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Maps, narratives, and demographic innovation

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1. Introduction

Maps are not solely indispensable instruments for navigation on a plane or in space. Maps, and particularly historical ones, may also offer startling testimonies on how we have altered our environment, both urban and rural. Spatial representations of social science data furthermore offer clues about relationships between forms of collective behaviour. Deductively, they can be used in hypothesis testing, or, inductively, for proposing broader theories. In other words, maps produce good narratives, and these in their turn are valuable for theory formation as well (cf. van de Kaa, 1996).

In the sections that follow we shall give two examples of such map-based narratives and their statistical elaboration. The first example deals with the history of the fertility transition in France, and subsequently with Coale's much broader formulation of preconditions for behavioural innovation (cf. A.J. Coale, 1973; Lesthaeghe and Vanderhoeft, 1999). The second example illustrates with Belgian data how successive waves of demographic innovation, from adoption of contraception in the 1880s till the spread of premarital cohabitation in the 1980s, can follow stable diffusion patterns over a period of a century. The latter finding can of course be matched by counterexamples in which new behaviour forms are spreading along different lines, but both types of spatial

patterning beg the question of stable versus changing underlying causes and mechanisms. But before turning to the details of illustrations, a word needs to be said about the feature of *ecological fallacy*.

Maps representing social science data have a crucial drawback: they only tend to represent averages, not distributions, for spatial aggregates. Of course, outcomes of multivariate analyses, even if they use individual level data, showing means or relative odds for subclasses of covariates do exactly the same. In both instances, we are not producing Quételet's single "*homme moyen*", of which all real men would be imperfect copies, but a set of little average men, each representing a robot picture of the real ones that are brought together in the various categories of our covariates (cf. Desrosières, 1993; Lesthaeghe, 2001). Hence, the covariate of *spatial proximity* is just as relevant as the others, such as age, gender, educational level or social stratum. Nevertheless, statistical analyses performed on data for spatial aggregates have frequently been accused of falling into the trap of ecological fallacy. But there are two issues here, not just one. First, since individual variance within an area is dramatically reduced by just retaining the area's average, correlations between such averages are of course higher than correlations computed for individuals as data points. This is indeed a statistical artefact. But the *real* ecological fallacy only arises if relationships observed at the level of aggregates are being projected on individuals. An indicator reflecting an attribute of an aggregate (e.g. the proportions employed in agriculture) cannot automatically lead to the pronouncement that individuals with this attribute (e.g. farmers) would exhibit the same statistical association (e.g. with fertility). In fact, coal-mining regions in Belgium in 1900 had lower fertility, but coal-miners themselves did not. In short, associations between characteristics of specific aggregates only have interpretations at this specific level of aggregation, and at no other, higher or lower. This holds *a fortiori* also for individual level data: if coal-miners have higher fertility, then the same must not of necessity be true for coal-mining regions. Coal-mining could trigger off other forms of industrialisation, which could raise aggregate incomes etc., and the whole "industrialisation" package - of which the proportions in mining would be an excellent *indicator* - could produce lower, not higher, fertility. Attributes of regions and of individuals can have very different *meanings*.

Armed with this major caveat, we can now turn to our two examples and their relevance for theory.

2. A narrative of the historical French fertility decline

The control of fertility in France has attracted the attention of demographers and historians alike because it occurs very early, i.e. already in part during the second half of the 18th Century, and precedes the great transformations of the 19th Century associated with urbanisation and industrialisation. The history of the French fertility decline has therefore been a major challenge to classic demographic transition theory because it was not driven by rising real incomes, investments in education, or declines in child mortality.

2.1. The geography

Detailed descriptions of the geography of the fertility decline in France have already been presented by other authors (e.g. van de Walle, 1974; Wrigley, 1985; Bonneuil, 1997), but it is clear that by 1831 highly contrasting levels of marital fertility had come into existence. For instance, at that date, Coale's index of marital fertility I_g indicates that the level had already dropped below 40 percent of the Hutterite standard of uncontrolled fertility in several Normand departments and in the Garonne valley, whereas it had remained in the vicinity of 80 percent of Hutterite fertility in Brittany, the southern part of the Massif Central and the Hautes-Alpes. The map of the index of marital fertility I_g as of 1831 and reconstructed by van de Walle is also shown in Figure 1 (map C) and clearly shows that there were essentially five zones of high fertility and late control:

(i) The smallest area is the departement du Nord, which corresponds to parts of Flanders and Hainaut (former parts of the Austrian Low Countries);

(ii) To the east there is a larger zone made up of Lorraine, Vosges, Alsace and the Franche-Comté;

(iii) In the middle, there is an extended zone of high fertility linking departements north and south of the Massif Central (from Nièvre to Aveyron), and continuing across the Rhone valley into the departments of Ain, Isère and Hautes-Alpes. This also includes the Savoie area, which was then not yet a part of France.

(iv) The southern zone of high fertility is located along the Pyrenees and in the Landes, and also includes Corsica.

(v) The western area, finally, covers the departments of Brittany and stretches as far south as the Vendée.

In an independent reconstruction of the index of overall fertility (i.e. without the partitioning in the shares of marital fertility, illegitimate fertility and marriage

postponement), Bonneuil (1997: 102 ff.) equally shows that there are essentially three zones of innovation of fertility control. These are:

(i) The Normandy area, stretching further south to the Pays-de-Loire;

(ii) The departements of the Champagne area and northern Burgundy;

(iii) The south-western area located in the Garonne valley and also comprising adjacent Charentes. It should be noted, however, that his south-western corner had relatively low fertility to start with (i.e. before 1790), possibly as a result of a more marked pattern of birth spacing and more prolonged lactation (cf. Lesthaeghe, 1992: 11-15).

To sum up, van de Walle's map of the marital fertility index I_g as of 1831 still gives a good picture of the geographic demarcations of areas with an earlier versus a later pattern of fertility control.

In addition to innovation with respect to fertility control, France is also the country with a pronounced correlation between the levels of marital fertility and the degree of marriage postponement (van de Walle, 1974). More precisely, areas with lower marital fertility tend to have the earliest ages at first marriage, and areas with higher marital fertility are also the ones with the latest and least universal marriage pattern. This can easily be seen on Figure 1 (map D) by comparing Coale's index of early marriage (I_m) to his index of marital fertility (I_g). In the North, the Malthusian pattern of late and non-universal marriage (i.e. higher definitive celibacy at age 50 for women) still prevails in 1831 in the departements of Nord and Pas-de-Calais. The eastern zones of high fertility from Lorraine to Franche-Comté are almost perfectly replicated on the map of late marriage. The southern half of the central area of high fertility and the Alpine area across the Rhone are also represented on the late marriage map, and the same holds for the western Pyrenees and Landes, and for the Brittany-Vendée western area. In short, with relatively few exceptions (parts of Normandy, northern half of the Massif Central), areas that had reduced marital fertility levels were equally the ones that had earlier marriage patterns and therefore deviated the most from the typical Malthusian system with postponed and non-universal marriage.

2.2. Explanatory hypotheses

In this section we shall treat four major hypotheses in accounting for the spatial patterns of marital fertility control and nuptiality. The first one deals with the production structure and with the economic motivations for reduced fertility centring on child utility. The second one links fertility to household structure, parental control and patterns of inheritance. The third one is the secularisation hypothesis and focuses on the moral legitimisation of a new form of behaviour. The last argument is of a political nature, and deals with the process of nation building and with patterns of regional and linguistic particularisms.

In earlier work dealing with the western European fertility transitions (Lesthaeghe, 1983; Lesthaeghe and Wilson, 1986) we have argued that familial forms of production such as smallholder or tenant-agriculture, whether or not in combination with cottage industries, are characterised by a high economic utility of children and by strong parental control over such family labour. Conversely, both the utility of children for household-based production and parental authority would weaken in systems with proletarisation, i.e. with the growth of a wage earning class employed outside familial production sectors. Such wage earning populations can be employed either in agriculture or in industry, but for the early French history of fertility control, especially agricultural wage sectors are of importance.

Micro-economic theory has a similar point of departure. David Weir (1982) argues that it is the relative value of children over the parents' life course that determines fertility. The value of family labour in its turn is a function of the economic situation of the family and of the prevailing labour market conditions in the community or wider area. Hence, Weir makes a distinction between (i) the French areas with traditional peasant agriculture operating on a familial basis and redistributing any surplus labour via a domestic service outlet, and (ii) areas with an early proletarisation and a labour market recruiting wage earners for large agricultural states, typically owned by nobility, bourgeoisie or the church.

According to these views, familial forms of production are conducive to the maintenance of high fertility, whereas the growth of agricultural wage labour fosters a fertility decline by virtue of reduced child utility over the parental lifetime.

The "mode of production" argument is of further significance for the nuptiality system as well. Peasant agriculture based on family labour is characterised by limited opportunities for an earlier establishment of new and economically independent households. Hence, according to the Malthusian principles of neo-local marriage (i.e. no coresidence of two or several married couples) and of economic independence, this means that those areas with smallholder and tenant farming ought to be characterised by late marriage. Furthermore, the circulation of surplus labour via domestic service (maids, manservants) also forcefully contributes to prolonged or even definitive celibacy (Hajnal, 1965, 1982). At this point, the interaction with the prevailing inheritance system has to be introduced. In regions with unequal division of property marriage postponement is typical for those who do not inherit or only get a smaller share, often in the form of a pension. Such persons tend to be pushed out of the system and enter other branches such as domestic service, army or navy, administration or the clergy. They are also prime candidates for emigration.

One can also expect that families tied to small farms or to artisanal workshops are more heavily involved in arranging their children's marriage. A younger son from one family would be an ideal match for another family's heiress. The protection or enlargement of familial property is served by endogamy and even more by consanguineous marriage. By contrast, the predominance of wage labour in capitalist forms of extensive agriculture would not be associated with further marriage postponement or celibacy, since wage labourers have little to inherit and to wait for. Households can be set up independently more easily on the basis of wages earned outside the familial sector, and there is no pressure for arranged marriages and consanguinity.

