an earlier onset of vision loss reduces the return to human capital, and hence delays the demographic transition. To our knowledge, we are the first to use demographic transition dates to directly explore the impact of formal and informal institutions on the timing of these transitions. As mentioned in Guinnane (2010), one difficulty in identifying which variables have been most responsible for the secular decline in fertility is that most changes in potential candidates took place around the same time. We consider the impact of institutions much before the onset of any of the demographic transitions in our sample, and therefore we are able to circumvent this problem. Note that for this argument to work, it is important that institutions are persistent enough so that colonial institutions still have an impact a few hundred years later, i.e., around the

[7] Using microeconomic data, Rosenzweig and Wolpin (1980) were the first to exploit exogenous variations in fertility to identify the effect of child quantity on child quality. They instrumented child quantity with increases in family size resulting from multiple births and show that child quantity significantly reduces children's education. Bleakley and Lange (2009) explore the causal effect of education on fertility by exploiting the eradication policy of the hookworm disease in South America. Their paper argues that this eradication increased the return to schooling and hence reduced the price of child quality. This exogenous change, in turn, increased school attendance and reduced fertility. Other relevant papers are Angrist et al. (2005), Black et al. (2005), and Qian (2009).

dates of the demographic transitions. Acemoglu and Robinson (2008) argue that it is meaningful to assume that this is indeed the case. They present a model in which changes in political institutions that alter the distribution of de jure power do not necessarily lead to significant changes in de facto institutions (e.g., bribes, the capture of political parties, or the use of paramilitaries). According to their analysis, this can explain why prominent examples of radical changes in political institutions, such as the end of colonial rule in Latin America or the abolishment of slavery in the US South, had little impact on actual policy and economic changes. Our paper aims to capture the effect of the de facto institutions on the timing of the demographic transition. Another consideration of our empirical strategy is that our measure of culture, the genetic distance between two countries relative to the UK (and the US), is measured in the 20th century and so we are implicitly assuming that cultural distance between countries did not change much from the end of the 19th century onwards. As Spolaore and Wacziarg (2009) argue, however, this assumption may be invalidated by the large migration flows between countries that began at the end of the 15th century. We address this endogeneity issue in Section 5 by instrumenting current genetic distance relative the UK (US) with genetic distance relative to the UK in the year 1500.

3 Data and Methodology

3.1 Cross-Section

Our variables of interest are different proxies of formal and informal historical institutions. We measure the former with settler mortality rates collected by Acemoglu et al. (2001). As robustness checks, we also consider a modification of the settler mortality variable to account for the criticism raised by Albouy (2011) and the variable constraints on the executive in 1900 from the Polity IV project (see Marshall and Jaggers, 2008). Our measure of cultural relatedness is genetic distance to the UK (US), taken from Spolaore and Wacziarg (2009).[8] We first investigate the effect of settler mortality on the timing of the fertility transition across countries by estimating the following model using ordinary least squares (OLS):[9]

$$log\, onset_i = \beta_1 + \beta_2 * log\, sm_i + \beta_3' X_i + \varepsilon_i \tag{1}$$

where $log\, onset_i$ represents (the log of) the year of the onset of the demographic transition in country i, $log\, sm_i$ represents (the log of) settler mortality rates faced by European colonists in country i, X_i is a set of country is control variables, and ε is a standard error term. X_i includes different sets of standard determinants of long-run development and productivity. To account for the potential effect of geography and climate, we control for the absolute latitude of a country's centroid, the average distance to the nearest ice-free coast, the percentage of land area in a tropical climate, and a set of continental dummies (Africa, Asia, Europe, North America, and South America). The historical variables are population density in 1400 and the years passed since the Neolithic revolution (i.e., the agricultural transition).[10] We also control for the type of legal origins (British common law, French

[8]Throughout our analysis we use the measure of *weighted genetic distance* that accounts for sub-populations' genetic groups. The other measure provided by Spolaore and Wacziarg (2009), named *dominant genetic distance*, considers only the largest groups of each country's population.

[9]We estimate this equation in logs to limit the effects of possible outliers. Not taking logs of the different variables does not alter the qualitative results of the exercise.

[10]Data on the agricultural transition are from Louis Putterman's Agricultural Transition Year Country Data Set.

civil law, socialist law, German civil law, and Scandinavian law) and the 1900 shares of population following different religions.[11] Table 2 in the Appendix contains the definitions and sources of all the variables used in the cross-sectional exercise. Next we perform two main robustness checks to assess the role of formal historical institutions. First, accounting for Albouy's critique, we use a modified settler mortality dataset.[12] Second, we use an alternative measure of formal institutions, namely executive constraints in 1900:

$$log\, onset_i = \alpha_1 + \alpha_2 * log\, xconst1900_i + \alpha_3' X_i + u_i \quad (2)$$

where $log\, xconst1900_i$ represents (the log of) executive constraints in 1900 in country i, and u is a standard error term. Our next step is to consider a measure of informal institutions as a possible determinant of the cross-country variation in the timing of demographic transitions. As stated above, we measure a country's culture in relative terms, i.e. its cultural relatedness to the UK (or the US). Our reasoning is that it is possible that countries characterized by informal institutions that are similar to those in the UK (or the US) should experience an earlier onset. We test for the existence of two channels, an indirect and a direct one, using a different set of regressors in each case. In the cross-section part we run some exploratory regressions while leaving the analysis of the role of genetic distance to the bilateral approach.

3.2 Bilateral Analysis

In this section, we assess the role of cultural relatedness as a determinant of the demographic transition using a bilateral approach considering countries pair by pair. We first test the validity of an indirect channel working through technology diffusion. To do so, we regress the distance in the onset of the demographic transition between each pair of countries on their genetic distance relative to the UK (US)[13] and on a set of controls very similar to those of Spolaore and Wacziarg (2009) aimed at capturing geographical, climatic, and historical differences which can be interpreted as distances. We account for the effect of geographical distances by including the absolute difference in latitudes and longitudes, the geodesic distance between countries, a dummy that takes a value of one if both countries in the pair are contiguous, a dummy that takes a value of one if at least one country is landlocked, a dummy that takes a value of one if at least one country is an island, and a measure of climatic similarity based on 12 Koeppen-Geiger climate zones.[14] We also add as covariates a set of dummies that take a value of one if two countries in a pair are located in the same continent. Finally, we include a measure of transportation costs based on freight rates for surface transport (sea or land).[15] All variables used in this section, along with their sources, are

[11] Norton and Tomal (2009) find evidence that adherence to some religions is associated with large gender gaps in education. Since female education has been found to be a relevant factor in shaping fertility decisions, we account for the effect of religion adherence by including the percentage of followers in 1900 for the following categories: Catholic, Protestant, Muslim, Hindu, Buddhist, Orthodox, other Christians, Jews, ethno-religions, and other religions.

