EFFECTS OF THE EUROPEAN LATE MARRIAGE PATTERN ON KINSHIP.

A study using a microsimulation model.

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Resum.- Hajnal va mostrar que les poblacions d'Europa Occidental, entre els segles XVI a XVIII, es casaven a una edat molt tardana. En aquest treball s'estudien els efectes del matrimoni tardà sobre el cicle de vida individual, a través dels canvis en la grandària i en la composició del grup de parents en vida. Les dades han estat obtingudes per un model de micro simulació. La grandària i la composició del grup de parents es simulen per a un rang ampli de règims demogràfics, el que permet estudiar els efectes del matrimoni tardà sobre la supervivència dels pares durant la vida de les persones en els segles XVI a XVIII i sobre la supervivència d'altres parents. Aquestes dades permeten també construir un petit test d'hipòtesis sobre la versemblança d'algunes explicacions de les causes del matrimoni tardà.

Paraules clau.- Parentiu, nupcialitat, microsimulació.

Resumen.- Hajnal mostró que las poblaciones de Europa Occidental se casaban a una edad muy tardía de los siglos XVI a XVIII. En este trabajo, se estudian los efectos del matrimonio tardío sobre el ciclo de vida individual a través de los cambios en el tamaño y la composición del grupo de parientes en vida. Los datos son obtenidos gracias a un modelo de micro simulación. El tamaño y la composición del grupo de pariente se simulan para un rango amplio de regímenes demográficos, lo que permite estudiar los efectos del matrimonio tardío sobre la supervivencia de los padres durante la vida de las personas en los siglos XVI a XVIII, sobre la supervivencia de otros parientes, y esos datos permiten también construir un pequeño test de hipótesis sobre la verosimilitud de algunas explicaciones de las causas del matrimonio tardío.

Palabras clave.- Parentesco, nupcialidad, microsimulación.

Abstract.- Hajnal showed that Western European populations married very late from the sixteenth to the eighteenth century. This work is a study of the general effects of late marriage on the life cycle of individuals through the change it produced on the size and composition of their living kin group. The data come from a micro simulation model of the kinship. The kin group size and composition of individuals is simulated for a wide range of demographic regimes, which allow to study the effects of late marriage on the survival of the parents during the life of individuals in the sixteenth to eighteenth centuries in Western Europe, on the survival of the totality of the biological kinship and to construct a small test of hypothesis on the question of the determinants of late marriage.

Key words.- Kinship, nuptiality, microsimulation.

Résumé.- Hajnal a montré que les populations d'Europe occidentale se mariaient à un âge très tardif du XVIe au XVIIIe siècles. Ce travail est une étude des effets du mariage tardif sur le cycle de vie des individus au travers de la variation produite sur la taille et la composition de leur parentèle en vie. Les données sont obtenues par un modèle de micro-simulation. La taille et la composition de la parentèle est simulée pour une série de régimes démographiques très différents, ce qui permet d'étudier les effets du mariage tardif sur la présence des parents pendant la vie des personnes du XVIe au XVIIIe siècles, de la présence de l'ensemble des parents proches, et qui permet aussi de construire un petit test sur la vraisemblance de certaines explication des causes du mariage tardif.

Mots clés.- Parenté, nuptialité, microsimulation.

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EFFECTS OF THE EUROPEAN LATE MARRIAGE PATTERN ON KINSHIP. A STUDY USING A MICROSIMULATION MODEL

In this work I study the demographic dimensions of the determinants of the late marriage in Western Europe in the past and its effects on kinship. HAJNAL (1965) first showed that western Europe populations married very late from the sixteenth to the eighteenth century. The age at marriage for women was in the 24-26 years range, when this age was of 18 to 22 years in all Europe before 1500, or in the rest of Europe after 1500. For men, the evolution was generally similar, from 25 years or less, to 28-30 years between 1550 and 1800, but with a higher range of variation than for women. This discovery of Hajnal, based on a bold generalisation given the few data at his disposal when he wrote, has been to a large extent confirmed by ulterior researches. Much has been written about the European late marriage pattern since Hajnal's classical work, but analysis of the causes of its diffusion are generally conduced on a very general level, and in some way often merely repeat what Malthus said about the "preventive check". On the contrary, the association between late marriage and the emergence of the nuclear family has been described in great details, but we lack a clear picture of the general effects of nuptiality change on kinship. In this work I will focus on the demographic dimension of late marriage, hoping to provide information on its determinants and will study its general effects on the life cycle of individuals through the change it produced on the size and composition of their living kin group.

The data I use come from a microsimulation model of the kinship. Marriage and family formation were often conditioned by the combined effect of demographic and socio-economic constraints. The interest of a model like the one I use is that it allows to separate the demographic from the socio-economic level of constraints, something more difficult to do when one has at hand only data on age at marriage and family characteristics of real populations, which are only the results of the various constraints at work. A model allows us to reproduce the observations by mean of a combination of hypotheses on the constraints at works, and can help to measure the range of variation any constraint can produce on the observed behaviours. The general procedure I will use here is to simulate the kin group size and composition of individuals for a wide range of demographic regimes, which will allow me to explore what can be called the frontiers of this demographic constraint.

In the first section I will justify the use of a microsimulation model for the study of the kinship. In the second section I will show what were the effects of the generalisation of the European marriage model on the survival of the parents of individuals living in the sixteenth to eighteenth centuries in Western Europe. In the third section I will extend this study of the effects of late marriage to the totality of the biological kinship. Finally in the last section I will consider the question of the determinants of the age at marriage, analysing the demographic dimensions of marriage for men and then for women.

1.- Interest of a microsimulation model of kinship. The sibling effect

The data in this work are obtained from a simulation of the kinship of individuals. The model is a derivative of one devised by LE BRAS (1982). It gives the number and the type of living kin that a person has at each age, based on normal mortality, nuptiality and marital fertility levels of his time. The use of a model is often the only way to obtain exhaustive data on kinship from populations of the past, and to study the effects of the change of the demographic parameters on the size and composition of the surviving kin group during the life of individuals. The results of a model provide data that only a very detailed and accurate survey could give. Normally information on kinship in the past for all the population is limited to household or family lists, always a small proportion of it. The collaboration among kin was probably important in past rural populations and for a person the fact of having few or many brothers and cousins, living or not in the same house, was certainly a meaningful and important economic factor. Another reason to study the number and variation of kinship is that it is the upper limit for family size and composition. The family composition could change with the age of the head of family or the level of the demographic parameters, when the rules governing its formation do not[1].

[1] This was the main motivation of WACHTER, HAMMEL, and others. (1978) when they developed the SOCSIM microsimulation model, one of the first of this kind and maybe the best example of the application of this methodology. They wanted to prove that the English nuclear family of the past was not the product of demographic constraints that limited the size of the kin group, but the consequences of the rules of family formation and dissolution.

I will not present here the technical details of the model. The reader interested in it will find a presentation in LE BRAS (1982)[2]. But it seems interesting to justify why it is generally a good idea to use a microsimulation instead of another kind of model[3]. The main reason is the way the model takes into account the effects of heterogeneity of mortality and fertility among individuals on the size and composition of the kin group. It is much easier to simulate the effects of the variation of biological and behavioural aptitudes in a micro simulation, where all the calculus are done at the individual level, rather than with a mathematical or with a macro simulation model. Each person has some particular biological aptitudes that determine his probabilities of dying, of having children, and the variations from the population mean are important. Similarly, each person has what could be called some "social aptitudes" regarding marriage and the resulting variations between individuals are also significant. Finally, even if all individuals were perfectly equals, homogeneous clones, natural or social events at a global level would create differences between the life of individuals. The various sources of randomness (genetic, behavioural, environmental) create deviations from the mean of the age at death, marriage and birth of children, that are all important in determining the kin group mean size and composition for the individuals. In a microsimulation model, it is easy to separate or to mix at will those various factors of randomness, again something more complicated with mathematical or macrosimulation models.

Taking into account the differences between individuals is important, because the size of the kin group is determined at the same time by the mean and the dispersion of net fertility. Thus the treatment of factors of variation between individuals is critical for the realism of the model. The simplest example of the number of brothers and sisters of an

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not the product of demographic constraints that limited the size of the kin group, but the consequences of the rules of family formation and dissolution.