The "mode of production" hypothesis has the advantage that it explains both the nuptiality and the fertility pattern: the duality between peasant agriculture and capitalist agriculture can be viewed as a common cause capable of explaining the observed correlation between nuptiality and marital fertility. In statistical terms, the strong negative correlation between Coale's indices I_g and I_m in France should largely vanish once a control is introduced for the prevailing form of agricultural production.

We now turn to the hypotheses focussing on patterns of parental and institutional authority. E. Todd (1983, 1988) introduces the parental control variable through a crosstabulation of

two other key variables, i.e. generational coresidence and form of inheritance system. He distinguishes between four types of family systems:

(i) the nuclear residence pattern with equal division of property;

(ii) the nuclear residence pattern with unequal division;

(iii) the stem-family with a privileged son (primo- or ultimogeniture) who does not leave the family of origin upon marriage (whereas all others do);

(iv) the extended family in which coresidence of parents and married sons is maintained. Upon the death of the older generation, coresidence between married brothers remains possible, and inheritance tends to be egalitarian.

In Todd's patterning, the egalitarian nuclear family with equal division of property is characterised by weak parental control, and it would therefore also be a weak basis for authoritarian religious or political doctrines. By contrast, the stem family with its marked inequality among children and the extended control of the parental generation over the privileged son would be most supportive of strongly hierarchical religious structure. Todd's reasoning, although originating from variables other than those connected to the mode of production bears nevertheless some resemblance to our own line of argument. In our view, parental control is strongest in areas with familial forms of production by virtue of the restricted opportunities for adult children to set up their own independent household and because of the need to control marriages.

The argument of parental and religious authority is equally of relevance for the marital fertility decline since it provides a basis for the secularisation hypothesis. If the act of consciously controlling fertility depends on the *moral legitimisation* of the act as well as on the *calculus of advantage*, then areas with strong structural props in favour of institutional moral or religious patronage would lag behind in the fertility transition, whereas those without these props would be characterised by earlier secularisation and by an earlier or faster fertility transition.

The last argument is of a political nature and deals with the process of nation building, and more particularly with regional or linguistic forms of particularism. It equally relates to patterns of spatial diffusion with particularisms of this nature acting as barriers to the spread of new forms of behaviour. France obviously provides an example of early nation building with a central government gradually extending its unifying influence. As a result

we should expect that characteristics of the core (here the larger Parisian Bassin) would gradually be exported to the structurally and linguistically different periphery. Also Le Bras and Todd (1981) have stressed this feature and its corollary, i.e. the power of linguistic particularisms in France in defending the original structural characteristics of the periphery against the pressures stemming from the core. In addition, both authors point again at the importance of the various agricultural systems, but in contrast to Weir, much more attention is also being paid to other structural and cultural variables. Their position can be summarised as follows: fertility control emerges in regions with early secularisation, which in its turn is fostered by the existence of a large rural proletariat and by nuclear family systems with equal division of property. Fertility control and secularisation are both slowed down by the survival of peasant agriculture with inegalitarian inheritance and endogamy protecting the family capital from fragmentation, authoritarian family relationships, and with linguistic particularism.

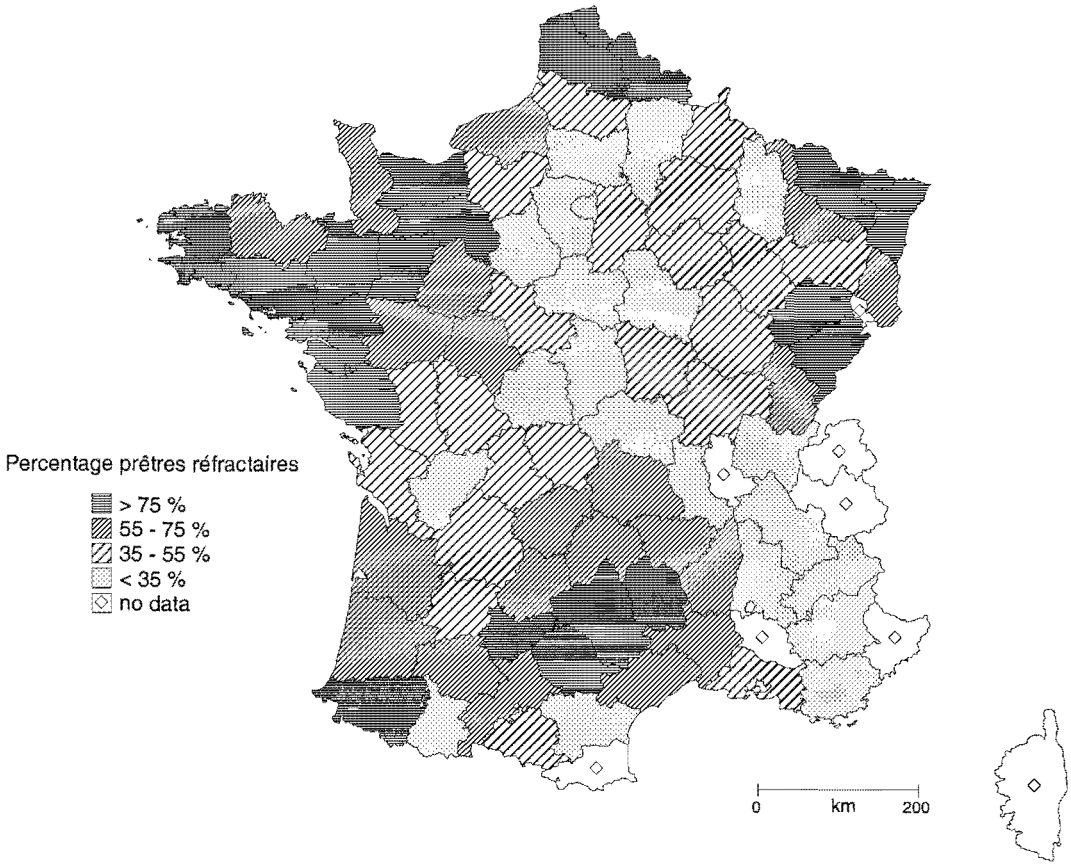
2.3. Empirical evidence

First of all, the strong spatial resemblance between the fertility levels and marriage patterns of French departements on the one hand and the pattern of secularisation on the other can be appreciated from the maps of Figure 1. Map A shows the religious divide as measured via the proportion of priests who refused to take the oath of allegiance to the secular government of the new Republic in 1791 (i.e. "*curés refractaires*"). These priests remained loyal to the Pope, and their spatial distribution shows the extent of Catholic resistance to the Revolution. The original map was produced by T. Tackett (1986). About 160 years later, i.e. in 1960-1970, R. Boulard's map of Sunday Mass attendance in the rural part of the departements (map B) exhibits a striking resemblance to Tackett's map of *prêtres réfractaires*: five zones of greater fidelity to religion again appear. And these five zones correspond once more with higher marital fertility in 1831 and later ages at first marriage as well.

A more elaborate statistical analysis is required to check our hypotheses. To this end, we have created a set of variables that characterise (i) the properties of the demographic regime (marital fertility, nuptiality, illegitimacy, endogamy), (ii) the agrarian production system (peasant farmers versus wage labour, i.e. *journaliers* and *métayers*, domestic servants) and related inheritance systems, (iii) the degree of secularisation (*curés*

FIGURE 1

A. Religious opposition to 1791 Constitution (prêtres réfractaires)
Source: T. Tackett, reprinted in Le Bras & Todd, 1981



B. Sunday Mass attendance 1960-70 in rural parts of départements (population 18+)
Source: R. Boulard, reprinted in Le Bras & Todd, 1981