[12] See Section 4 for more details on the differences between the two datasets.

[13] We take logs of this measure to be consistent with the analysis of the previous section and reduce the impact of outliers.

[14] This is measured as the average absolute value difference in the percentage of land area in each of the 12 climate zones between two countries.

[15] These controls are similar to the ones in Spolaore and Wacziarg (2009). Transportation-cost data is from http://www.importexportwizard.com/. The measure refers to 1000kg of unspecified freight transported over sea or land, with no special handling.

listed in Table 3 of the Appendix. Our estimation model is the following:

$$|log\, onset_i - log\, onset_j| = \alpha + \beta |log\, gendist_{i,UK} - log\, gendist_{j,UK}| + \gamma' Q_{i,j} + \epsilon_{i,j} \qquad (3)$$

where $|log\, onset_i - log\, onset_j|$ represents the absolute value of the log difference in the year of the onset of the demographic transition between country *i* and *j*, $|log\, gd_{i,UK} - log\, gd_{j,UK}|$ represents the absolute value of the genetic (log) distance relative to the UK between country *i* and *j* and $Q_{i,j}$ includes the mentioned measures of geographical, climatic and historical distances between country *i* and *j*. Finally, $\epsilon_{i,j}$ is the error term associated with the country pair *ij*.[16] This approach allows us to investigate whether differences (and similarities) in culture (relative to the UK and the US) explain the distance in the timing of the onset of demographic transitions between pairs of countries. Specifically, we ask whether similar (different) timing in the onset is explained by similar (different) culture (relative to the UK and US), controlling for the effect of similar (different) geographical, climatic, and historical contexts.

The second step in the bilateral analysis investigates the possibility of a direct role of cultural relatedness. We focus here on direct determinants of fertility differences across countries. Our measure of fertility is the net reproductive rate (NRR). [17] We believe this is the best available proxy for a family's desired number of children. To test whether genetic distances relative to the UK (US) between countries explains differences in the NRR we control for several direct determinants of fertility (see e.g. Lehr, 2009). Specifically, we control for differences in (lagged) average years of education in the population aged 15 and above to account for parental education, differences in productivity proxying for demand for human capital, and religion diversity to capture cultural characteristics that may have a direct effect on fertility choices. The main model we estimate is the following:

$$|log\, NRR_i - log\, NRR_j| = \alpha + \beta |log\, gendist_{i,UK} - log\, gendist_{j,UK}| + \gamma' Z_{i,j} + \epsilon_{i,j} \qquad (4)$$

where $|log\, NRRt_i - log\, NRR_j|$ represents the absolute value of the log difference in the NRR between country *i* and *j*, $|log\, gendist_{i,UK} - log\, gendist_{j,UK}|$ represents the absolute value of the genetic (log) distance relative to the UK between country *i* and *j* and $Z_{i,j}$ includes log differences in education, productivity, and a measure of religious diversity between country *i* and *j*. Finally, $\epsilon_{i,j}$ is the error term associated with the country pair *ij*. [18]

4 Results: Cross-Section Analysis

4.1 The Role of Formal Historical Institutions: Settler Mortality Rates

Table 4 displays the results using the original settler mortality data from Acemoglu et al (2001). The estimates suggest that extractive early institutions (proxied by high settler mortality rates)

[16] As Spolaore and Wacziarg (2009) point out, spatial correlation results from the construction of the dependent variable. We follow their strategy to address this issue by using two-way clustered standard errors.

[17] This measures the average number of daughters a hypothetical cohort of women would have at the end of their reproductive period if they were subject during their whole lives to the fertility rates and the mortality rates of a given period. It is expressed as number of daughters per woman".

[18] As in equation (3) we use two-way clustered standard errors in our estimation.

delay the onset of demographic transition, even after controlling for geography, climate, history, and legal origins. This supports our hypothesis that institutions created in the 18th and 19th centuries played an important role in explaining the cross-country variation in the timing of the onset of demographic transitions. One mechanism through which this may have happened is that alternative institutional environments affected the allocation of resources across economic activities, hence providing different incentives for technological progress and human-capital accumulation in different colonies and eventually generating a demographic transition. An alternative view considers the possibility that European settlers brought their own human capital (Glaeser et al., 2004) and therefore this European-style education may be the key to generate a demographic transition.[19] The dataset on settler mortality rates used in Acemoglu et al. (2001) has been recently criticized on the grounds that it is not a valid instrument for institutional quality. Albouy (2011) argues that in the original dataset, several countries' mortality rates were assigned based on conjectures about countries that had similar disease environments and warns about the comparability of mortality rates from different populations (laborers, bishops, and soldiers). To account for this critique, we use Albouy's modified subset of the original data to estimate equation (1). This modified dataset drops 36 countries for which settler mortality rates were conjectured and assigns a value of 280 (instead of 2,940) to Mali. The estimates shown in Table 5 suggest that, despite the strong reduction in sample size (from 60 to 24), settler mortality rates still have a positive effect on the timing of the fertility decline. However, when adding the whole set of controls (column 5) the coefficient turns not significant, even if at the margin.[20]

TABLE 4 HERE

TABLE 5 HERE

4.2 An Alternative Measure of Formal Historical Institutions

In this section, to further test the role of formal institutions we study the effect of the variable executive constraints in 1900 (from the data set Polity IV, see Marshall and Jaggers 2008) on the timing of demographic transition. Many researchers have used this variable as a proxy for the quality of institutions (see Acemoglu et al., 2001). This variable is defined as "the extent of institutionalized constraints on the decision making powers of chief executives, whether individuals or collectivities (Marshall and Jaggers, 2008).[21] The question we ask here is whether countries with better institutions in 1900 experienced the onset of the fertility transition earlier on than countries with lower-quality institutions in that initial year.[22] Consistent with our hypothesis, Table 6 shows that this proxy has a negative impact although it turns not significant in column (5), where all controls are added. Overall our findings suggest that formal institutions played a significant role in shaping the timing of the fertility decline across countries. However, the variables we have

[19] Unfortunately, our data and strategy cannot shed light on discriminating between these two theories.

[20] The associated p-value is 0.102. The debate about the Acemoglu et al.'s dataset is still open (see Acemoglu et al. 2011), and so we have decided to include the two sets of estimates in the paper.

[21] The main reason why we prefer not to use this variable as a measure of institutional quality in our main exercise is that we are interested in exploring the effect of variables that have been reasonably constant over very long periods of time, and constraints on the executive is typically subject to sudden and large changes.