[2] Let me say only that LE BRAS' model, sometimes known as BACKFOR, is very close to the CAMSIM model well documented in SMITH and OEPPEN (1993). There are only two significant differences between the two. First I have not included remarriage in the model when CAMSIM does it. Second in LE BRAS' model the reproductive process is modelled at a finer detail than in the CAMSIM model which model marital fertility heterogeneity at the birth interval level. In LE BRAS' model, the description of the reproductive process goes much more into details, with a distribution function of fecundability between women, a distribution of sterility by age and a modelisation of fertility control at the parity level.

[3] Following BONGAARTS, it is customary to distinguish between analytical or mathematical, macrosimulation and microsimulation models of the kinship. The first one use as the name says only mathematical formula to obtain kin distributions, the second one operates at the population level, using a methodology similar to multistate population projections. In microsimulation all the modelisation is done at the individual level. See DE VOS and PALLONI (1989) for a recent survey of family and kinship models.

individual chosen at random will show why. In a typical population of Western Europe in the eighteenth century, with a life expectancy at birth for men and women of 26 years, and an age at first marriage of 24.5 years for the women and of 30.4 years for the men, without fertility control within marriage, the mean total fertility was 5.7 births for woman. In this case, we have the following distribution of women according to their number of births when they are 50 years old.

Table 1. Women distribution according to the number of births at 50 years. Western Europe circa 1750

Number of births	0	1	2	3	4	5	6	7	8	9	10+
Proportion of women (%)	22.4	5.1	5.1	5.5	5.9	5.7	5.9	6.3	7.2	6.8	24.2

These women had an average of 5.7 live born children, but this does not mean that each son had an average of 4.7 brothers or sisters. This would be true only if all the women had exactly the same number of children. To arrive at this situation, the women would have to have married at the same age and have identical levels of fecundability and sterility, all the husbands would have to have the same age at marriage and at death, etc. It is the variability of these parameters between couples that leads to the dispersion that we observe in the distribution of the number of their children. In fact the average number of brothers and sisters that have a person chosen at random in a population of these characteristics is not 4.7, but 8.3, a value almost the double. This number is deduced applying the following formulae:

Mean number of brothers and sisters = G + V / G - 1

where G is the mean total fertility (mean number of children per woman) and V is the variance of the women's distribution according to their number of births[4]. In Table 1 we have G = 5.7 and V = 20.8, so the average number of brothers and sisters for an individual chosen at random is 8.3.

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[4] KEYFITZ (1977).

To understand why there is a difference between the number of children and the number of brothers and sisters, consider only the families with one son and the families with nine in table 1. The first one represent 5.1% of the total of the families and the second one 6.8%. But if we change the point of view and consider the children of these families, those that have eight brothers or sisters are 12 times more numerous than the children without one. The mean number of children of these two groups of family is 5.6, but each child does not have an average of 4.6 brothers or sisters, but 7.4. This change from the parent's to the children's point of view is what I call the "sibling effect".

Table 2 gives the mean number of brothers and sisters that a person had in five European populations of the past simulated with this model. A wide range of demographic regimes is covered with those five populations. The first one in table 2 has the high mortality, high marital fertility and high nuptiality levels of Italian Tuscany in 1427, a population well studied by HERLIHY and KLAPISCH-ZUBER (1978). The second one, with high mortality and marital fertility but low nuptiality, is a model of the French population in the first half of the eighteenth century. The third one represents northwestern Europe around 1870, just before the secular decline of fertility. The fourth one with the low mortality and marital fertility of western Europe in the 1970s, but with an intermediate nuptiality level, is halfway of the French population in the eighteenth century and Tuscany in the fifteenth century. Only the fifth population is not realistic, with the mortality and nuptiality level of western European populations in the 1970s, but with the marital fertility level of European populations before the demographic transition. So we have an experiment with three different levels of mortality, three levels of nuptiality and two levels of marital fertility[5].

The data in table 2 show that marital fertility is the principal factor explaining the variation in the mean number of brothers and sisters that has an individual, much more than mortality and nuptiality. When there is no fertility control, that number is similar, in spite of the great variation in the level of mortality and nuptiality, and only the individuals in the contemporary population with controlled fertility have significantly fewer brothers and sisters. Going into details, it is of interest to note the effect of late marriage: a reduction of about 20% of the number of brothers and sisters between Tuscany in 1427 and France in the eighteenth century. But those numbers are of live born children and mortality here have an effect only on the fathers during the reproductive life of the mothers. In the

[5] To ease the comparison with the original work by LE BRAS, the parameters for the second and the fourth demographic regimes are the same that the two regimes he used in the presentation of his model.

following sections, I will consider only the surviving kin, taking into full account the effect of mortality on kinship.

Table 2. Mean number of brothers and sisters in five different European demographic regimes

Zone and period ----------------- Demographic parameters	Tuscany, 1427	France, eighteenth century	North-western Europe, 1870	Western Europe circa 1970	Western Europe circa 1970 with natural fertility
Mortality	high	high	intermediate	low	low
Marital fertility	high	high	high	low	high
Nuptiality	high	low	low	intermediate	intermediate
e0	26	26	50	73	73
Age at marriage (W)	18.4	24.5	24.5	21.8	21.8
Age at marriage (M)	25.2	30.4	30.4	24.3	24.3
G	8.7	5.7	6.1	2.2	8.5
V	23.5	20.8	22.1	2.0	21.4
NBS	10.4	8.3	8.7	2.1	10.1

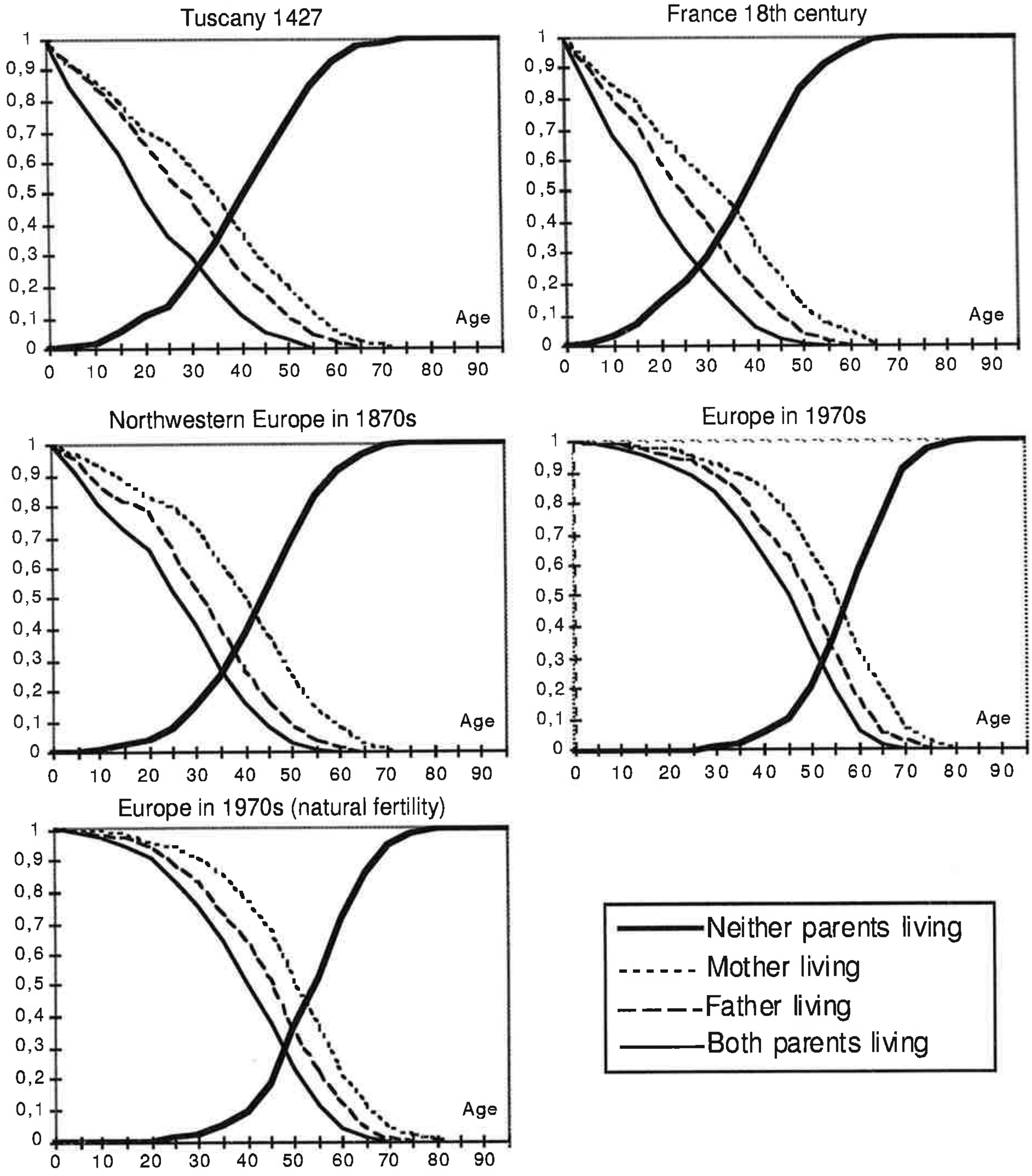
e0: Life expectancy at birth for both sexes. Age at marriage (w): mean age at first marriage for women. Age at marriage (m): mean age at first marriage for men. G: mean total fertility for women. V: variance of women's distribution according to the number of births at 50 years. NBS: mean number of brothers and sisters for an individual chosen at random.