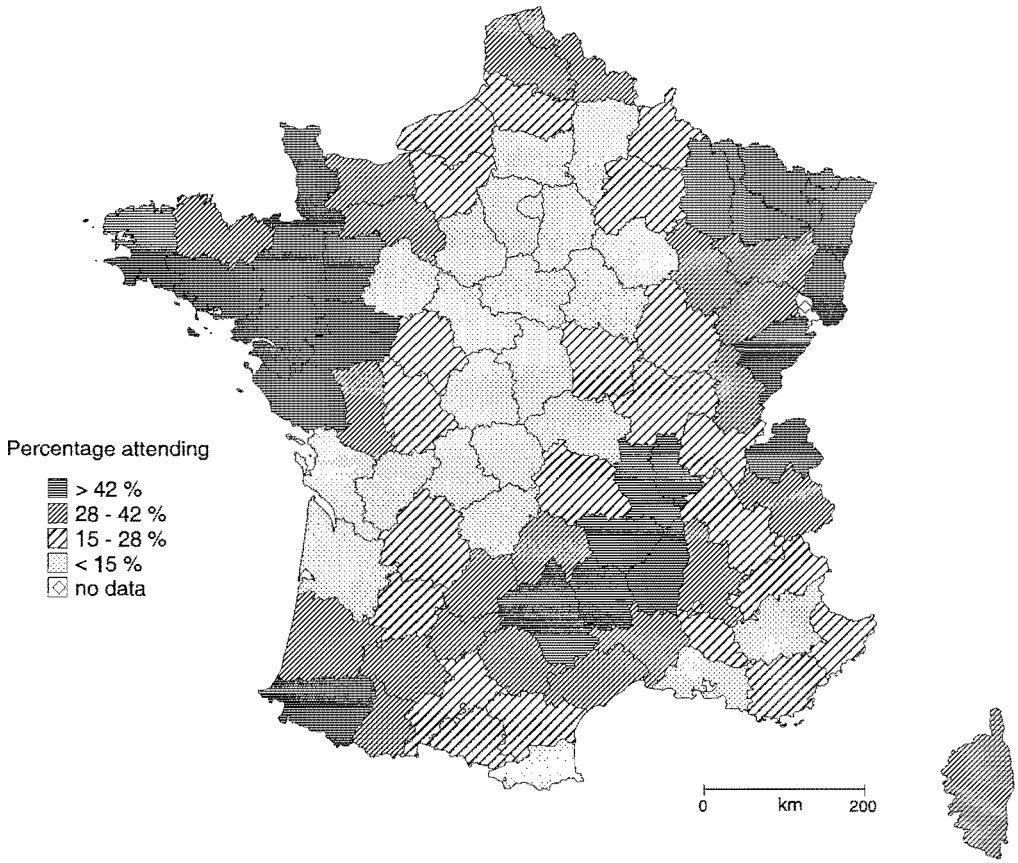
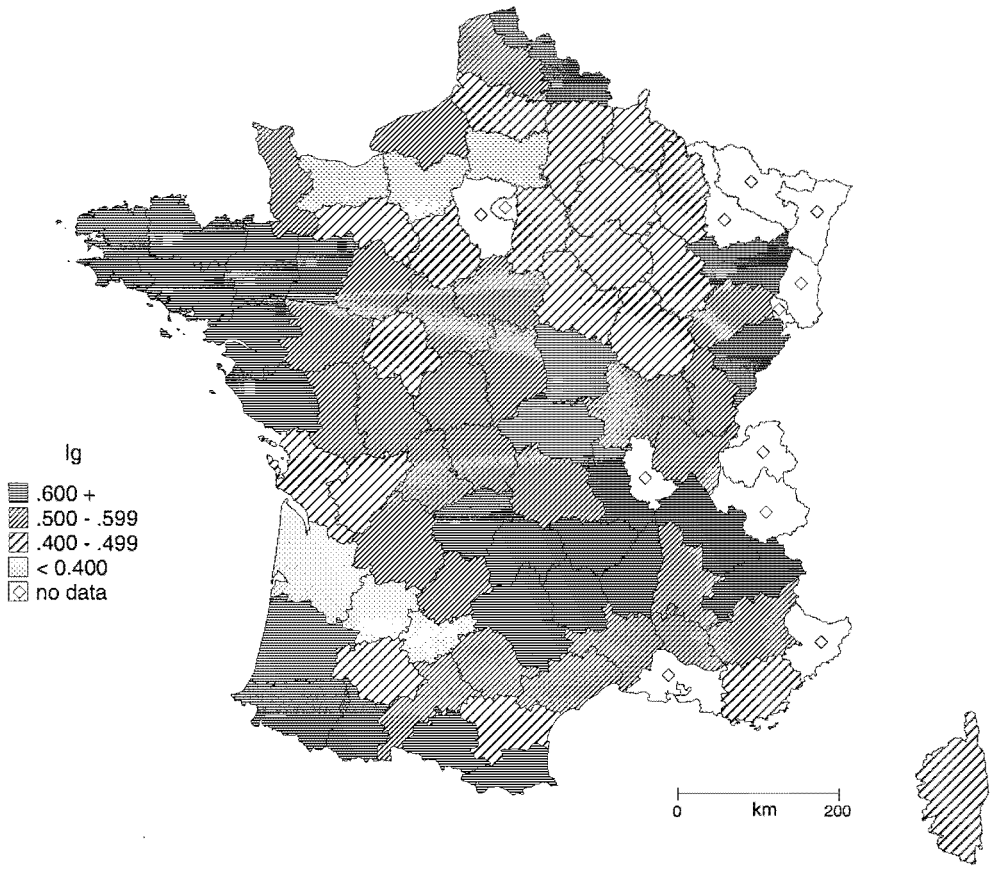


FIG. 1 CONTINUED

C. Level of marital fertility, 1831 (Coale's index Ig)
Source: E. van de Walle, 1971



D. Index of proportions married, 1831 (Coale's index Im)
Source: E. van de Walle, 1971

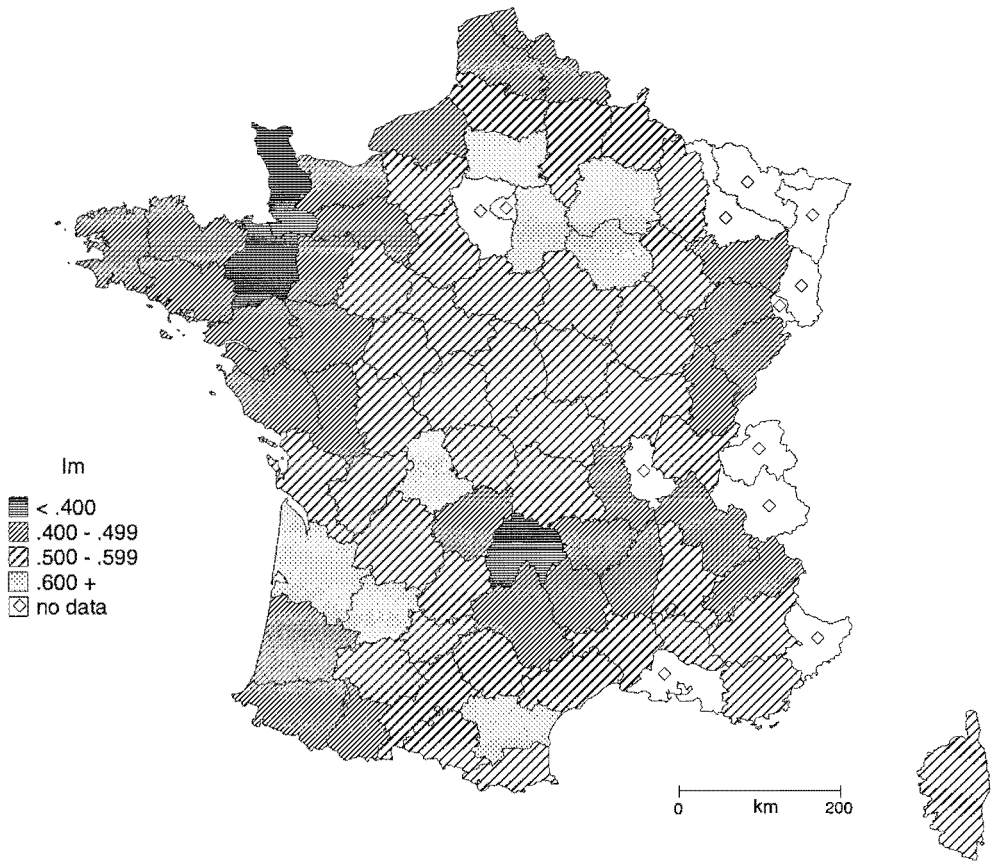


Table 1: Definition and sources of indicators used in the analyses of French reproductive regimes in the 19th Century

A. Demographic indicators		
*I_g (1831, 1876	Index of marital fertility relative to the Hutterite standard of uncontrolled fertility (Coale)	van de Walle, 1974: 226-467
*I_m (1831, 1876)	Index of proportions married (Coale)	ibidem
*I_h (1831)	Index of illegitimate fertility (Coale)	ibidem
*Age difference marriage (1861-65)	Husband-wife difference in age at marriage	Le Bras & Todd, 1981: 440
*Endogamy (1911-13)	Rankorder of departements according to the percentage cousin marriages (grouped from 0=lowest to 11=highest incidence)	Le Bras & Todd, 1981: 215
B. Agricultural system and inheritance pattern		
*Capitalist agriculture (1852)	Areas of large farms operating with *journaliers* and areas with *metayage* (=1) versus areas with smallholders and tenants (17%+ fermage) (=0)	Todd, 1998: 84
*Inegalitarian inheritance (1900)	Inegalitarian system (=1) with primogeniture or other preferential treatment, versus egalitarian system (=0)	Todd, 1988: 32 (based on A. de Brandt, 1901)
C. Secularization		
*Refusal revolutionary oath (1791)	Refusal of revolutionary oath by clergy: 2 = more than 50% refused, 1 = 40-50% refused, 0 = less than 40% refused	Todd, 1988: 64 (based on T. Tackett, 1986)
*Priests among army recruits (1825)	Priests per 10,000 recruits	Le Bras & Todd, 1981: 430
*Ordinations (1876)	Ordinations of priests per 100,000 population	ibidem
*Vacant vicarages	Proportion of vicarages that were vacant, i.e. without priests. Grouped values: 0 = less than 6%; 1 = 6-15%; 2 = 15-21%; 3 = more than 21%	ibidem: 379
*Sunday Mass attendance (1960-70)	Percent of rural population attending Sunday Mass	ibidem: 430 (based on R. Boulard)
D. Literacy and language		
*No writing (1872)	Percentage of the population that can at most read French, but cannot write it	ibidem: 454
*Linguistic particularism (1863)	Persistence of patois or languages other than French. Grouped values: 0 = all speak French; 1 = traces of patois; 2 = large proportions or entire villages do not speak French; 4 = more than 50% non-francophone.	ibidem: 279

Table 2: Correlation coefficients between the level of marital fertility (I_g) in 1831 and selected agricultural, socio-economic and cultural variables; French departements, 19th Century

Correlates (various dates)	correlation coeff. with I_g
A. Modes of production	
*Capitalist agriculture (versus smallholders and/or tenants), 1852	-.46
*Servants in households, 1856	+.33
*Inegalitarian inheritance, 1900	+.40
B. Secularisation	
*Clergy refusing revolutionary oath, 1791	+.46
*Priests among army recruits, 1825	+.31
*Vacant vicarages, 1885	-.52
C. Literacy and language	
*No writing in French, 1872	+.55
*Persistence of patois or language other than French, 1863	+.40
D. Nuptiality system	
*Index of proportions married (I_m), 1831)	-.73
*Index of illegitimacy (I_h), 1831	-.30
*Endogamy (cousin marriage), 1911-13	+.47

Data sources: see table 1

Table 3: Correlation coefficients between the change in marital fertility among cohorts married before 1770 and marriage cohorts of 1790-1819, and indicators of the type of agricultural production; INED-sample of 40 villages

Indicators in 1852 (agricultural census) A: familial peasant agriculture B: capitalist agric. with labour market	correlation coeff. with marital fertility decline in 2 marriage cohorts (decline I_g)
A - percent fallow land	-.31
- percent common land	-.46
- percent owner cultivators	-.48
B - percent artificial meadows	+.58
- percent absentee landlords	+.46
- price per hectare of first quality arable land	+.40

Source: D. Weir (1982)

réfractaires, ordinations, priests among army recruits, vacant vicarages, and Sunday Mass attendance), and (iv) indicators of linguistic particularism and literacy. These indicators are defined in Table 1 for easy reference, and all but one pertain to the period between 1790 and 1900. Hence, they can be taken as typical for the 19th Century.