[22] We exclude five countries that experienced the onset of the transition before 1900.

considered so far can be considered as proxies for formal institutions. We next explore whether informal institutions are also an important historical determinant of demographic transitions.

TABLE 6 HERE

4.3 The Role of Informal Institutions or Culture: Indirect effect

As we pointed out in the previous section, we are interested in testing two possible channels through which genetic distance relative the UK (US) might affect fertility choice and the demographic transition. On the one hand, following Spolaore and Wacziarg (2009), genetic distance might indirectly affect the timing of the fertility decline as it proxies for a cultural environment favourable to technological progress and adoption of innovations. Table 7 shows the estimation results obtained by regressing the timing of the fertility transition on genetic distance to the UK. Specification (1) simply uses the log of genetic distance to the UK as regressor. Its impact is positive and statistically significant, suggesting that a larger genetic distance from the UK (i.e. a larger distance from the ideal cultural environment) delays the onset of the demographic transition. This estimate is qualitatively similar if one adds geography and climate, history, legal origins, or religion as controls. Including all these regressors simultaneously in the same specification does not significantly alter the results (column 6), even after controlling for settler mortality rates (column 7); the same applies when considering genetic distance to the US (column 8). [23]

TABLE 7 HERE

4.4 The Role of Informal Institutions or Culture: Direct effect

With regard to the direct channel, we test for a direct effect of genetic distance by assessing its effect on differences in the net reproduction rate (NRR). Table 8 shows the results of regressing the NRR on genetic distance to the UK (US), controlling for (lagged) education, productivity and lagged productivity.[24] We use lagged educational attainments as our benchmark to reduce reverse causality, that is the effect of fertility decision on parental education. Genetic distance to the UK has a positive and significant effect on the NRR measured in the year 2000 (columns 1,2,3,4), as does genetic distance to the US (columns 5,6,7,8).[25]

TABLE 8 HERE

[23] To save space we do not include all the specifications using the US as the reference country. These regressions are available from the authors upon request.

[24] Education is the log of average years of schooling in the population aged 15 and above from Barro and Lee (2011). Productivity is the log of total factor productivity (TFP) from from Baier et al. (2006).

[25] Similar results are obtained if considering NRR in the years 1980 and 1960.

5 Results: Bilateral Approach

The results of the previous section strongly support the role of genetic distance, through both a direct and an indirect channel in explaining the cross-sectional variation in the demographic transition dates. To fully exploit the distance-based approach, however, we now consider the bilateral framework of Spolaore and Wacziarg (2009).

5.1 Indirect channel

We examine a specification where the absolute log difference in the timing of the onset of demographic transitions between pairs of countries is regressed on measures of similarity (and distance) between the countries described in Section 3.2. Table 9 shows the OLS estimates obtained from the regression in equation (3). In this subsection we focus on the role of cultural relatedness (i.e., informal institutions) in shaping the timing of the onset of the fertility transition. The analysis is consistent with the indirect channel identified by Spolaore and Wacziarg (2009), even if technology diffusion may not be the only explanation of the effect captured by genetic distance. In column (1), where we do not add any control variable, larger differences in genetic distance (relative to the UK) are associated with larger time distances in the onset of demographic transitions. In columns (2) to (5), we add different controls. In particular, column (2) adds measures of geographical differences, column (3) includes a measure of climatic similarity (see Section 3.2), column (4) includes a set of continental dummies, whereas column (5) adds the measure of transportation costs described above. Throughout all specifications, including column (6) where we add all the controls, larger genetic distances (relative to the UK) are associated with wider differences in the timing of the fertility transition. These results again provide strong evidence of the importance of cultural differences–or differences in informal institutions–in determining international differences in the onset of demographic transition.

Until now, our analysis has focused on controlling for geographically related measures of distance. Historical and other cultural differences, however, also might be important factors in explaining the timing in the onset of demographic transitions between countries. In Table 10, we add a control for similar legal origins, colonial history, language and religion.[26] The inclusion of these variables affects neither the significance nor the size of the coefficient associated with the difference in genetic distance relative to the UK, even after controlling for all of them (column (3)). However, as Spolaore and Wacziarg (2009) note, this exercise may be biased due to an endogeneity problem concerning the measure of current genetic distance. Migration flows starting in 1500 could have affected genetic distance in such a way that *'genetic distance today could be positively related to income distance not because genetic distance precluded the diffusion of development, but because similar populations settled in regions prone to generating similar incomes'* (Spolaore and Wacziarg, 2009). In our context, the issue is that two countries could share a similar timing in the onset of demographic transition, not because they are culturally similar (relative to the British), but because

[26] These controls are a dummy taking a value of one if both countries in a pair share the same legal origins, and zero otherwise; a dummy taking a value of one if both countries in a pair share the same colonial origins, and zero otherwise; and a dummy taking a value of one if both countries share a common official language. As for climate, our measure of religious similarity is the average absolute value difference, between two countries, in the percentages of religions followers in 1900 in each of 10 religious categories.

similar populations settled in countries that share similar geographical and climatic characteristics that favoured the fertility transition's onset. To account for this possibility, we instrument current genetic distance (relative to the UK) with genetic distance (relative to the British population) in 1500. Table 10 (column 4) displays the results from the second stage of the two-stage least squares regression: the role of cultural relatedness in explaining the timing of the fertility transition is confirmed. Also, when excluding from the sample all pairs of countries in which at least one country belongs to North and South America (column 5) and for which endogeneity is likely to be more severe, results are not affected. The same applies when instrumenting genetic distance relative to the US (column 6).

TABLE 9 HERE

TABLE 10 HERE

5.2 Direct channel

Table 11 displays the results obtained from estimating by OLS equation (4) where the dependent variable (i.e., the log difference in the NRR between each pair of countries) is measured in the year 2000. Throughout the different specifications, we control for log differences in (lagged) average years of education and in primary education, lagged and contemporaneous log differences in total factor productivity (TFP), and a measure of religious diversity.[27] Larger genetic distances (relative to the UK) are associated with wider differences in the NRR. This is also the case when we use genetic distance relative to the US (Table 12). However, as explained above, the OLS estimates do not identify causal effects. To address this endogeneity problem, we run IV regressions to cope with potential endogeneity of genetic distances, differences in education and productivity. Besides genetic distance to the British in 1500, we use the number of newspapers and cars per working age adult to construct instruments for differences in education and productivity between countries.[28] The results from the IV estimation (tables 13 and 14) confirm the role of genetic distance both measured relative to the UK and the US.[29] The direct impact of genetic distance relative to the UK (US) on differences in the NRR might be possibly capturing different preferences over quantity and quality of children, although one cannot rule out alternative explanations. As a robustness check we investigate whether cultural relatedness to the UK (US) is related to differences in wanted

[27]We consider average years of primary schooling in the adult population as evidence suggests its relevance in the process of fertility decline (e.g., Murtin, 2009). We control for lagged productivity differences (TFP) as one of the factors determining the switch from quantity to quality of children is technological progress and the consequent increase in the demand for human capital. However, the effect of the adoption of new technology is likely to take place with some lag. Households have first to realize the actual need of more skilled workers and the associated increase in the return of education. The data on TFP is from Baier et al. (2006).