2.- Survival of parents

The analysis of the size of the surviving kin group begins naturally with the presence of parents at each age of individuals. Figure 1 gives the probabilities of having both, each or neither parents surviving during the life of an individual, for the five demographic regimes defined in the preceding section. Logically, the level of mortality is the main determinant of the differences between demographic regimes, and the form of these curves is similar to the general mortality curves of these populations.

Nevertheless one can notice significant differences between populations with the same level of mortality. For example in Tuscany in the fifteenth century, the median age of orphanhood was 40.8 years while in France in the eighteenth century this age fell to 38.1 years. But this difference is much less than the one between age at marriage in the two populations, around 6 years. Late marriage did not result in a diminution of the same extent of the age at orphanhood because European preindustrial populations normally did not control fertility. So Tuscan women in the fifteenth century had a greater age interval of fertility than French women in the eighteenth century and the difference between their mean age of childbearing was smaller than the one for marriage: 29.6 against 32.2 years.

Figure 1. Probability that a person has his parents living during his life in five demographic regimes

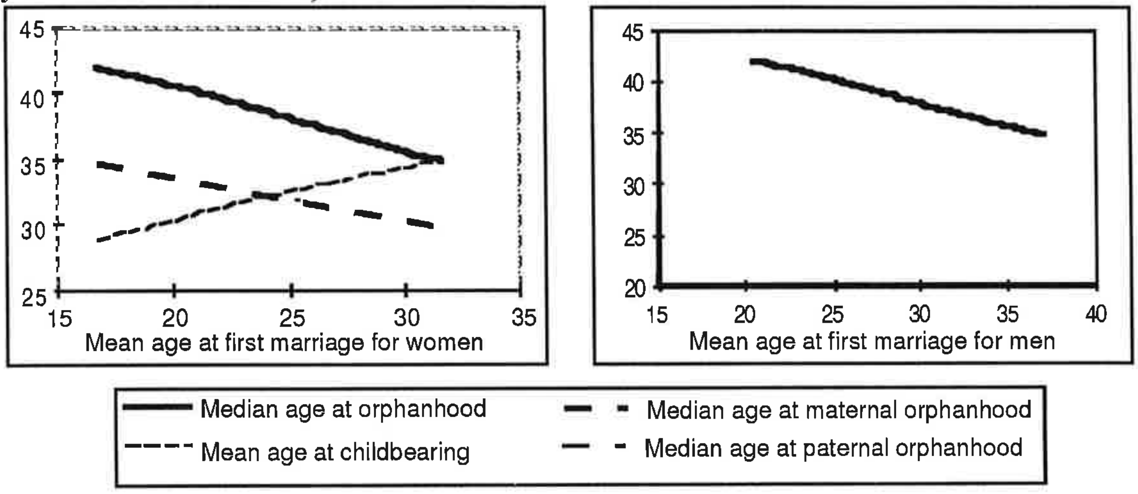


The effect of fertility control on orphanhood is clear when we compare the two populations with a low mortality. The median age at orphanhood is 54.3 years for the population with natural fertility and 58.2 for the population with fertility control, whose demographic regime is similar to that of Western Europe around 1970. The diffusion of fertility control during the twentieth century contributed indirectly to the increase of the probability of having the parents surviving during the life of their children. If one compares contemporary to preindustrial populations, more of 20% of the gain on the median age at orphanhood correspond to the generalisation of fertility control, through the reduction of the age at childbearing (6 years in this case)[6].

Nuptiality variations in European preindustrial populations were very significant. So it is interesting to study in a systematic manner the relationship between the age at orphanhood and the level of nuptiality. In order to do so, I calculated survival probabilities of parents for populations with a high mortality and without fertility control, for a large interval the age at first marriage of women (16.5 to 32 years) and for men (20.5 to 37.5 years) with a step of approximately 1 year (see figure 11). Figure 2 gives the results of this experiment in form of the relationship between the median age at orphanhood and the level of male and female nuptiality. One observes that orphanhood (absolute, maternal and paternal) goes up as a consequence of the postponement of marriage, but the reduction of the age of orphanhood is slower than the increase of the age at marriage. Precisely a variation of one year of the age at first marriage of women translated into a variation in inverse direction of approximately half year of the median age of orphanhood orphanage and a third of a year of the median age at maternal orphanhood (figure 2, left panel). The effect of late marriage on orphanhood levels were lessened by a slower increase of age at childbearing than the age at marriage, consequence of natural fertility (a variation of one year of the age at first marriage of women lead to a variation of only 0.4 year of the age at childbearing). The relationship between male nuptiality and paternal orphanhood is almost the same (see figure 2, right panel).

[6] The probability that a person of age **a** has a living mother is approximately equal to: $\mathbf{p(A_r + a) / p(A_r)}$, where $\mathbf{p(x)}$ is the survival probability at age $\mathbf{x}$ in the life table and $\mathbf{A_r}$ is the mean age at childbearing in the population, which has a value close to the mean age of childbearing. The same formula holds for the survival of fathers, using fertility for men. See LOTKA (1931)

Figure 2. Relation between orphanhood and the level of nuptiality in preindustrial European populations (Life expectancy at birth of 26 years for both sexes)



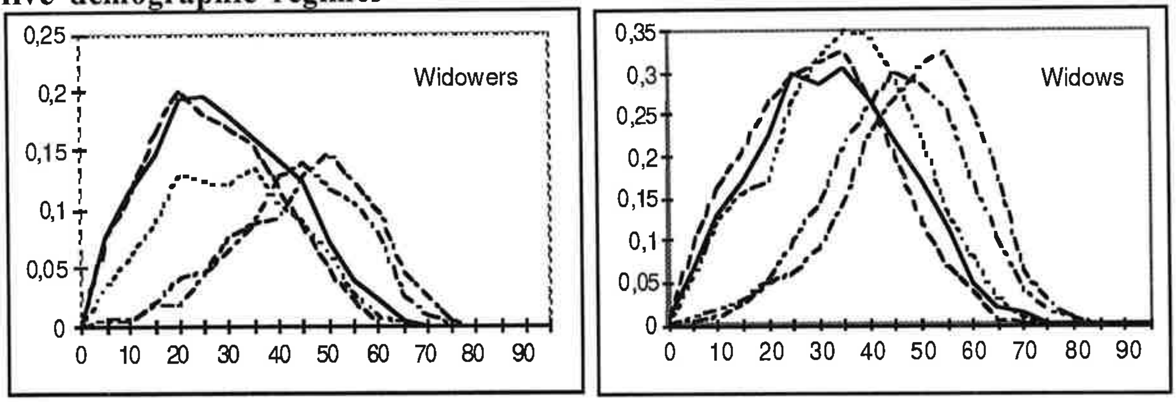
Another interesting aspect of the curves at figure 1 is the difference between the survival of the father and that of the mother. In all these demographic regimes the death of the father occurred normally earlier than that of the mother. This can be explained by the difference in the age of marriage -and therefore of the age at birth of children- between the two sexes, but also by the excess mortality for male. These difference between sexes are not equal in all the demographic regimes and the probability that a person have his father living and widower was greater in preindustrial populations that in contemporary populations. We can see that looking at the gap between the curve of survival of the two parents and the one for the father alone. This gap corresponds to the survival of the father when the mother was dead, according to the age of their children[7]. I have plotted the curves of survival of father as widower for the five demographic regimes at figure 3, on the left panel, and the corresponding curves for widows on the right panel. Male widowhood was clearly more important in traditional societies than nowadays. At age 20 approximately 20% of individuals had a father living and widower in populations with a life expectancy at birth of 26 years, while in contemporary populations the maximum is of 15%, reached at age 50. This difference is greater in relative terms: for individuals who had at least one of the two parents in life, between 20 and 30% of the cases corresponded

[7] I have to make clear that in the model I consider only first marriages, not remarriage. So the widow or widower state here is not the matrimonial status of parents but instead the situation of the children regarding the survival of their biological parents. That is here widow means 'widow of the biological father' and widower: 'widower of the biological mother' of the individuals considered here.

to father widower in preindustrial populations, when the children had between 15 and 55 years, against only 10 to 20% of cases for contemporary population and for children aged between 30 to 70[8].