In Table 2 we report the zero-order correlation coefficients between the level of marital fertility in 1831 (I_g) and the other indicators characterising the agrarian modes of production, the cultural dimensions, and the nuptiality patterns. The structure is clear: high marital fertility and a late fertility transition are positively associated with two characteristics of peasant agriculture (servants in households, inegalitarian inheritance), with Catholic strength (refusal revolutionary oath, priests among army recruits), linguistic particularism (no writing in French, survival of other languages) and with endogamy (cousin marriages). A low level of marital fertility and an early transition are associated with capitalist agriculture operating with wage labour, with high secularisation (vacant vicarages), earlier marriage and higher illegitimate fertility.

The indicators used by Weir (1982) corroborate these findings in Table 3. The three indicators of the presence of familial peasant agriculture (fallow land, survival of the commons, and high percentage of owner-cultivators) are all three negatively correlated in a sample of 40 French villages with the amount of fertility decline witnessed among two sets of marriage cohorts (cohorts married between 1790-1819 compared to those married before 1770). Conversely, the indicators of the predominance of capitalist agriculture (artificial meadows, high percentage absentee landlords and high prices of arable land) are all three positively correlated with a faster decline of marital fertility.

The overall patterning can be brought out by means of a canonical correlation analysis. In this analysis we have brought together all demographic variables in one set (**Y**) and all the other indicators in a second set (**X**). From both sets latent dimensions (canonical variables) are constructed in such a way that there is a maximal correlation between them. As the results in Table 4 indicate, the first canonical variate yields a correlation coefficient of .87 between the first **Y**-dimension and the first **X**-dimension (r_{x1y1}). For each of these dimensions the best indicator can be listed by means of the correlations between dimension **Y**1 or **X**1, and their respective indicators. In this fashion, dimension **Y**1 is best identified by the indices of proportions married (I_m), the indices of marital fertility (I_g), the index of

Table 4: Canonical correlation results for indicators of the demographic regime and for socio-economic or cultural indicators, 19th Century France, 90 departements

First canonical variate:		canonical correlation r_{x1y1}= .87 Wilk's lambda: .05 eigenvalue: .76	
Best indicators reproductive regime (**Y1**) (r>.40)		Best indicators socio-econ/cultural dimension (**X1**) (r>.40)	
*I_m, index of proportions married 1831:	-.86	*Sunday Mass attendance, 1960:	+.90
*I_m, index of proportions married 1876:	-.82	*Proportion not writing French, 1872:	+.73
*I_g, level marit. fertility 1871:	+.77	*Refusal revolutionary oath, 1792:	+.70
*I_g, level marit. fertility 1831:	+.75	*Ordinations per 100,000 pop., 1876:	+.66
*I_h, level illegitimate fertility, 1831:	-.65	*Capitalist agriculture, 1851:	-.68
*Endogamy (cousin marriage) 1911-13:	+.46	*Vacant vicarages, 1855:	-.61
		*Priests per 1000 recruits, 1825-35:	+.59
		*Inegalitarian inheritance, 1900:	+.53
		*Linguistic particularism, 1863:	+.50
Second canonical variate:		canonical correlation r_{x2y2}=.74 Wilk's lambda: .21 eigenvalue: .54	
Best indicators reproductive regime (**Y2**) (r>.40)		Best indicators socio-econ/cultural dimension (**X2**) (r>.40)	
*husband-wife age difference at marriage 1861-65:	+.64	*Inegalitarian inheritance, 1900	+.59
		*Linguistic particularism, 1863	+.49

illegitimate fertility (I_h) and by endogamy. The signs reveal that **Y**1 captures a *slow* demographic transition: marital fertility and endogamy are high, proportions married and illegitimate fertility are low. These features are strongly correlated with the best indicators of the dimension **X**1: strong adherence to Catholicism (5 indicators), inegalitarian inheritance and linguistic particularism. Conversely, negative correlates of dimension **X**1 are capitalist agriculture and vacant vicarages, which are obviously associated with faster demographic innovation. Finally, the second canonical variate, which is uncorrelated with the previous one, tells us that there is a separate dimension indicated by a high difference in ages at marriage between spouses. This specific demographic feature is more exclusively correlated with areas of inegalitarian inheritance and with the survival of languages other than French.

An analysis of correlations brings out the general pattern of association, but it says little about synergistic or combinatory effects. A Boolean analysis highlights these interactive effects by exploring *combinations* of factors that are propitious in producing specific outcomes (cf. Ragin, 1987). In the present example we have first dichotomised the independent variables as follows:

C: capitalist agriculture with a substantial rural proletariat of *journaliers* and *métayers*

c: peasant agriculture with a dominance of smallholders and tenants (1852)

P: mainly partible inheritance

p: mainly impartible or inegalitarian inheritance (1900)

F: mainly French-speaking area

f: patois or major non-francophone groups (1863)

S: more secularised, with 50% or more of the clergy taking the oath of allegiance to the Revolution (1791)

s: less secularised, with less than 50% taking the oath.

The dependent variable is equally dichotomised and indicates whether a department had marital fertility levels higher or lower than the mean in 1831 (mean $I_g = 0.56$). With four dichotomous predictors, one can inspect 16 different combinations ranging from cpfs to CPFS. The use of lower case letters in cpfs means that none of the characteristics that are propitious to producing lower than average fertility are present, whereas the use of capitals in CPFS identifies the areas where all four of the conditions for a faster marital fertility transition are present. Among the possible 16 combinations, two have empty cells: CFps

and CFSp, or simply CFp. In other words, we encounter a case of *limited diversity*. This is common in social science applications: systems have a degree of functional consistency and may therefore lack a number of "inconsistent" combinations. In this instance there were no departements with capitalist agriculture (C), and French speaking (F) and with impartible or inegalitarian inheritance (p): the latter seems to be inconsistent with capitalist agriculture or vanished during the course of history in the core regions of France.

Boolean minimisation allows us to combine two Boolean expressions that differ in *one and only* one condition, yet produce the same outcome, into a new expression without that single contrasting condition. For instance if both CPfS and cPfS produce a faster fertility transition, the contrasting condition (here c versus C) can be dropped and the condition can be simplified to PfS. We have considered two types of outcomes for the 14 cells. First we wanted to establish which combinations of conditions are associated with less than a quarter of departements in each cell having I_g-values below the mean. In other words, what combinations lead to a strong majority of departements with a late or slow fertility transition? The resulting Boolean expression for strongly lagging is:

$$LAG = Fcps + Cpfs + Pfc$$

This expression states that francophone (F) departements failed to experience a fast fertility decline by 1831 if this characteristic was combined with three counteracting conditions (i.e. c *and* p *and* s). Similarly, departements with only capitalist agriculture (C) also largely failed if the other three obstructing conditions (p *and* f *and* s) were simultaneously present. Finally, departements with egalitarian inheritance (P) also failed if they had a dominance of peasant agriculture and were not francophone (c *and* f). If the last term would have been Pcfs, the rule would have been very simple: the effects of F, C and P, which on their own are propitious for low fertility, are neutralised if they are combined with the *joint* operation of counteracting factors. Stated differently, *if three of the four factors pushing in the direction of a faster fertility decline are missing, then the vast majority of such departements would lag behind in the fertility transition.*

The Boolean expression for the combinations leading to at least three quarters of the departements having lower than average levels of marital fertility in the 14 cells is:

$$LEAD = CP(F+s) + S(Cpf + Fcp)$$

The first term, CP(F+s), describes the prevailing conditions in 21 of the 24 departements which have a very early fertility decline. It indicates that the joint presence of capitalist

agriculture and partible inheritance was necessary but not sufficient. These two conditions need to occur in tandem with either being francophone or having low secularisation. The second term, S(Cpf+Fcp) spells out the prevailing conditions in the remaining three departements (Creuze, Dordogne, Lot et Garonne). For these secularisation is necessary but not sufficient since it has to be combined with another factor (either C or F) that is conducive to a low fertility level. Equally striking is that these three departements are located in the South-West and may have had the more marked pattern of birth-spacing leading to low pretransitional marital fertility already referred to for the Garonne area.

The main conclusions to be drawn from the Boolean analysis are:

(i) The sole distinction with respect to the type of agriculture does not constitute a sufficient condition for lower marital fertility in 1831. Other propitious factors need to be added to the combination.

(ii) When partible inheritance is added, the results are much stronger.

(iii) Cultural factors strongly interfere as brakes on the transition. This holds in particular for religious fidelity and linguistic particularism, as can be seen in the Boolean expression for "LAG".

The present analysis is only based on regional cross-sectional data, and not on a more elaborate time-space analysis. N. Bonneuil (1997) offers such a more complete picture for the period 1831-1906, using Coale's index of overall fertility (I_f). This added time dimension leads this author to consider extra variables such as urbanisation, the decline in mortality, the rise in education and migration. All of these become obviously much more important after 1830. Yet, by that date the basic map of the French marital fertility transition was already largely drawn, and as we have shown, it was shaped by more general systemic characteristics of both a structural and a cultural nature. Most of these are absent in Bonneuil's analysis for the subsequent period. In essence, these systemic characteristics have their roots in the diversity of agrarian production systems that developed in France prior to the 19th Century. These agrarian systems are associated with different nuptiality systems, differential use of non-familial labour (servants versus wage earners), contrasting inheritance patterns, strong timing differences in secularisation and in patterns of marital fertility control. The diffusion of the latter innovation probably originated in more than one "centre", and it followed the lines of "weakest resistance" as spelled out by the covariates used here. Of equal importance is that this diffusion was

hitting the obstacles formed by both linguistic and religious barriers. These barriers were not crossed so easily after 1830 either: in 1901 the map of marital fertility (van de Walle, 1974: 175) still reflects the five zones of high fertility shown by the map for 1831, and the same holds in 1906 for Bonneuil's index of overall fertility, despite its contamination by differential marriage patterns.