[28]The number of newspapers and cars are correlated with educational attainments and productivity levels, and they do not have any direct effect on fertility decisions. These data is taken from the CHAT dataset (http://www.nber.org/data/chat).

[29]In both tables we consider productivity measures as endogenous (column 3). However, testing for endogeneity in differences in education and productivity, we cannot reject that productivity differences are exogenous. The test is evaluated using the difference of two Sargan-Hansen statistics: one for the equation where the suspect regressor is treated as endogenous, and one for the equation where the suspect regressor is treated as exogenous. Hence we also estimate the same regressions but treating productivity differences as exogenous (column 4).

fertility rates (WFR): this is "an estimate of what the total fertility rate would be if all unwanted births were avoided" (WDI) and may better reflect a preference motive. As these data are scarce and available only for some developing countries we construct averages over different periods of time using available yearly data. We consider three time periods (1990-2009; 1990-1999; 2000-2009) and we regress log differences in the WFR over genetic distance relative to the UK (US) and other control variables. Results using genetic distance relative to the UK are reported in Table 15. We control for log differences in education and productivity measured at the beginning of the period considered. Both OLS and IV estimations support the effect of cultural similarity to the UK as a determinant of desired quantity of children: the closer culturally to the UK, the lower the wanted fertility rates. Similar results are obtained when using genetic distance relative to the US (Table 16).

TABLE 11 HERE

TABLE 12 HERE

TABLE 13 HERE

TABLE 14 HERE

TABLE 15 HERE

TABLE 16 HERE

6 Conclusion

This paper contributes to our understanding of the main determinants of demographic transitions across a large sample of rich and developing countries. We provide evidence that both formal institutions and culture -here measured by genetic distance to the UK (US) have been crucial factors of the timing of the fertility transition across these economies. We provide evidence that genetic distance affect the timing of the onset of the fertility transitions through an indirect channel possibly working through technology diffusion as in Spolaore and Wacziarg (2009). Our findings suggest that genetic distance might affect the timing of the transition also through a direct effect, possibly capturing different preferences over quantity and quality of children. There is evidence that also formal institutions, proxied by settler mortality rates by Acemoglu et al. (2001), played some role in shaping cross-country differences in the onset of the demographic transition. Our finding that informal institutions matter as triggers of demographic transitions may be seen as a bridge between the literature that emphasizes the importance of economic determinants of these transitions (e.g., Galor 2011) and the one that points to purely cultural factors (e.g., Coale and Watkins 1986).

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Appendix

Table 1: Reher's (2004) estimates of the onset of the demographic transition

Albania 1965	Denmark 1910	Korea, Rep. 1960	Portugal 1925
Algeria 1975	Djibouti 1985	Korea, Dem. Rep. 1970	Qatar 1955
Angola 1995	Dominican Rep. 1965	Kuwait 1975	Romania 1935
Antigua 1960	Ecuador 1970	Kyrgyzstan 1965	Rwanda 1995
Argentina 1910	Egypt 1965	Laos 1995	Saudi Arabia 1980
Armenia 1965	El Salvador 1965	Lebanon 1965	Senegal 1980
Austria 1915	Eritrea 1990	Lesotho 1985	Seychelles 1955
Azerbaijan 1965	Ethiopia 1990	Liberia 1995	Singapore 1955
Bahamas 1965	Finland 1915	Libya 1980	South Africa 1975
Bahrain 1970	France 1900	Madagascar 1990	Spain 1910
Bangladesh 1980	Gambia 1985	Malawi 1980	Sri Lanka 1960
Barbados 1955	Georgia 1965	Malaysia 1965	Sudan 1980
Belgium 1905	Germany 1900	Mali 1995	Suriname 1965
Belize 1965	Ghana 1985	Mauritania 1980	Swaziland 1975
Benin 1985	Guatemala 1985	Mauritius 1960	Sweden 1865
Bhutan 1995	Guinea 1995	Mexico 1970	Switzerland 1910
Bolivia 1975	Guyana 1965	Mongolia 1975	Syria 1985
Botswana 1975	Haiti 1985	Morocco 1965	Taiwan 1955
Brazil 1965	Honduras 1985	Myanmar (Burma) 1975	Tanzania 1975
Brunei 1960	Hungary 1890	Namibia 1990	Thailand 1965
Bulgaria 1925	India 1960	Nepal 1995	Togo 1985
Burundi 1995	Indonesia 1970	Netherlands 1910	Trinidad and Tobago 1965
Cameroon 1980	Iran 1985	Nicaragua 1985	Tunisia 1965
Canada 1905	Iraq 1975	Niger 1985	Turkmenistan 1965
Central Afr. R. 1990	Israel 1955	Nigeria 1995	United States 1925
Chile 1960	Italy 1925	Norway 1905	Uruguay 1890
China 1970	Ivory Coast 1985	Oman 1995	Uzbekistan 1965
Colombia 1965	Jamaica 1925	Panama 1970	Venezuela 1965
Comoros 1990	Japan 1950	Paraguay 1985	Vietnam 1980
Costa Rica 1965	Jordan 1975	Peru 1975	Zambia 1980
Cuba 1920	Kenya 1980	Philippines 1955	Zimbabwe 1970

Excluding countries that were assigned the onset in the year 2000 and those not used in the analysis.