For women, the absolute level of this probability to have a mother living and widow is very comparable between the five demographic regimes and the main difference is the displacement of these curves toward higher age of children for contemporary populations.

Figure 3. Probability of having a living father in widower state or a living mother in widow state according to the age of individuals in the five demographic regimes



Tuscany 1427 — France 18th century — Europe in 1870s — Europe in 1970s — Europe in 1970s (natural fertility)

3.- Effects of late marriage on the biological kinship

To extend the analysis of the preceding section, I consider now the kinship up to the second degree in the ascending and descending lines (grandparents, parents, children and grandchildren) and up to the fourth degree in the lateral lines (brothers/sisters, nephews / nieces, uncles / aunts and first cousins), but excluding grandnephews/grandnieces. I have included only biological kin, excluding kin by alliance (their inclusion would unnecessarily complicate the analysis). I give in tables 3a to 3d the mean number of living

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[8] Following the commentary in the preceding footnote, I can add that this high level of widowhood for men is an explanation of the importance of remarriage in the past societies. See DUPÂQUIER, HELIN, and others. (1981).

kin of each type at various ages of individuals for the four realistic demographic regimes of previous sections, excluding the case of the European contemporaneous population with natural fertility.

Table 3a. Mean number of living kin, in a stable population with the Tuscan demographic regime in 1427

		Exact age of individuals						
Kin	Max	0	5	20	35	50	65	80
Father	1.00	0.99	0.92	0.65	0.33	0.07	0.00	0.00
Mother	1.00	1.00	0.94	0.71	0.45	0.18	0.02	0.00
Brother/Sister	9.40	2.45	3.58	4.32	3.47	2.73	1.62	0.62
Grandfather	2.00	0.82	0.64	0.16	0.01	0.00	0.00	0.00
Grandmother	2.00	1.06	0.90	0.38	0.09	0.00	0.00	0.00
Aunt/Uncle	18.76	7.52	6.89	5.16	3.15	1.32	0.27	0.02
First cousin	63.71	16.76	20.27	25.96	23.19	17.91	11.05	5.15
Nephew/niece	31.93	0.10	0.30	3.74	10.52	14.11	12.09	9.01
Child	7.36	0.00	0.00	0.44	3.25	4.06	3.23	2.68
Grandchild	24.69	0.00	0.00	0.00	0.01	2.44	9.62	13.39
Total	161.85	30.70	34.44	41.51	44.45	42.83	37.89	30.87
Ascending	24.76	11.40	10.29	7.06	4.02	1.58	0.29	0.02
Lateral	73.11	19.20	23.85	30.27	26.66	20.64	12.67	5.77
Descending	63.98	0.10	0.30	4.18	13.78	20.62	24.93	25.08

Table 3b. Mean number of living kin, in a stable population with the French demographic regime in the eighteenth century

		Exact age of individuals						
Kin	Max	0	5	20	35	50	65	80
Father	1.00	0.99	0.90	0.59	0.26	0.04	0.00	0.00
Mother	1.00	1.00	0.93	0.70	0.42	0.13	0.01	0.00
Brother/Sister	8.10	2.31	3.33	3.60	2.98	2.28	1.36	0.46
Grandfather	2.00	0.56	0.38	0.08	0.01	0.00	0.00	0.00
Grandmother	2.00	0.87	0.66	0.19	0.02	0.00	0.00	0.00
Aunt/Uncle	16.22	5.97	5.55	3.95	2.15	0.70	0.11	0.01
First cousin	35.39	9.89	12.37	14.83	12.85	9.63	5.97	2.52
Nephew/niece	17.73	0.01	0.05	1.35	5.20	7.95	6.92	5.14
Child	4.97	0.00	0.00	0.10	1.93	2.89	2.44	1.91
Grandchild	10.97	0.00	0.00	0.00	0.00	0.32	2.91	5.68
Total	99.38	21.59	24.18	25.37	25.82	23.93	19.70	15.71
Ascending	22.22	9.38	8.42	5.50	2.86	0.86	0.11	0.01
Lateral	43.49	12.20	15.71	18.42	15.83	11.91	7.33	2.98
Descending	33.67	0.01	0.05	1.45	7.13	11.15	12.26	12.73

Table 3c. Mean number of living kin, in a stable population with the northwestern European demographic regime in 1870

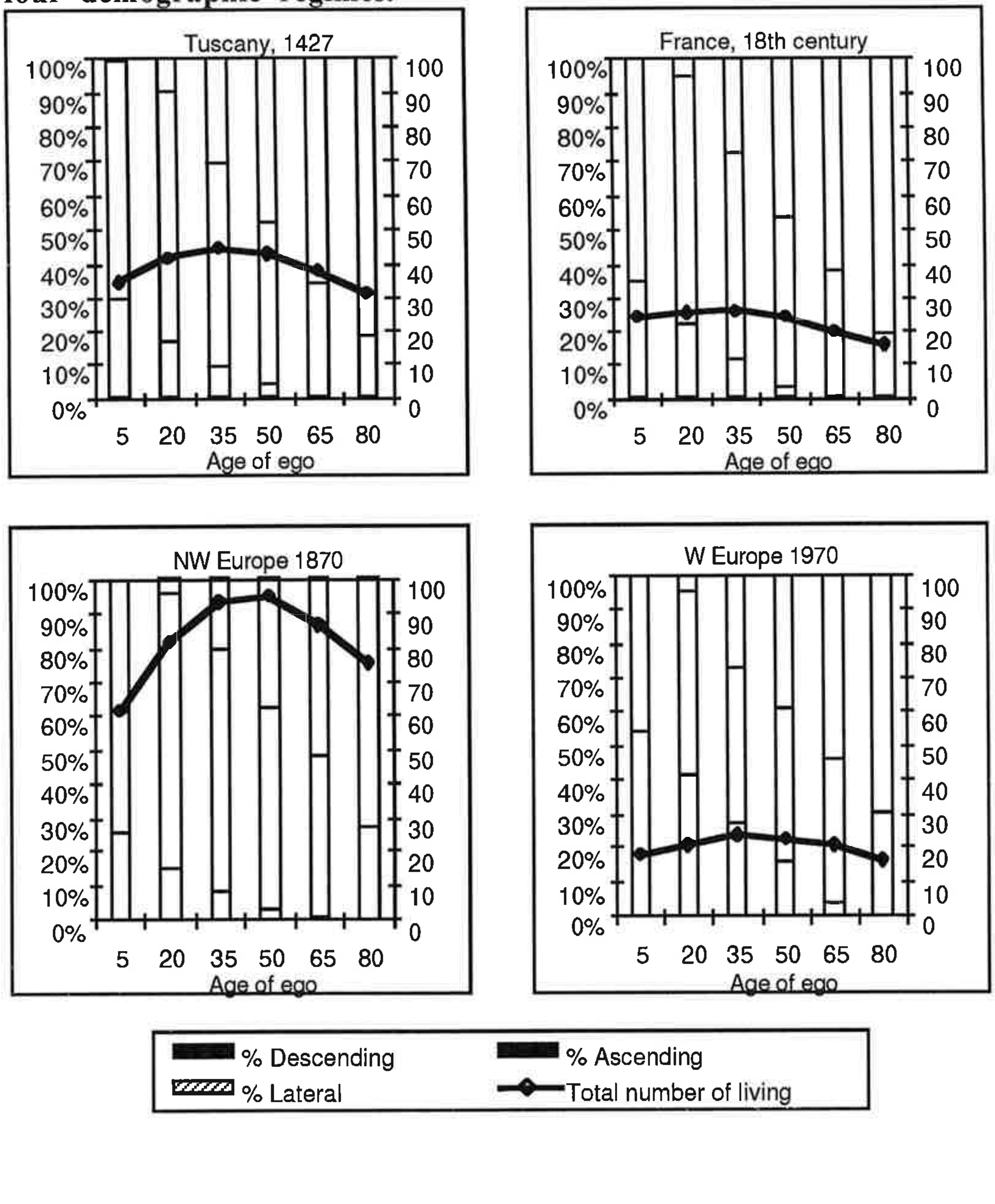
Kin	Max	Exact age of individuals 0	5	20	35	50	65	80
Father	1.00	1.00	0.95	0.76	0.42	0.08	0.01	0.00
Mother	1.00	1.00	0.97	0.84	0.60	0.22	0.02	0.00
Brother/Sister	8.73	3.40	4.92	6.65	6.23	5.27	3.68	1.65
Grandfather	2.00	0.81	0.59	0.15	0.00	0.00	0.00	0.00
Grandmother	2.00	1.18	1.02	0.35	0.05	0.00	0.00	0.00
Aunt/Uncle	17.43	12.48	11.89	9.74	6.39	2.53	0.52	0.04
First cousin	85.08	32.09	40.84	59.30	60.09	51.27	36.93	18.67
Nephew/niece	42.37	0.04	0.18	3.66	16.74	29.51	30.89	27.87
Child	6.35	0.00	0.00	0.10	2.90	5.33	5.31	4.57
Grandchild	30.88	0.00	0.00	0.00	0.00	0.75	9.11	22.24
Total	196.84	51.98	61.36	81.55	93.42	94.95	86.48	75.02
Ascending	23.43	16.46	15.42	11.84	7.46	2.83	0.55	0.04
Lateral	93.81	35.49	45.76	65.95	66.31	56.54	40.61	20.31
Descending	79.60	0.04	0.18	3.76	19.64	35.58	45.31	54.67