3. The narrative of Belgian demographic innovation

The Belgian example is an even more striking case of consistency in the spatial patterning of new forms of demographic behaviour. We shall try to document that:

(i) the features of the "second demographic transition", such as the rise of divorce and of cohabitation after 1970, are strongly spatially correlated with the geography of the "first demographic transition", i.e. the control of marital fertility and the weakening of the Malthusian marriage pattern after 1850;

(ii) and that both are reflecting a basic socio-economic and cultural map which already started to differentiate Belgian regions since the middle of the 19th Century.

3.1. Background

As in France, there existed an older contrast between Belgian regions characterised by more intensive and more extensive farming respectively. The former type was operated by family labour supplemented by unmarried servants, and it was mainly located on the sandy soils of Flanders. Since the beginning of the 18th Century, such small-scale intensive farming was very often combined with cottage industrial activities (especially textiles). The more extensive form is more common in the southern part of the country, i.e. in Wallonia, and uses wage labour as well. Cottage industries are rare. The demarcation is, however, not always clear cut and does not exactly follow the linguistic border between the Dutch-speaking North and the French-speaking South. There are also exceptions within each of the linguistic areas. For instance, in Flanders more extensive agriculture is practised on the rich alluvial clay soils of the Polders along the North Sea coast and of the Scheldt river estuary, whereas many Walloon farm labourers also operated their own small plots.

Nevertheless, political and religious differences developed along these lines, and most noticeably from the French period (1794-1815) onward. In fact, there was a first

groundswell of secularisation inspired by the ideals of the French Revolution, and carried by intellectuals and bourgeoisie, and later on, i.e. after Belgian independence (1830) by the Liberal party. At the same time, Catholic opposition had also hardened, first against the French occupation (peasant revolts) and then against the Dutch kind during the period of reunification of the Low Countries (1815-1830).

At the time of independence in 1830, two political pillars had formed, Liberal and Catholic respectively, and until the 1880s these two were increasingly vying for popular support. Crucial for our purposes is that the Liberal party remained strong, not only among the urban bourgeoisie, but also in the Walloon countryside. By contrast, the Catholic party remains very firmly anchored in rural Flanders and particularly in the high population density belt characterised by intensive farming and cottage industries. For the period 1841-47, for instance, we already have a good measurement of secularisation for the entire territory via the percentage of annual marriages taking place in March and December, i.e. violating the Catholic ban on marriages during the two "closed periods" of Lent and Advent. Already during the French period there were clear signs of a weakening of this ban in various Walloon areas, but the map for 1841-47 leaves no doubt: the secularisation movement started from rural southern Wallonia and from the Liège area, and stops at the language border with Flanders by the 1860s. Contrary to common belief, the initial roots were not to be found in differential industrialisation, since many strictly rural Walloon arrondissements showed levels of secularisation that were as high as those witnessed in the emerging Walloon industrial belt (Lesthaeghe, 1991). In Flanders, there were only a few pockets with somewhat higher levels of secularisation: the two towns of Antwerp and Ghent, and to some degree also the Polders strip along the coast.

The second wave of secularisation is more closely associated with industrialisation and urbanisation, and its effect emerges essentially during the second half of the 19th Century. It is also linked to the growth of the third political pillar, i.e. the socialist movement. At the same time, it is also matched by the Catholic revival and popular mobilisation, as in other parts of Europe. New shades are then added to the map of secularisation. By 1880, this map looks as follows:

(i) there is a Walloon zone with the highest levels in the industrial belt, but also in all adjacent rural arrondissements (e.g. Thuin, Philippeville, Huy). The northern edge of this zone corresponds perfectly to the linguistic border with Flanders.

(ii) A second Walloon zone with somewhat lower levels dates back to the first secularisation wave, and it is entirely made up of rural arrondissements, mainly located in the Ardennes region.

(iii) High levels are found in Brussels, the bilingual capital.

(iv) Moderate levels are found in a number of Flemish urban areas (Antwerp, Ghent) and in a few industrialised towns (e.g. Aalst).

(v) Low levels prevail in the central part of Flanders (provinces of East-Flanders and Brabant) and along the coast.

(vi) Very low levels are encountered in the western and eastern corners of Flanders, i.e. in the interior of the province of West-Flanders and in the Antwerp Campine area and adjacent Limburg. These areas remain strongholds of Catholicism until the 1960s at least.

Much of this story is reflected in the statistical correlations presented in Tables 5 and 6. In Table 5 we have brought together the correlations between our various measurements for secularisation, starting with the index of marriages during Lent and Advent (MLA) in 1841-47, continuing with the parliamentary election results for 1919 (male universal suffrage) and 1958 (last "school war" between the Catholic pillar and the other two), and ending with absenteeism in the Sunday Mass attendance survey of 1964. As was expected, the spatial pattern of secularisation measured through MLA in 1841-47 is an early indicator that remains valid till the 1880s (correlation with MLA 1860-65 = 0.91 and with MLA 1881-84 = 0.83), but the added effect of the second wave of secularisation, associated with the rise of the Socialist pillar, leads to a reduction of the spatial correlation (r with vote for secular parties in 1919 = +0.55). If, on the other hand, we start with MLA in the 1880s, the spatial pattern remains more intact, and if we take the election results of 1919 as a starting point, the subsequent maps of secularisation remain almost identical till the 1960s. Table 6, finally illustrates that the rural character of arrondissements was less discriminating with respect to secularisation levels until the 1860s, and that these were better predicted by adult literacy (higher in Wallonia than in Flanders, also in Walloon rural areas) and by the proportion French-speakers. The rural-urban distinction emerges more strongly after 1880, but the linguistic divide survives. The effect of differential adult literacy disappears of course during the 20th Century as a consequence of universal primary education.

Table 5: Correlation coefficients between various indicators of secularisation, Belgian arrondissements (N=41)

	Marriage index during Lent and Advent			Socialist + Liberal + Com. vote		Absenteism Sunday Mass
	1841-47	1860-65	1881-84	1919	1958	1964
Marriage index Lent + Advent (MLA)						
*1841-47	-	+.91	+.83	+.55	+.36	+.26
*1860-65		-	+.87	+.73	+.58	+.50
*1881-84			-	+.83	+.72	+.65
Vote Socialist + Com. + Liberal (Sec vote)						
*1919				-	+.91	+.81
*1958					-	+.91

Table 6: Correlation coefficients between indicators of secularisation and their determinants, Belgian arrondissements (N=41)

	Marriage index during Lent and Advent (MLA)			Socialist + Liberal + Com. vote (Secvote)		Absenteism Sunday Mass
	1841-47	1860-65	1881-84	1919	1958	1964
*Percent male active population in agriculture, 1890	-.45	-.59	-.67	-.81	-.70	-.72
*Percent male active pop. in agric. + cottage industries, 1900	-.26	-.43	-.59	-.75	-.75	-.80
*Percent pop. 15-55 literate, 1880	+.56	+.46	+.31	+.13	-.13	-.14
*Percent francophone, 1880	+.63	+.70	+.76	+.79	+.61	+.52

The overall outcome of the two-wave secularisation process was a profound "pillarisation" of Belgian society. Many aspects of public life (e.g. co-operative shops, labour unions, charities, pension funds, schools, leisure activities, media....) were organised by the three political families (Catholic, Liberal, Socialist). In addition, the Flemish-Walloon contrast was further enhanced. Only after the 1960s would the political pillars weaken. Related to this new process of "depillarisation" is the growth of other parties, such as the Greens during the 1970s and right wing extremists (e.g. Vlaams Blok) during the 1990s. Both Liberal and Socialist Parties had abandoned their anticlerical ideology, and at present even the Christian democrats are debating whether the "C" should stand for "Christian" or for "Centrum". But, as we shall now show, both old and new forms of demographic behaviour are still closely related to the older maps of secularisation. It apparently takes longer for Belgian demography to "depillarise" than for the Belgian political scene.

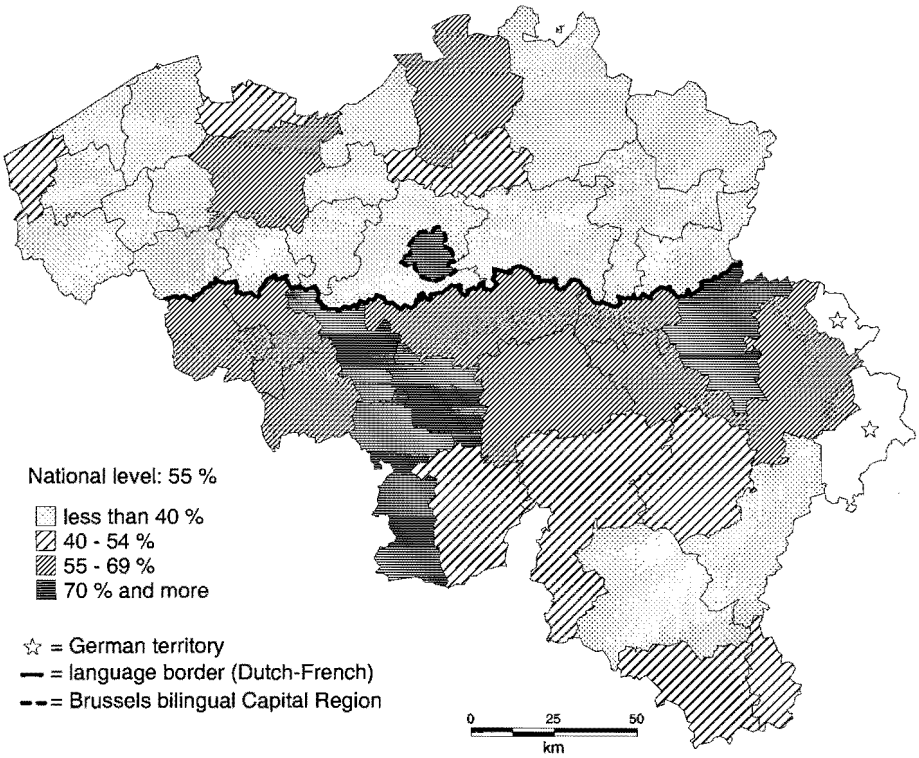
2.2. Belgium's spatial aspects of the "first" and "second" demographic transitions

A first impression of Belgian spatial pattern stability can be gleaned from the four maps presented in Figure 2. At the top we have juxtaposed the map of the speed of the marital fertility transition for the period 1880-1910 (map A) and the map of voting for the secularised parties in 1919 (map B). On both maps the central Walloon belt of industrial and adjacent rural arrondissements emerges very clearly. This was the area of early demographic "innovation" with respect to the adoption of birth control and also the weakening of the Malthusian late marriage pattern. This zone stops at the language border over its full East-West length. Fertility control has only spilled over this border in Brussels, which was already then a largely French-speaking city. It also started to develop in the urban arrondissements of Antwerp (to the North) and Ghent (to the West). The two zones of late adoption of fertility control and of Catholic loyalty also show up clearly at the eastern (Limburg + Campine) and western ends (Interior West-Flanders) of the Dutch-speaking region.