Table 2: Variables and data sources: cross-section analysis

Variable name and description	Source
Onset of the demographic transition	Reher (2004)
Executive constraints in 1900	Polity4, version 3 (2008)
Settler mortality rates	Acemoglu et al. (2001) and Albouy (2011)
Genetic distance to UK and US, weighted	Spolaore and Wacziarg (2009)
Absolute value of latitude of country centroid	Nunn and Puga (2011); and Gallup et al.(2001)
Average distance to nearest ice-free coast (1000 km)	Nunn and Puga (2011)
Continental dummies	Nunn and Puga (2011)
% of land area in a tropical climate	Nunn and Puga (2011)
Population density in 1400	Nunn and Puga (2011)
Years passed since the Neolithic revolution	Putterman (2006)
Legal origins	Nunn and Puga (2011)
Shares of religion followers in 1900	Robert Barro's website
Net reproduction rate (NRR)	UN WPP, The 2010 Revision
Average years of education, population older than 15	Barro and Lee (2010)
Total factor productivity (TFP)	Baier et al. (2006)

Table 3: Variables and data sources: bilateral analysis

Variable name and description	Source
Onset of the demographic transition	Reher (2004)
Genetic distance to UK and US, weighted	Spolaore and Wacziarg (2009)
Absolute value of latitude of country centroid	Nunn and Puga (2011); and Gallup et al.(2001)
Continental dummies	Nunn and Puga (2011)
Dummy for landlocked	Nunn and Puga (2011)
Dummy for island	CIA Factbook
Dummy for countries' contiguity	http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Legal origins	Nunn and Puga (2011)
Colonial history	Nunn and Puga (2011)
Area in each Kopper climatic zone	Gallup et al.(2001)
Absolute value of longitude of country centroid	Nunn and Puga (2011); and Gallup et al.(2001)
Geodesic distance between countries	http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Common official languages between pair of countries	http://www.cepii.fr/anglaisgraph/bdd/distances.htm
Shares of religion followers in 1900	Robert Barro's website
Transportation costs	http://www.importexportwizard.com/
Net reproduction rate (NRR)	UN WPP, The 2010 Revision
Wanted fertility rate (WFR)	WDI, GenderStats
Average years of education, population older than 15	Barro and Lee (2010)
Average years of primary education, population older than 15	Barro and Lee (2010)
Total factor productivity (TFP)	Baier et al. (2006)
Number of newspaper copies circulated daily	http://www.nber.org/data/chat
Number of passenger cars in use	http://www.nber.org/data/chat
Number of cellphones in use	http://www.nber.org/data/chat
Working-age population (15-64 years old)	UN WPP, The 2010 Revision

Table 4: Cross-section OLS. Onset of DT and settler mortality rates

	(1)	(2)	(3)	(4)	(5)
(Log of) Settler mortality rates	0.005***	0.002**	0.0051***	0.0048***	0.002**
	[0.0010]	[0.0010]	[0.0011]	[0.0009]	[0.0009]
Geography and climate	no	yes	no	no	yes
History	no	no	yes	no	yes
Legal origins	no	no	no	yes	yes
R-squared	0.27	0.54	0.35	0.30	0.64
Observations	60	60	56	60	56

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Estimation with robust standard errors (reported in squared brackets). All regressions include a constant. Dependent variable: (log) onset of the demographic transition as in Reher (2004).

Table 5: Cross-section OLS. Onset of DT and modified settler mortality rates

	(1)	(2)	(3)	(4)	(5)
(Log of) Settler mortality rates (not conjectured)	0.0048***	0.0032***	0.0052***	0.0047***	0.0021
	[0.0016]	[0.0011]	[0.0018]	[0.0015]	[0.0012]
Geography and climate	no	yes	no	no	yes
History	no	no	yes	no	yes
Legal origins	no	no	no	yes	yes
R-squared	0.32	0.81	0.39	0.40	0.87
Observations	24	24	24	24	24

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Estimation with robust standard errors (reported in squared brackets). All regressions include a constant. Dependent variable: (log) onset of the demographic transition as in Reher (2004).

Table 6: Cross-section OLS. Onset of DT and executive constraints in 1900

	(1)	(2)	(3)	(4)	(5)
(Log of) executive constraints in 1900	-0.011***	-0.0038***	-0.011***	-0.0111***	-0.0031
	[0.0025]	[0.0014]	[0.0028]	[0.0026]	[0.0021]
Geography and climate	no	yes	no	no	yes
History	no	no	yes	no	yes
Legal origins	no	no	no	yes	yes
R-squared	0.28	0.86	0.41	0.44	0.86
Observations	41	40	41	41	40

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Estimation with robust standard errors (reported in squared brackets). All regressions include a constant. Dependent variable: (log) onset of the demographic transition as in Reher (2004).

Table 7: Cross-section: OLS. Indirect effect: genetic distance and onset of DT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Log of) Genetic distance to the UK	0.0093*** [0.0008]	0.0026** [0.0012]	0.0106*** [0.0012]	0.0085*** [0.0009]	0.0073*** [0.0011]	0.0045*** [0.0017]	0.0076*** [0.0021]	
(Log of) Settler mortality rates							0.0021** [0.001]	
(Log of) Genetic distance to the US								00.0073* [0.0037]
Geography and climate	no	yes	no	no	no	yes	yes	yes
History	no	no	yes	no	no	yes	yes	yes
Legal origins	no	no	no	yes	no	yes	yes	yes
Religion	no	no	no	no	yes	yes	yes	yes
R-squared	0.49	0.72	0.53	0.61	0.74	0.83	0.85	0.82
Observations	124	123	114	124	123	112	56	112

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Estimation with robust standard errors (reported in squared brackets). All regressions include a constant. Dependent variable: (log) onset of the demographic transition as in Reher (2004).

Table 8: Cross-section: OLS. Direct effect: genetic distance and NRR

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Log of) Genetic distance to the UK	0.2228*** [0.0195]	0.0968*** [0.0235]	0.075** [0.0324]	0.0891*** [0.0332]				
(Log of) Genetic distance to the US					0.4587*** [0.0394]	0.1994*** [0.049]	0.1449** [0.0653]	0.173** [0.0674]
Education_{t-10}	no	yes	yes	yes	no	yes	yes	yes
Productivity_{t}	no	no	yes	no	no	no	yes	no
$\text{Productivity}_{t-10}$	no	no	no	yes	no	no	no	yes
R-squared	0.34	0.55	0.56	0.56	0.35	0.55	0.56	0.57
Observations	166	138	120	111	166	138	120	111

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Estimation with robust standard errors (reported in squared brackets). All regressions include a constant. Dependent variable: (log) NRR in 2000.

Table 9: Bilateral analysis: OLS. Indirect effect

	(1)	(2)	(3)	(4)	(5)	(6)
Genetic log distance relative to the UK	0.0081*** [0.0008]	0.0071*** [0.0008]	0.0079*** [0.0008]	0.0075*** [0.0008]	0.0081*** [0.0008]	0.0061*** [0.0008]
Geography	no	yes	no	no	no	yes
Climate	no	no	yes	no	no	yes
Continental dummies	no	no	no	yes	no	yes
Transportation costs	no	no	no	no	yes	yes
Observations	7503	6555	6555	7503	7503	6555

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Standard errors are clustered (two-way) and reported in squared brackets. All regressions include a constant. Dependent variable: absolute log difference in the onset of the demographic transition.