Table 3d. Mean number of living kin, in a stable population with the western European demographic regime in 1970

Kin	Max	Exact age of individuals 0	5	20	35	50	65	80
Father	1.00	1	0.99	0.95	0.83	0.47	0.08	0
Mother	1.00	1	1	0.97	0.91	0.68	0.21	0.01
Brother/Sister	2.09	0.95	1.88	1.99	2.04	1.93	1.63	0.85
Grandfather	2.00	1.83	1.74	1.25	0.41	0.03	0	0
Grandmother	2.00	1.92	1.86	1.57	0.70	0.07	0	0
Aunt/Uncle	4.16	4.08	4.04	3.94	3.54	2.27	0.58	0.02
First cousin	9.21	4.26	6.28	9.19	8.75	8.22	7.1	4.01
Nephew/niece	4.57	0	0	0.82	4.18	4.57	4.28	4.09
Child	2.26	0	0	0.23	2.14	2.17	2.21	2.09
Grandchild	4.97	0	0	0	0.01	2.17	4.96	4.99
Total	33.26	15.05	17.78	20.90	23.51	22.57	21.05	16.05
Ascending	10.16	9.83	9.62	8.67	6.39	3.52	0.86	0.03
Lateral	11.30	5.22	8.17	11.17	10.79	10.15	8.73	4.86
Descending	11.80	0.00	0.00	1.05	6.33	8.91	11.46	11.17

The number of living kin during the life of individuals can be compared to the maximum number an individual could have, given in the first column of these tables. This maximum is the number of live born kin of each type, restricted to those born 100 years before or 100 years after the birth of the individuals considered here, the 'ego' that are the starting points of our artificial genealogical trees. I have also aggregated all the kin types in three groups: ascending (grandparents, parents, uncles/aunts), lateral (brothers/sisters, first cousins) and descending (children, grandchildren, nephews/nieces) to gain a clearer view of the relation between generations in each demographic regime. The total number of kin and its distribution in these three groups for the four demographic regimes is represented at figure 4.

Figure 4. Total number of living kin and distribution into ascending, lateral and descending groups, at various ages of individuals (ego) in four demographic regimes.



The first observation is that the total number of surviving kin throughout the life of a person is very similar for western European populations in the eighteenth century (between 20 and 25) and in the second half of the twentieth century (between 18 and 23), while this number is greater, 50% to 90% higher according to the age of the person, in a fifteenth century population like that of Tuscany around 1427. That number was even higher in the populations of northwestern Europe around 1870, when an individual had typically 3 to 4 times more surviving kin during his life than a person a century before. The total number of kin grows in a multiplicative way with the degree of the kin relation, and the more numerous are the children of the brothers and sisters of ego (nephews/nieces) and the children of the brothers and sisters of the parents of ego (first cousins), consequence of the "sibling effect" explained in the first section.

The second observation is that the size of simple families, reduced to parents and children, was much the same in preindustrial populations and in contemporary one. If we take for example the mean sibling size (brothers and sisters plus ego) when ego was 20 years and if we add the mean number of parents, we obtain 6.7 for Tuscany around 1427, 5.9 for France in eighteenth century and 5 for Western Europe around 1970. If we exclude married brothers and sisters, to consider only nuclear families, then the mean size of family was probably very close in the three cases.

If we now take a look at the differences between the two preindustrial populations, the first one with early marriage, Tuscany around 1427, and the second one with late marriage, France in the eighteenth century, we can go a little farther than the previous observation about the reduction of the size of the kin group with the postponement of marriage. This difference in the total number of kin is due to the abundance of first cousins, nephews/nieces and grandchildren in Tuscany. The number of parents, of brothers and sisters that are the kin a person lives with and collaborates more narrowly, was almost the same in the two populations. So in the fifteenth century, the close kin group, the family group of young persons, formed part of a kinship network with a high density of kin and an individual aged between 20 and 65 years had 40 living biological relatives that could help or support him. In the eighteenth century, that number fell to 25, a factor that probably forced families to be more self-sufficient. But the reduction of the size of the kin group had its greater effect for the old. At 65 years and more, the number of living descending kin of a French in the eighteenth century was less than half than the same number for a Tuscan in the fifteenth century. This probably had consequences on the status of old persons in these two societies. In the late marriage populations, the position of the old was weakened, since they depended economically on fewer persons and because disappeared in part the figure of the patriarch, who exercised his authority on a numerous group of descendants (12 in France in the eighteenth century against 25 in Tuscany around 1427).

So Europeans aged 35 years had more living kin in 1427 than in 1750. Late marriage had a very significant effect on kinship, above all for kin of the third degree (uncle/aunt and nephew/niece) and fourth degree (first cousin). Another aspect of this effect of nuptiality on kinship is the eventual change in the age distribution of living kin at each age of individual (see figure 5 to 8 that give the age distribution of brothers, uncles/aunts, first cousins and the total of kin considered here, for an ego aged 35). We observe that there are very few differences in these age distributions of kin between the populations with natural fertility. The large age distribution of relatives in European past societies allowed the extension of solidarity and collaboration among kin for almost all the work life. An individual aged 35 had more relatives than nowadays, and they were also younger, susceptible of helping him in the activities that required a great number of persons, like the harvest or the construction of buildings. But this age dispersion also implied a faster renovation of the kin group. The group of brothers or first cousins could be very different in past populations for individuals at 20 and at 50 years. In contemporary populations, the age span between kin is smaller than in the past and the group of brothers and first cousins does not change much until a person reaches 65, what can contribute to reinforce, at least at the affective level, the relations between kin.