The last two maps in Figure 2 present two indicators of the "second demographic transition", i.e. the rise of unmarried cohabitation during the 1970s and 80s (map D) and the concomitant increase of the share of births out of wedlock in the 1980s (map C). The central Walloon zone shows up again in tandem with a broad ring of rural French-speaking arrondissements. Only in the southern corner of Wallonia is the rise of cohabitation more modest. The linguistic border is once more a major dividing line. In Flanders the growth

FIGURE 2

A. Speed of the marital fertility transition (1880 - 1910):
Percentage of the total marital fertility transition completed by 1910, Belgian arrondissements (NUTS 3)



B. Secularization (1919):
Percentage votes for Socialist, Liberal and Communist parties in 1919, Belgian arrondissements (NUTS 3)

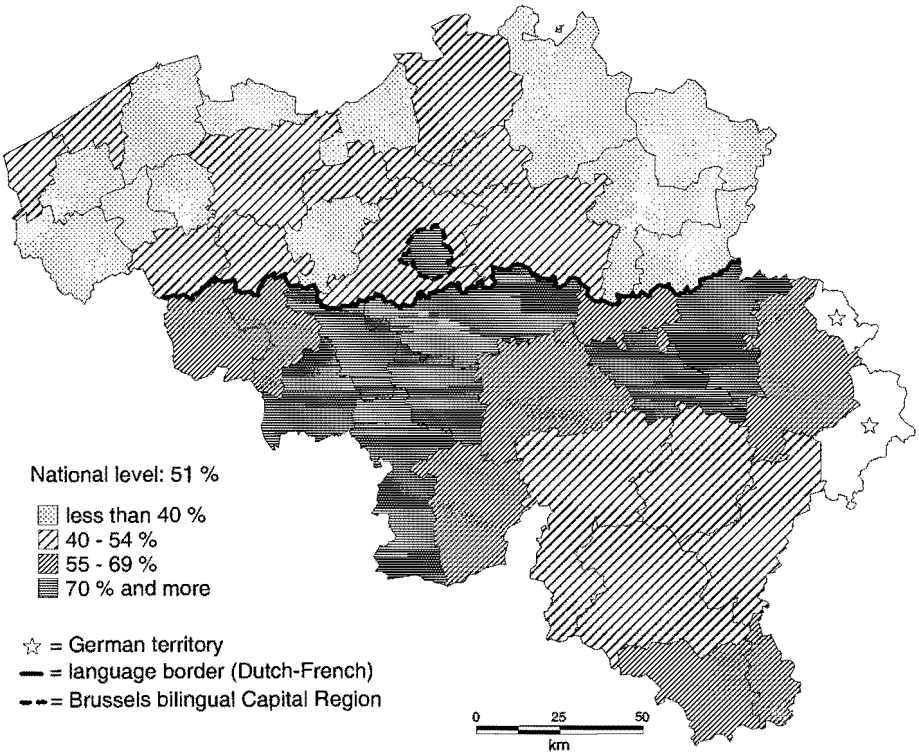
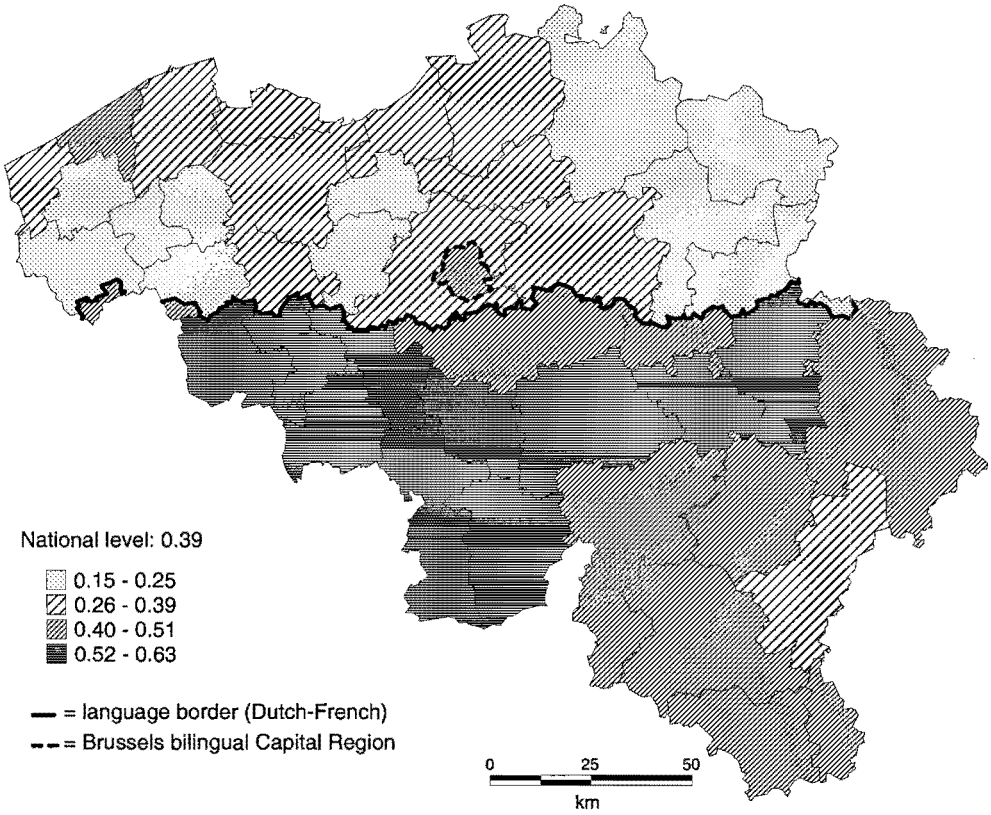
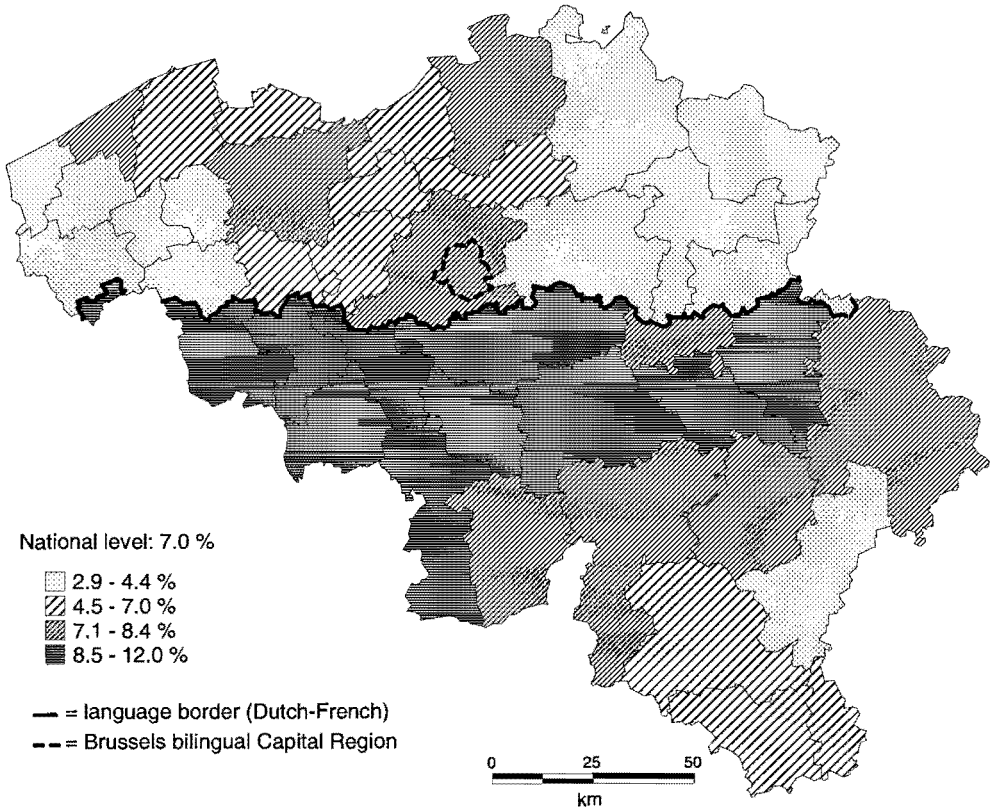


FIG. 2 CONTINUED

C. Births out of wedlock (1992):
Indirectly age structure standardized index of extramarital fertility for unmarried women, Belgian arrondissements (NUTS 3)



D. Unmarried cohabitation (1991):
Percentage cohabiting among all women in age group 25-29, census of 1991, Belgian arrondissements (NUTS 3)



poles are again the urban areas of Antwerp and Ghent, now followed by the urban area along the coast. The eastern and western corners of Flanders stand out by virtue of low levels of cohabitation and small shares of non-marital births, in the same way as they were the last regions to practise fertility control a century earlier.

The story can also be told with a larger set of indicators measured over a period of about 150 years. These indicators are presented in Table 7, and include early and later measures of secularisation, socio-economic indicators in 1900 and 1970, and historical literacy differentials. They are paired to indicators of the "first" and "second" demographic transitions, including levels of marital fertility and nuptiality for the earlier period, and indicators of divorce, cohabitation and non-marital fertility for the later period. As in the example of France, a canonical correlation analysis has also been performed on these indicators, and the results are shown in Table 8.