Table 10: Bilateral analysis. Indirect effect: Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)
				2SLS	No new world	2SLS
Genetic log distance relative to the UK	0.006*** [0.0008]	0.0058*** [0.0008]	0.0058*** [0.0008]	0.0063*** [0.001]	0.0052*** [0.0011]	
Genetic log distance relative to the US						0.0197*** [0.0034]
Geography	yes	yes	yes	yes	yes	yes
Climate	yes	yes	yes	yes	yes	yes
Continental dummies	yes	yes	yes	yes	yes	yes
Transportation costs	yes	yes	yes	yes	yes	yes
Legal origins, colonial history and language	yes	no	yes	yes	yes	yes
Religion	no	yes	yes	yes	yes	yes
Observations	6555	6216	6216	6216	3570	6105

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Standard errors are clustered (two-way) and reported in squared brackets. All regressions include a constant. Dependent variable: absolute log difference in the onset of the demographic transition. In column (4), the instrument for the genetic log distance relative to the UK (US) is the genetic log distance relative to the English in 1500. Precisely, the instrument is $|log\,(1+gd1500_{i,UK})-log\,(1+gd1500_{j,UK})|$, since for some countries $gd1500_{i,UK}$ takes value zero.

Table 11: Bilateral analysis: OLS. Direct effect: relatedness to the UK and NRR differences in 2000

	(1)	(2)	(3)	(4)	(5)	(6)
Genetic log distance relative to the UK	0.1024*** [0.0164]	0.0693*** [0.0153]	0.0789*** [0.0157]	0.0918*** [0.0191]	0.0626*** [0.0169]	0.0722*** 0.0183
Education$_{t-10}$	no	yes	no	no	yes	yes
Primary education$_{t-10}$	no	no	yes	no	no	no
Productivity$_t$	no	no	no	yes	yes	no
Productivity$_{t-10}$	no	no	no	no	no	yes
Religion$_t$	yes	yes	yes	yes	yes	yes
Observations	13366	9180	9180	8778	6903	5886

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Standard errors are clustered (two-way) and reported in squared brackets. All regressions include a constant. Dependent variable: absolute log difference in the NRR in 2000.

Table 12: Bilateral analysis: OLS. Direct effect: relatedness to the US and NRR differences in 2000

	(1)	(2)	(3)	(4)	(5)	(6)
Genetic log distance relative to the US	0.2339*** [0.0342]	0.1517*** [0.031]	0.1809*** [0.0322]	0.2022*** [0.0397]	0.1306*** [0.0328]	0.1526*** [0.0357]
Education$_{t-10}$	no	yes	no	no	yes	yes
Primary education$_{t-10}$	no	no	yes	no	no	no
Productivity$_t$	no	no	no	yes	yes	no
Productivity$_{t-10}$	no	no	no	no	no	yes
Religion$_t$	yes	yes	yes	yes	yes	yes
Observations	13366	9180	9180	8778	6903	5886

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Standard errors are clustered (two-way) and reported in squared brackets. All regressions include a constant. Dependent variable: absolute log difference in the NRR in 2000.

Table 13: Bilateral analysis:2SLS. Direct effect: relatedness to the UK and NRR differences in 2000

	(1)	(2)	(3)	(4)	(5)
Genetic log distance relative to the UK	0.0714*** [0.0225]	0.085*** [0.0231]	0.0697** [0.0273]	0.0707*** [0.0265]	0.0776*** [0.0279]
Education_{t-10}	yes	no	yes	yes	yes
$\text{Primary education}_{t-10}$	no	yes	no	no	no
Productivity_{t}	no	no	yes	yes	no
$\text{Productivity}_{t-10}$	no	no	no	no	yes
Religion_{t}	yes	yes	yes	yes	yes
Observations	4371	4371	3828	3828	3240
Hansen J Test (p-value)	0.51	0.21		0.94	0.69

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Standard errors are clustered (two-way) and reported in squared brackets. All regressions include a constant. Dependent variable: absolute log difference in the NRR in 2000. Variables treated as endogenous are genetic log distance relative to the U.K. (columns 1 to 5), educational differences (columns 1 to 5), productivity differences (columns 3). The instruments in all columns are the genetic log distance relative to the English in 1500 (precisely $|log\,(1 + gd1500_{i,UK}) - log\,(1 + gd1500_{j,UK})|$), the absolute value of the log difference in newspapers per working age adult, and the absolute value of the log difference in cars (vehicles) per working age adult.

Table 14: Bilateral analysis: 2SLS. Direct effect: relatedness to the US and NRR differences in 2000

	(1)	(2)	(3)	(4)	(5)
Genetic log distance relative to the US	0.2302*** [0.072]	0.2736*** [0.0706]	0.2152** [0.0941]	0.2288*** [0.0889]	0.2428*** [0.0893]
Education_{t-10}	yes	no	yes	yes	yes
$\text{Primary education}_{t-10}$	no	yes	no	no	no
Productivity_{t}	no	no	yes	yes	no
$\text{Productivity}_{t-10}$	no	no	no	no	yes
Religion_{t}	yes	yes	yes	yes	yes
Observations	4278	4278	3741	3741	3160
Hansen J Test (p-value)	0.45	0.23		0.76	0.55

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Standard errors are clustered (two-way) and reported in squared brackets. All regressions include a constant. Dependent variable: absolute log difference in the NRR in 2000. Variables treated as endogenous are genetic log distance relative to the U.S. (columns 1 to 5), educational differences (columns 1 to 5), productivity differences (columns 3). The instruments in all columns are the genetic log distance relative to the English in 1500 (precisely $|log\,(1 + gd1500_{i,UK}) - log\,(1 + gd1500_{j,UK})|$), the absolute value of the log difference in newspapers per working age adult, and the absolute value of the log difference in cars (vehicles) per working age adult.