Figure 5. Distribution by age of living brothers and sisters for individuals at age 35 in different demographic regimes

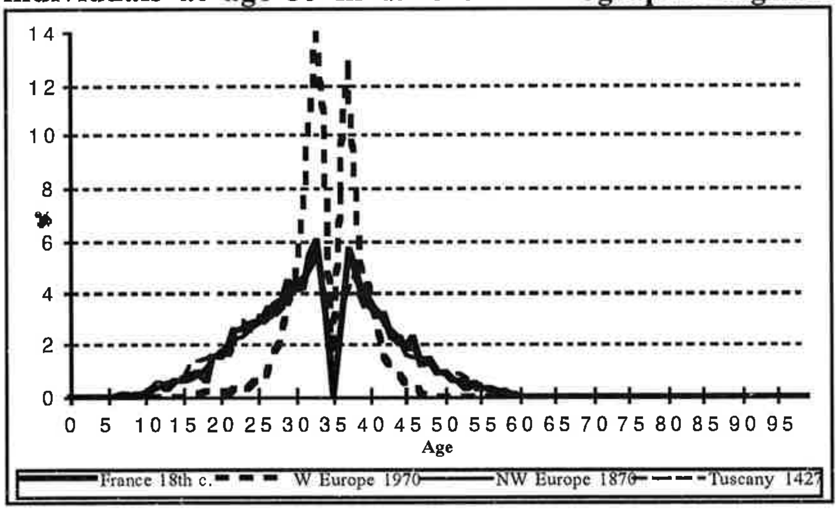


Figure 6. Distribution by age of living uncles and aunts for individuals at age 35 in different demographic regimes

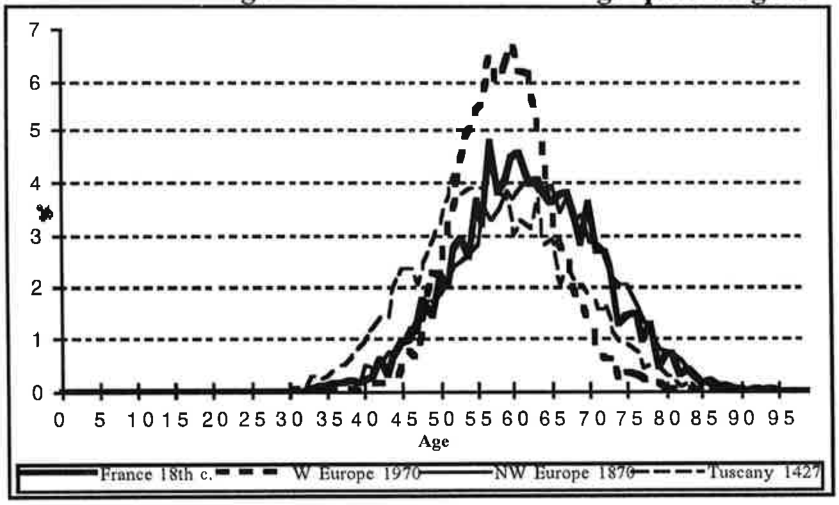


Figure 7. Distribution by age of living first cousins for individuals at age 35 in different demographic regimes

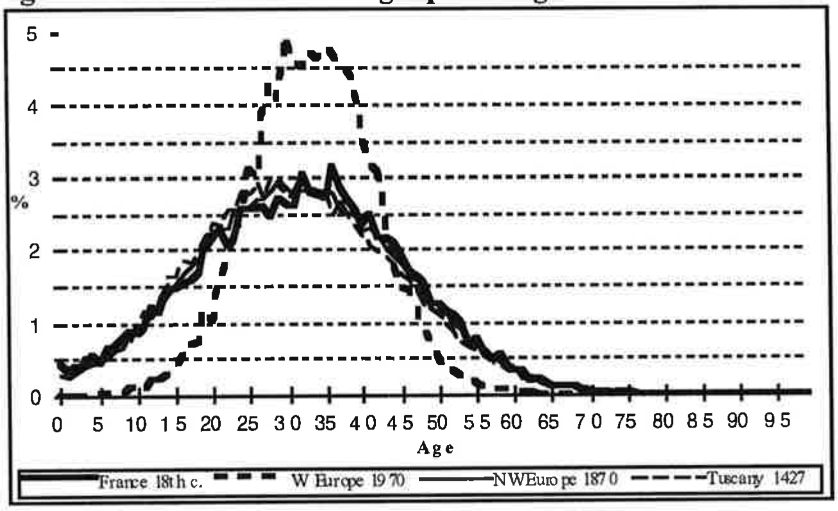
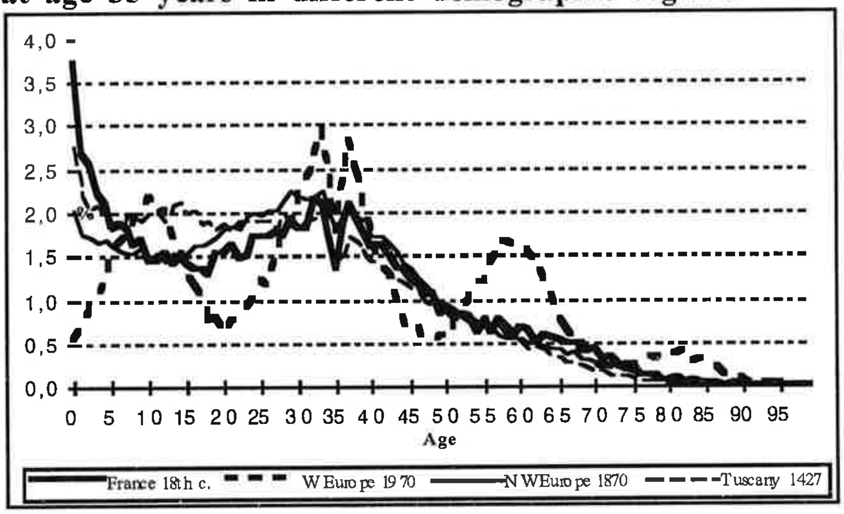


Figure 8. Distribution by age of living biological kin for individuals at age 35 years in different demographic regimes



The smaller age spread of kin in current societies also implies a greater distance between generations. For example the uncles and aunts now belong clearly to the generation of the parents. On the other hand in the populations of the past and above all in those with early marriage, a very significant proportion of the uncles and aunts had a similar age than some of the brothers and sisters of ego (45% of the uncles and aunts for a person of 35 years had less than 55 years in Tuscany in 1427). This age overlap of kin in the ascending and lateral groups in past societies explains why of the age distribution of the kin group of a person has a form very similar to the age pyramid for the whole population (see figure 8). Symmetrically the age distribution of the kin group in contemporary populations shows a greater distance between kin groups and therefore between generations. A person aged 35 has now substantially more relatives of his age (brothers, sisters and first cousins) of his age plus 25 years (parents, uncles and aunts), and of his age less 25 years (children, nephews and nieces).

So the main consequence of the postponement of marriage in preindustrial European populations was a reduction of the total number of kin that a person had during his life. This decrease in kin numbers did not affect directly families, because it was the number of first cousins, nephews/nieces and grandchildren that was mostly reduced. On the contrary the distribution by ages of kin was not affected by late marriage and did not suffer important variations before the twentieth century, when fertility control reduced the age difference between brothers.

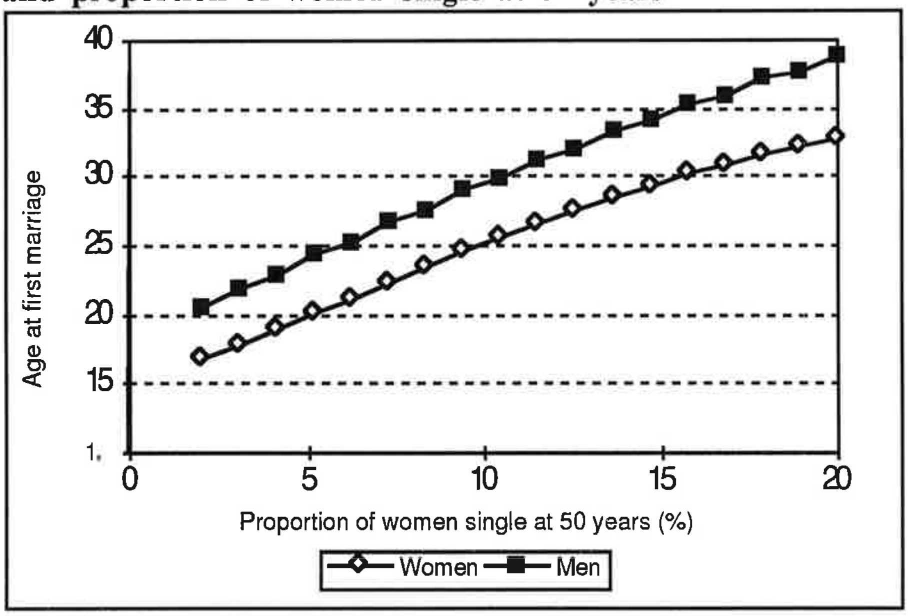
4.- The demographic dimension of late marriage

I will now focus on the analysis of the determinants of the European marriage pattern, as Hajnal names it. In this section I try to see if it is possible to discriminate between the theories of late marriage by a separate examination of the demographic dimension of age at marriage of women and age at marriage of men.