As before, the demographic indicators are brought together in the Y-set and the socio-economic and cultural factors in the X-set. The first canonical variate absorbs most of the information, and $\mathbf{Y}_1$ and $\mathbf{X}_1$ are very strongly correlated (r=.98). Virtually all demographic indicators load strongly on $\mathbf{Y}_1$, starting with the speed of the marital fertility decline in 1880-1910 and with the recent level of non-marital fertility of 1992 and the divorce incidence in 1967-1970. The current levels of cohabitation are next in line, together with the level of marital fertility more than a hundred years earlier. The historical indicators of the weakening of the Malthusian late marriage pattern are the weakest correlates of the dimension of demographic innovation, but still have loadings of +.70. The corresponding $\mathbf{X}_1$-dimension is almost perfectly identified by the voting for secularised parties in both 1919 and 1958 (loadings of 0.90 or more), closely followed by Sunday Mass absenteeism in 1964. This also reflects the socio-economic structure as it existed in 1900 and indicated by the proportions then employed in agriculture and cottage industries. The 19th Century measures of secularisation are weaker indicators, but the index of marriages during Lent and Advent (MLA) of the 1860s still correlates with $\mathbf{X}_1$ to a respectable degree (+.69).

The only demographic indicator that identifies a second and uncorrelated canonical variate is the level of illegitimate fertility near the end of the 19th Century. This map does not correspond so well to the secularisation dimension, but is much more in line with the urban-rural divide and with 19th Century literacy levels. At that time, urban and especially

Table 7: Definitions of the demographic, socio-economic and cultural indicators used in the analysis for 41 Belgian arrondissements

I_g	Coale's index (1963) of marital fertility, indirectly standardised for age and marital status composition and based on the Hutterite fertility standard; measured for 1880 and 1900.
Speed fert. trans	Percentage of the total marital fertility transition already completed before 1910; measured as $I_g(1910)-I_g(1880)/I_g(1880-0.200$, where $I_g=0.200$ is considered as the end point of the transition.
I_m	Coale's index of proportions married weighted by Hutterite fertility, 1880.
EM	Percentage ever-married women age 20-24, 1880.
I_h	Coale's index of illegitimate fertility, 1880
Divorce	Divorce rate per 10.000 married women, 1967-70
I_c	Index of non-marital fertility comparable to Coale's I_h, except weighting by Belgian national age-specific fertility rates of 1989-91 instead of Hutterite fertility, 1992
Cohab	Percentage of all women 20-24 or 25-29 currently in cohabitation, 1991
MLA	Marriage index Lent & Advent, i.e. percent of total annual number of marriages in March and December divided by 2/12 (normal share for 2 months); averaged over several years to neutralise effect of variable date for Easter. Measured for 1841-47, 1860-65, 1881-84.
Sec vote	Percentage of votes for Socialist, Liberals and Communists, parliamentary elections of 1919 and 1958.
Absent Mass	Percentage of adult population 15+ absent at Sunday Mass, 1964
Agcot	Percentage of male active population employed in agriculture and cottage industries, 1900
Agric	Percentage of male active population employed in agriculture, 1970
Literacy	Percentage of population 15+ able to read + write, 1900

Note: There are currently 43 arrondissements instead of 41. The old Brussels arrondissement has been reformed by bringing the Brussels Capital Region together with the Flemish arrondissement of Halle-Vilvoorde, whereas the newly formed French-speaking arrondissement of Mouscron (formerly a small section of the Flemish arrondissements of Ypres and Kortrijk) was dropped from the analysis. In other words, we have stayed as closely as possible to the historical division of the territory.

Table 8: Canonical correlation results for indicators of the "first" and "second" demographic transitions and for socio-economic and cultural indicators, 19th and 20th Century, 41 Belgian arrondissements

First canonical variate: canonical correlation $r_{x1y1} = .986$
Wilk's lambda = .00

Best indicators demographic innovation Y_1 r>.40		Best indicators socio-econ. & cultural factors X_1 r>.40	
*Speed marit. fertility transition 1880-1910	+.95	*Vote for secular parties, 1919	+.95
*Level marital fertility, I_g 1900	-.93	*Vote for secular parties, 1958	+.90
*Level non-marital fertility, I_c 1992	+.92	*Absenteeism Sunday Mass, 1964	+.83
*Divorce, 1967-1970	+.91	*Percent male act. pop. agric. + cottage ind.,1900	-.82
*Cohabitation women 25-29, 1991	+.86		
*Level marital fertility, I_g 1880	-.82	*Marriages Lent + Advent, 1881-84	+.79
*Cohabitation women 20-24, 1991	+.78	*Marriages Lent + Advent, 1960-65	+.69
*Percent ever-married women 20-24, 1880	+.70	*Marriages Lent + Advent, 1841-47	+.47
*Index proportions married, I_m 1880	+.70		

Second canonical variate: canonical correlation $r_{x2y2} = .927$
Wilk's lambda = .01

Best indicators Y_2, r>.40		Best indicators X_2, r>.40	
*Index illegit. fertility, I_h 1900	+.78	*Pct. act. pop. in agriculture, 1970	-.76
		*Literacy adult pop., 1900	-.64
		*Pct. male act. pop. agric + cottage ind., 1900	-.42

industrial environments with a concentration of low literacy working class populations were the main settings of high illegitimacy. The present levels of non-marital fertility are, as already indicated, spatially differentiated along the axis of the first canonical variate since they reflect much more the fertility levels of cohabiting couples, and are therefore typical indicators of the second wave of demographic innovation developing since the 1960s.

4. Other narratives: an invitation for new research

Obviously similar narratives can be produced for other European countries, and not all should exhibit similar degrees of spatial continuity over time as the examples of France and Belgium used here. For several countries a good start of the analysis is available, and many possess the necessary range of socio-economic and cultural indicators. For instance, Livi-Bacci's work on Portugal (1971) and Italy (1977) clearly indicates that there are promising avenues to be followed for documenting the survival of older spatial patterns in the genesis of newer forms of demographic behaviour. For Italy, the author is rather disappointed about the statistical explanatory power of classic socio-economic variables in accounting for the historical marital fertility transition, but he finds that provincial fertility levels measured as early as 1911 are the best predictors of the regional voting results in favour of a liberalisation of divorce laws in 1974 (1977: 288-289). Also the Swiss and Austrian narratives can be explored further since these countries too have long histories of spatial heterogeneity with respect to cultural, socio-economic and demographic variables. Both of them are therefore excellent testing grounds for the study of spatial continuity of first and second demographic transition variables.

But there are of course counter-examples. The British history of the fertility decline is still an elusive case. Except for the initial Scottish-English divide, there are no clear geographic patterns of innovation and subsequent diffusion (cf. Bocquet-Appel, 1997), nor are regional socio-economic indicators providing convincing explanations (Teitelbaum, 1984). Social class distinctions rather than geographic ones may have been more important. Some Scandinavian countries may also produce a distinct class of narratives. For instance, unmarried cohabitation and concomitant extra-marital fertility may have been features that were pushed to the northern frontiers of Norway and Sweden during a first phase, only to spread back south during the "second demographic transition". Such a

"revenge of the fringe"-hypothesis needs, however, more detailed documenting than is hitherto available. Furthermore, both Norway and Sweden have their more traditional Bible-belts, and to our knowledge, there has been no systematic investigation of this spatial cultural feature and its impact in shaping both first and second demographic transitions.

To sum up, many European countries provide settings of highly spatially differentiated cultural, socio-economic and demographic developments that can be captured statistically since the 19th Century. With a bit of imagination and luck new indicators can be mined. The socio-economic and demographic ones are easier to find, whereas the cultural ones may need more probing. But then, a greater reward in the form of a more complete narrative may be down the line.

5. Narratives and theories of demographic innovation

The narratives produced in the Princeton Project of the 1970s on the history of fertility control and the modernisation of the nuptiality systems in Europe inspired A.J. Coale (1973) to specify three preconditions for demographic innovation and adaptation. They are known as the "Ready, willing and able"-specification. These terms refer to the following:

(i) *Ready*: the new form of behaviour must be economically advantageous and more so than the older form;

(ii) *Willing*: the new form must be culturally acceptable and not run counter to prevailing ethical or religious (or other ideational) convictions and values;

(iii) *Able*: there must be means, old or new, to implement the choice. This implies that these means must be known and are accessible.

In the narratives, readiness has been connected to socio-economic structures and changes, to the evolution of real wages (cf. Lesthaeghe, 1992: 28-31, for France) and to economic aspirations (e.g. A. Dumont's "social capillarity", 1880, or H. Denis' relative deprivation theory, 1899). At the micro-level, readiness also refers to the terms of economic calculus as for instance defined in Easterlin's (1978) demand function for children: utilities, disutilities and relative means or income. Willingness, on the other hand, has been operationalised through the secularisation indicators on the assumption that religious barriers would inhibit the adoption of new forms of demographic behaviour, whereas secular outlooks foster the adaptation of behaviour to new objective circumstance. The ability condition has not been operationalised here since we obviously do not have spatial

information on the methods of contraception being used in historical times. In studies of much more recent fertility transitions, however, the ability condition could be operationalised via spatial patterns of knowledge and availability of modern methods of contraception.