Table 15: Robustness checks. Relatedness to the UK and differences in WFR

	(1)	(2)	(3)	(4)	(5)	(6)
$\text{Period}_{t,t+j}$	1990-2009	1990-1999	2000-2009	1990-2009	1990-1999	2000-2009
	OLS	OLS	OLS	2SLS	2SLS	2SLS
Genetic log distance relative to the UK	0.2297***	0.1519***	0.2246***	0.1265*	0.1012	0.188***
	[0.0421]	[0.0493]	[0.0454]	[0.0649]	[0.0702]	[0.0507]
Education_t	yes	yes	yes	yes	yes	yes
Productivity_t	yes	yes	yes	yes	yes	yes
Religion	yes	yes	yes	yes	yes	yes
Observations	1081	703	780	903	666	780

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Standard errors are clustered (two-way) and reported in squared brackets. All regressions include a constant. Dependent variable: absolute log difference in the WFR in several periods. Variables treated as endogenous are genetic log distance relative to the UK (columns 1 to 6) and educational differences (columns 1 to 6). The instruments in columns (4,5) are the genetic log distance relative to the English in 1500 (precisely $|log\,(1+gd1500_{i,UK})-log\,(1+gd1500_{j,UK})|$) and the absolute value of the log difference in newspapers per working age adult, while in column (6) the absolute value of the log difference in cellphones per working age adult takes the place of the measure using newspapers. We drop the latter because of data unavailability for the year 2000.

Table 16: Robustness checks. Relatedness to the US and differences in WFR

	(1)	(2)	(3)	(4)	(5)	(6))
$\text{Period}_{t,t+j}$	1990-2009	1990-1999	2000-2009	1990-2009	1990-1999	2000-2009
	OLS	OLS	OLS	2SLS	2SLS	2SLS
Genetic log distance relative to the US	0.3589***	0.2391***	0.3611***	0.2134*	0.1708	0.3758***
	[0.0808]	[0.0835]	[0.0892]	[0.1114]	[0.1195]	[0.1267]
Education_t	yes	yes	yes	yes	yes	yes
Productivity_t	yes	yes	yes	yes	yes	yes
Religion	yes	yes	yes	yes	yes	yes
Observations	1081	703	780	903	666	780

***, **,* denotes statistical significance at 1% , 5% and 10% levels, respectively. Standard errors are clustered (two-way) and reported in squared brackets. All regressions include a constant. Dependent variable: absolute log difference in the WFR in several periods. Variables treated as endogenous are genetic log distance relative to the US (columns 1 to 5) and educational differences (columns 1 to 5). The instruments in columns (4,5) are the genetic log distance relative to the English in 1500 (precisely $|log\,(1+gd1500_{i,UK})-log\,(1+gd1500_{j,UK})|$) and the absolute value of the log difference in newspapers per working age adult, while in column (6) the absolute value of the log difference in cellphones per working age adult takes the place of the measure using newspapers. We drop the latter because of data unavailability for the year 2000.