We can regroup the theories of late marriage taking into account what they attempt to explain: the postponement of marriage for both sexes, for men alone or for women alone. Theories that do not differentiate between male and female nuptiality generally link late marriage with modernisation. They tend to consider the consequences of the new nuptiality behaviour rather than their determinants. On the contrary theories that place the emphasis either on the age at marriage of men or of women give much more importance to their determinants. For example, one version of the 'homeostatic' model links age at marriage of men and the transmission of patrimony between generations. In this model the diffusion of the European marriage pattern is related to changes in the inheritance systems[9]. Another group of theories gives more importance to the delay of the age at marriage for women, building on the Malthus argument who saw the nuptiality as the main factor behind the "preventive check" to population growth. In this view a relation is established between individual behaviour and the growth rate of the population and the adjustment mechanism considered is more complex than in the 'male homeostatic' model[10].

My purpose is not to select between these theories, but only to see if the level of the age at marriage of women or of men resulting from the modelisation of their main arguments is compatible with the actual levels observed. For this, I built a wide range of male and female nuptiality distributions, using the formula given by COALE (1971) and used it in the microsimulation model.

Figure 9. Mean age at first marriage for men and for women and proportion of women single at 50 years



[9] An example of an elaborated model of 'male homeostasis' is OHLIN (1961).

[10] For example LE ROY LADURIE (1969) and WRIGLEY and SCHOFIELD (1981).

4.1.- The age at marriage of women

If we consider preindustrial populations, with a high mortality and without fertility control within marriage, the principal effect of late marriage was a reduction of the growth rate of the population to a value just above or under zero. As shows in figure 10, the relationship between these two variables is almost linear and a variation of 4 years of the age at first marriage of women corresponds to a reduction of about 10 for thousand of the growth rate, and a zero rate is achieved for an age at first marriage of women of 26 years. These observations give some weight to the argument that the European late marriage pattern was a response to the need of a reduction of demographic growth. But this relationship exists at a global level, and is only the result of the reproductive process of the population. It does not give us information on the mechanisms that drove the individuals to marry at an age that guaranteed a sustainable demographic growth rate for the population as a whole.

Figure 10. Relationship between the intrinsic growth rate of the associated stable population and the mean age at first marriage for women, in a population with high mortality (e0= 26 years for both sexes) and without fertility control

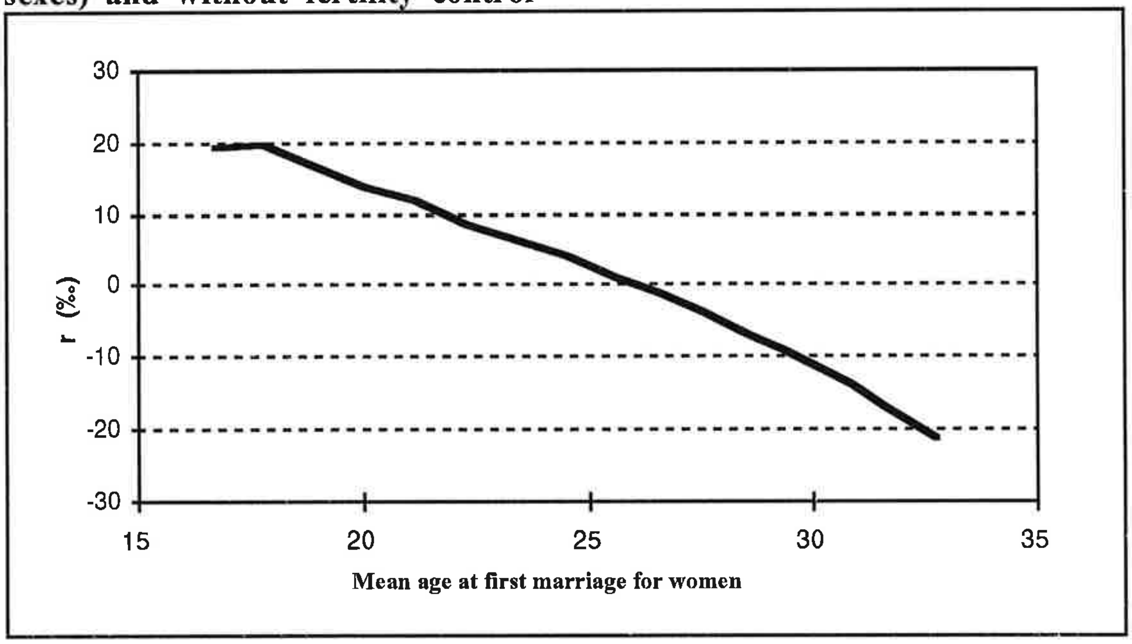
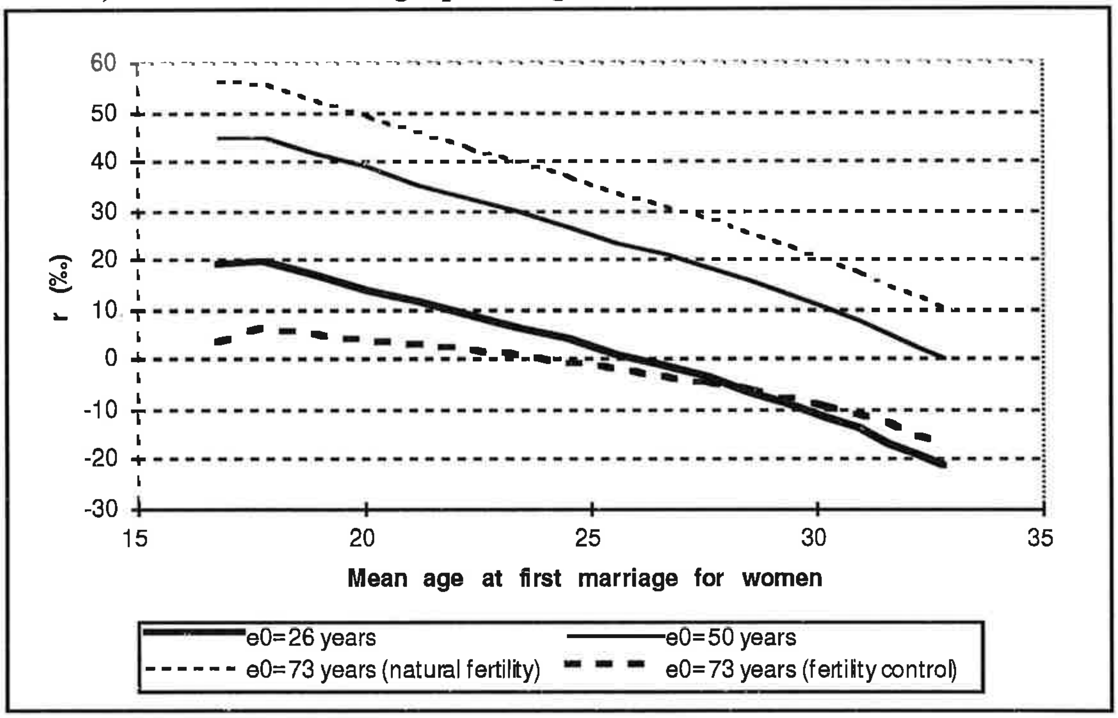


Figure 11 gives the same relationship between population growth rate and age at first marriage of women in four different demographic regimes. The first regime corresponds to the same preindustrial populations as in figure 10, the second to populations of north-western Europe around 1870, with a life expectancy at birth of 50 years for both sexes, and the third and the fourth regime to populations with low mortality, a life expectancy of 73 years, with or without fertility control. An examination of these curves reveals that nuptiality is an effective adjustment variable for demographic growth, at any mortality level, but not enough to obtain a zero growth rate when the life expectancy is higher than 50 years. Fertility control is a much more effective method to limit and maintain the growth rate of the population around zero, when the mortality is at the low levels of European populations in the twentieth century.