At the micro-level, we can imagine that an individual or household i has a score on readiness (R_i), willingness (W_i) and ability (A_i), each ranging from low or unfavourable (=0) to high or favourable (=1), and with a zone of uncertainty in the middle (=0.5). Coale's specification is a *bottleneck model* since the three conditions need to be met simultaneously. This means that the final decision score (S_i) is the *minimum* of the individuals' values for R_i, W_i and A_i. In other words:

$$S_i = \text{minimum}\ (R_i, W_i, A_i)$$

A particular person or household would only switch to the new behaviour if his $S_i>0.5$, i.e. when the minimum of the three component scores has crossed the boundary of indecision. Aggregating over all individuals or households implies that we are dealing with distributions for R, W, A and for the minimum S (cf. Lesthaeghe and Vanderhoeft, 1999). This, however, is a model for a single, homogeneous population. The spatial patterning, however, requires a disaggregation according to distinct regional networks. A classic specification focussing on individual and network effects respectively (cf. Montgomery and Casterline, 1996) takes the following form:

$$Y_{i,t} = \beta_i X_{i,t} + \delta_i \Sigma\, \omega_{i,j}\, Z_{j,t-1} + e_{i,t}$$

The Greek letters indicate coefficients or weights, and the roman letters refer to variables. In this equation an outcome Y for individual or household i at time t is made up of the influence β_i of a set of *individual* characteristics $X_{i,t}$ and the influence δ_i attributed to the influence of a *network* composed of N persons or households. In this network, members j have characteristics Z_j, but the actor i gives differential "credibility" scores $\omega_{i,j}$ to each of them. These are then summed over all network members. The last term, $e_{i,t}$, is the error term.

Applied to Coale's conditions, we have to set up three such equations, one for R_i, W_i and A_i respectively:

$$R_{i,t} = \beta_i X^R_{i,t} + \delta_i \sum \omega_{i,j} Z^R_{j,t-1} + e^R_{i,t}$$

$$W_{i,t} = \beta_i X^W_{i,t} + \delta_i \sum \omega_{i,j} Z^W_{j,t-1} + e^W_{i,t}$$

$$A_{i,t} = \beta_i X^A_{i,t} + \delta_i \sum \omega_{i,j} Z^A_{j,t-1} + e^A_{i,t}$$

The superscripts of the individual and network members' characteristics X and Z imply that these characteristics may vary or be of unequal relevance, depending on whether R, W or A is considered. These characteristics can of course be objective attributes (e.g. wealth, income...), forms of behaviour, or opinions and values. The individuals in the actor's network are likely to belong to the same kinship group, social class or have a shared location. The credibility weights are highly likely to vary according to social distance. The model above does not imply that R_i, W_i and A_i have to change at the same time: one of the three can be lagged and this would cause the minimum S_i to lag as well. Nor does the model imply a fixed sequence such as R→W→A, i.e. readiness increasing first, thereby causing a reevaluation of normative barriers, and then leading to a search for appropriate means. It may well be, as possibly in the case of the early French fertility decline, that normative barriers had weakened before (early secularisation) and that means (e.g. coitus interruptus) were already well known before the economic motivations developed. In this instance, it would be the population distribution for R that would be the last to shift, and the bottleneck condition would not be defined by the distributions of W or A.

Let us now consider how the French and Belgian narratives fit with the model above. Familial forms of production (small-scale owner or tenant farming or cottage industry), inegalitarian inheritance (avoidance of fragmentation of land) and endogamous marriage strategies imply lower scores on readiness. Conversely, capitalist agriculture (C) and partible inheritance (P) imply higher scores on R. Early secularisation (S) - whatever its initial cause - means higher scores on W. And linguistic particularism signals non-membership of the core network. In this fashion, the Boolean expressions for LEAD and LAG describing the French marital fertility transition can be translated into the RWA-model. Recall that the presence of one propitious factor (either P or C related to R, or S related to W, or F related to a core connection) but the absence of the other three are

closely associated with a slow fertility transition. In other words, there was not one but a combination of bottlenecks (pc, ps, cs...) that produced the LAG-outcome. All such departements are low on secularisation (s), and all of them have a missing element of the CP-combination. Conversely, this CP-combination was the best predictor of a faster fertility transition and in the majority of LEAD departements, this was also combined with F, i.e. being part of the innovating core.

The Belgian fertility decline is characterised by two separate models as a result of the linguistic divide. In the South, the levels of secularisation were already high before the start of the fertility decline so that W was no longer the bottleneck condition. The fertility transition can then be seen as advancing in tandem with the socio-economic changes that influenced child utility and child costs. In the North, by contrast there were several urban centres of innovation with respect to fertility control, but this new form of behaviour could only spread to the eastern and western corners of Flanders when moral and religious obstacles were weakening. In fact, the adoption of family limitation in these Catholic parts of Flanders may, at a later stage, have contributed to the gradual secularisation of these areas as well (reversed causation).

The importance of region-linked networks in the Belgian example is further highlighted by the survival of subcultures that are either more permissive or more obstructive with respect to the typical features of the second demographic transition. Stable local networks then explain the replication of the diffusion model exhibited during the first demographic transition on both sides of the linguistic border: (i) diffusion from the Walloon core region towards the Ardennes in the southern corner of the country, and (ii) diffusion from Brussels and urban areas in Flanders to the middle of Flanders first, and to the two Flemish corners later on. The connection with the secularisation maps prior to 1970 furthermore indicates that the local subcultures kept their differentiation along the normative or the willingness dimension, even if the issues have changed (now: divorce, cohabitation, procreation within cohabitation). To sum up, countries characterised by strong and stable subcultures are also likely to produce narratives of long term demographic continuity, similar to the Belgian experience.

6. Conclusion

The conclusion can be brief. In social science theories developed after the 1960s it has become fashionable to attribute innovation of new behaviour to the powers of individual agency. Individuals can cut all ties with tradition and adopt modes of action that are economically and functionally most suitable for a given objective situation. But, as our narratives have shown, demographic innovations over more than a century can originate in very much the same places, they can diffuse geographically in the same hierarchical fashion, and this can be steered along the same "*lignes de force*" governed by a *normative* dimension. Clearly, such a pattern can only emerge if (i) there is a continued and locally differentiated ethical and political socialisation of successive generations, (ii) if members of local and regional networks reinforce each others ways of thinking and of acting, and (iii) if no outside forces (such as large migration streams) upset the stability of normative subcultures. In this sense, many Europeans may be more the product of their regional roots than that the primacy of individual agency has led them to believe.

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8. References

Bonneuil, N. (1997). The transformation of the French demographic landscape, 1806-1906. Oxford, Clarendon Press.

Coale, A. J. (1965). "Factors associated with the development of low fertility: a historical summary"." *United Nations World Population Conference 1965* **20**: 205-209.

Coale, A. J. (1973). The demographic transition. International Union for the Scientific Study of Population: International Population Conference 1973. Liège, IUSSP. **1:** 53-73.

Denis, H. (1899). Le mouvement de la population et ses conditions économiques. Brussels, vol. 59, Académie Royale des Sciences, des Lettres et des Beaux Arts - Mémoires couronnés et autres mémoires.

Desrosières, A. (1993). La politique des grands nombres - Histoire de la raison statistique. Paris, Editions La Découverte.

Dumont, A. (1880). Dépopulation et civilisation - Etude démographique. Paris, Editions Lecrosnier & Babé.

Easterlin, R. (1978). The economics and sociology of fertility - A synthesis. Historical studies of changing fertility. C. Tilly. Princeton, N.J., Princeton University Press: 57-134.

Hajnal, J. (1965). European marriage patterns in perspective. Population in History. D. V. Glass and D. Eversley. Chicago & London, Aldine Publishing Co.: 101-143.

Hajnal, J. (1982). "Two kinds of preindustrial household formation systems." *Population and Development Review* **8**(3): 449-494.

Le Bras, H. and E. Todd (1981). L'invention de la France. Paris, Librairie Générale de France.

Lesthaeghe, R. (1978). The history of the Belgian fertility decline, 1800-1970. Princeton, N.J., Princeton University Press.

Lesthaeghe, R. (1991). Moral control, secularization and reproduction in Belgium, 1600-1900: Historiens et Populatio ns, Société belge de démographie, Louvain-la-Neuve, Editions Académia: 259-279.

Lesthaeghe, R. (1992). Beyond economic reductionism: the transformation of the reproductive regimes in France and Belgium in the 18th and 19th Centuries. Fertility transitions, family structure and population policy. C. Goldscheider. Boulder & San Francisco, Westview Press: 1-44.

Lesthaeghe, R. (2001). Lambert-Adolphe-Jacques Quételet, 1796-1874. International Encyclopedia of the Social and Behavioural Sciences. N. Smelser and P. Baltes. Oxford, forthcoming, Elsevier Science Ltd.

Lesthaeghe, R. and C. Vanderhoeft (1999). Une conceptualisation des transitions vers de nouvelles formes de comportements. Théories, paradigmes et courants explicatifs en démographie. D. Tabutin, et al. Louvain-la-Neuve, Académia-Bruylant & l'Harmattan: 279-306.

Lesthaeghe, R. and C. Wilson (1986). Modes of production, secularization and the pace of fertility decline in Western Europe, 1870-1930. The decline of fertility in Europe. A. J. Coale and S. C. Watkins. Princeton, N.J., Princeton University Press.

Livi-Bacci, M. (1971). A century of Portuguese fertility. Princeton, N.J., Princeton University Press.

Livi-Bacci, M. (1977). A history of Italian fertility during the last two centuries. Princeton, N.J., Princeton University Press.

Montgomery, M. and J. Casterline (1996). "Social learning, social influence, and new models of fertility." *Population and Development Review* **22-supplement**: 151-175.

Ragin, C. (1987). The comparative method. Berkeley, CA, University of California Press.

Tackett, T. (1977). Priests and parish in 18th Century France. Princeton, N.J., Princeton University Press.

Takett, T. (1986). La révolution, l'église, La France. Paris, Livre de Poche - Collection Pluriel.

Teitelbaum, M. (1984). The British fertility decline. Princeton, N.J., Princeton University Press.

Todd, E. (1983). La troisième planète - Structures familiales et systèmes idéologiques. Paris, Eds. Le Seuil.

Todd, E. (1988). La nouvelle France. Paris, Eds. Le Seuil.

van de Kaa, D. (1996). "Anchored narratives: the story and findings of half a century of research in the determinants of fertility." *Population Studies* **50**: 389-342.

van de Walle, E. (1974). The female population in France in the 19th Century - A reconstruction of 82 départements. Princeton, N.J., Princeton University Press.

Weir, D. (1982). Fertility transition in rural France, 1740-1829. Stanford, Dept. of Economics, Stanford University.

Wrigley, E. A. (1985). "The fall of marital fertility in 19th Century France: exemplar or exception?" *European Journal of Population* **1**(1): 31-60.