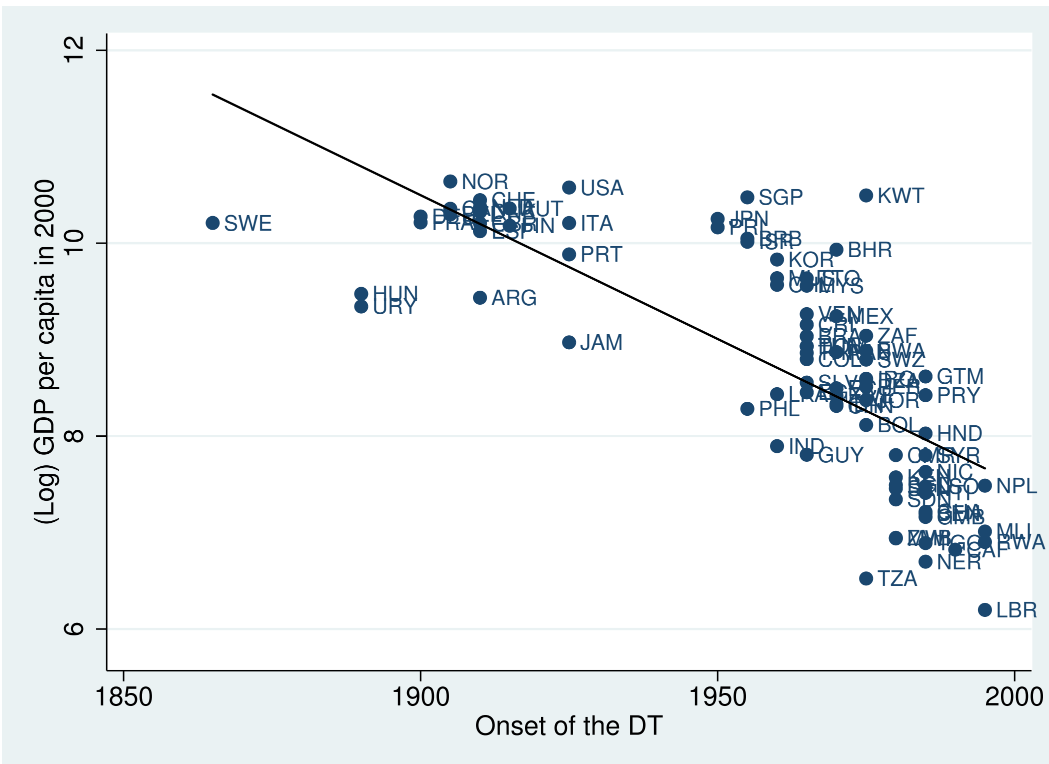

Figure 1: Onset of the demographic transition and GDP per capita in 2000

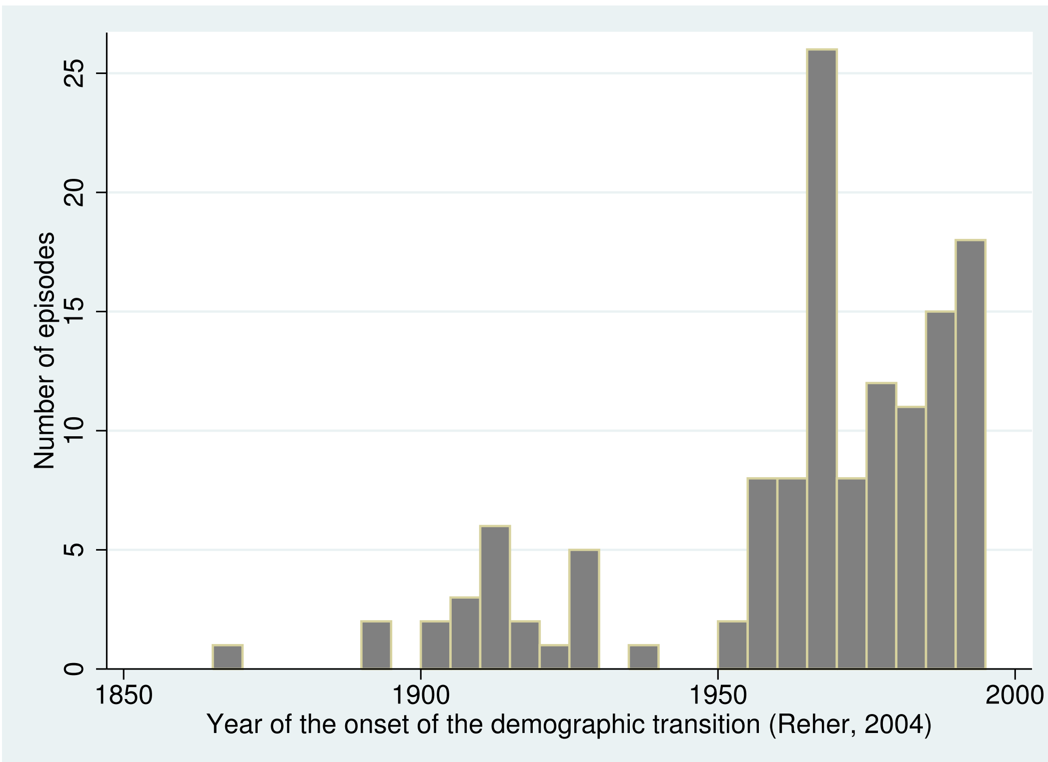

Figure 2: Year of the onset of the demographic transition (Reher, 2004)

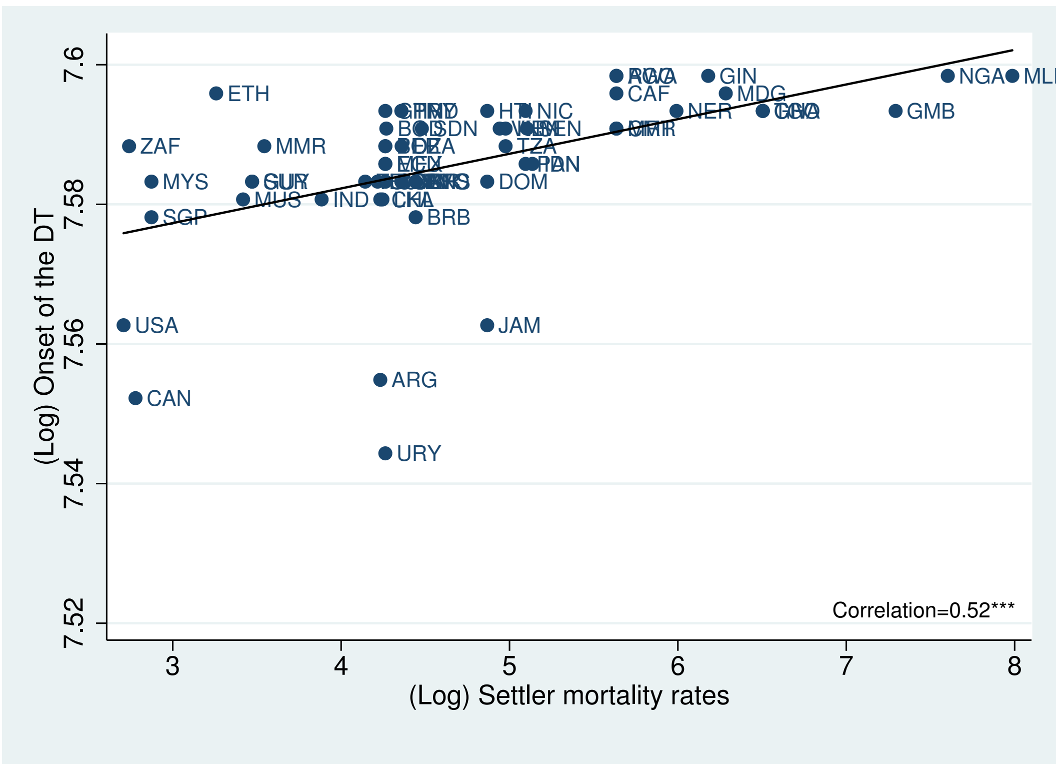

Figure 3: Settler mortality and the onset of the demographic transition

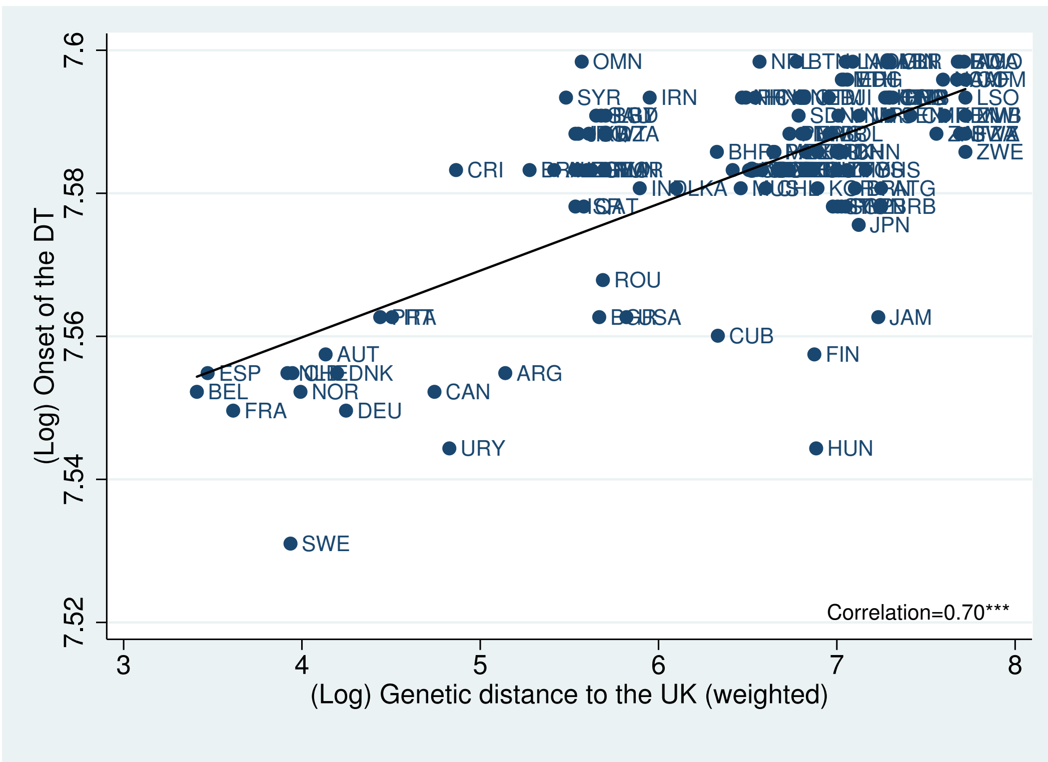

Figure 4: Genetic distance to the UK and the onset of the demographic transition