Figure 11. Relationship between the intrinsic growth rate in the associated stable population and the mean age at first marriage of women, in different demographic regimes

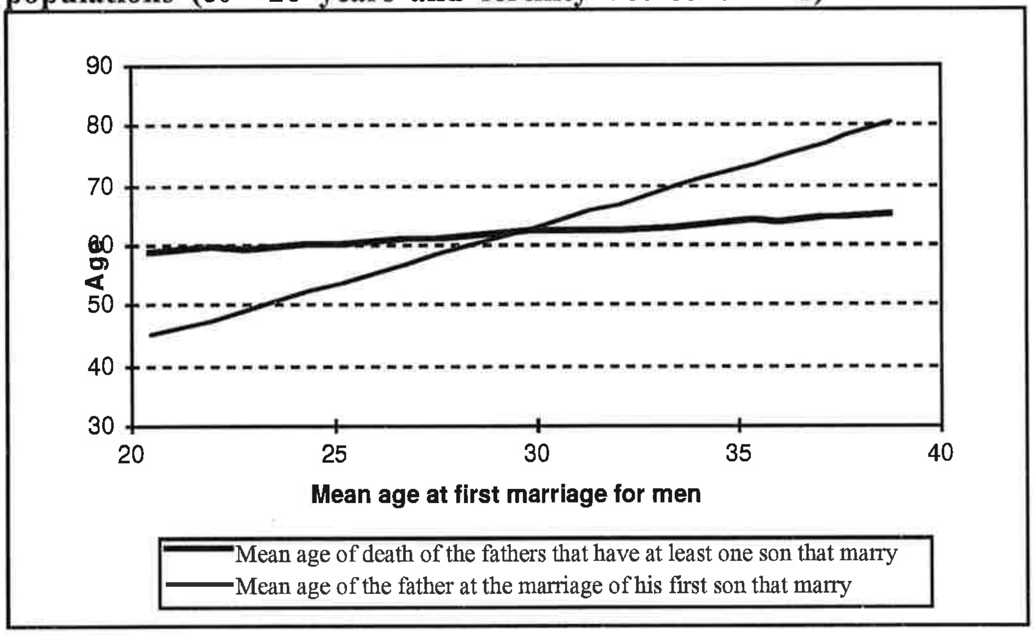


4.2.- The age at marriage of men

The theories that consider the age at marriage of men as the most important variable in the European model of nuptiality generally make the supposition that marriage was linked to the transmission of the patrimony between generations. I have tried here to examine this relationship making the hypothesis that the transmission of the patrimony takes place when dad died, the father being very often the family head. For this I have again used the microsimulation model for the full range of variation of nuptiality defined above, for the same four demographic regimes. I have reduced the sample of genealogical trees obtained from the model to those with fathers of ego who had at least one son that marry. I have calculated then the mean age at death of these fathers and the mean age they would have in the moment of the marriage of their first son who marry.

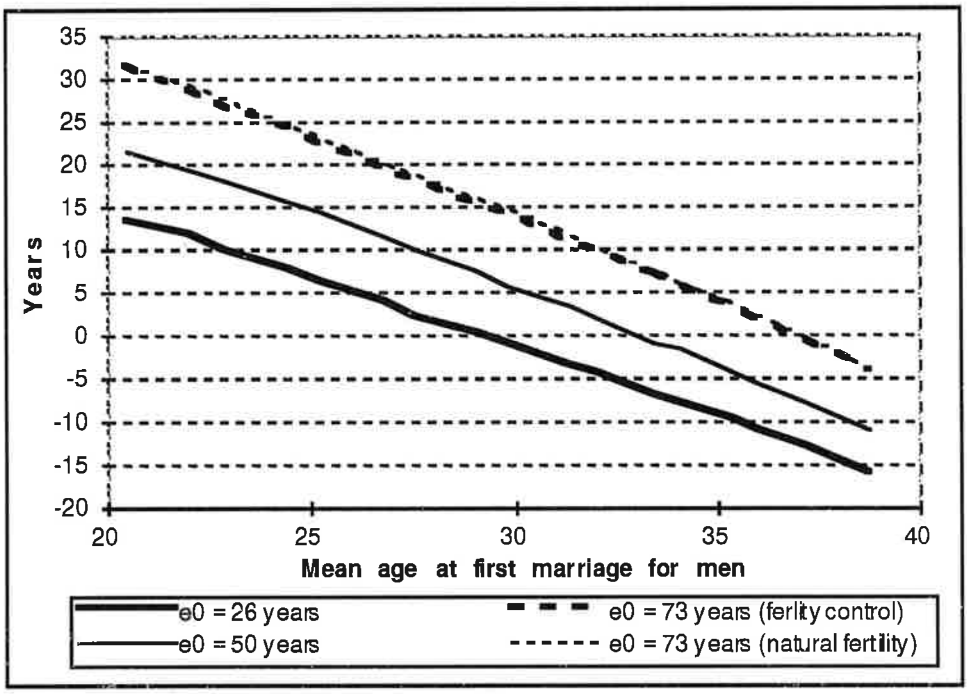
Figure 12 gives the results for France in the eighteenth century, a preindustrial population with late marriage. The two curves intersect at an age at marriage of men of 29.5 years, which is in the middle of the age range of marriage observed for late marriage populations. So the first son that married tended to do it just before or just after the death of his father, what gives sense to the hypothesis that a change in the inheritance systems coincided with the generalisation of the new standard of nuptiality.

Figure 12. Mean age at death of fathers with at least one married son and mean age at the moment of the marriage of their first son that marry, according to the nuptiality level, in European preindustrial populations (e0= 26 years and fertility not controlled)



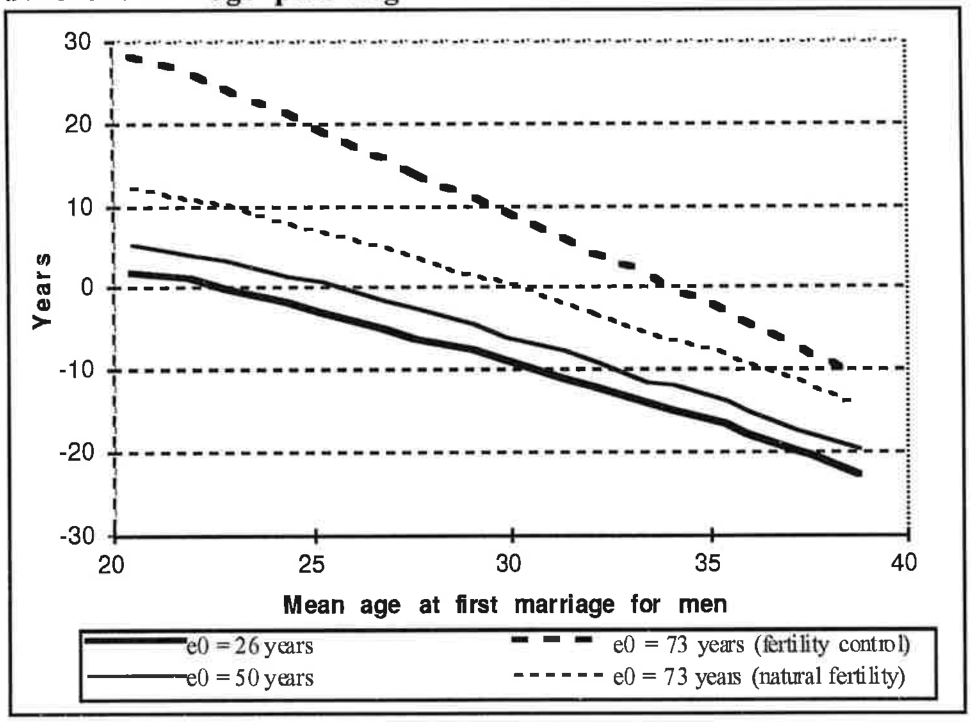
Another way to consider the two mean ages of father in figure 12 is to calculate the difference between both. This gives us the mean number of years that lives a man after the marriage of his first son that marry, a number that is negative if fathers die before that marriage. I have calculated this number for the four demographic regimes (figure 13). What is more surprising in these results is that the gain in this number of years lived by a father is not proportional to the increase in life expectancy. The number of years gained by fathers when the life expectancy at birth increased from 26 years to 50 years is inferior to the gain for an increase of life expectancy from 50 to 73 years. This is explained by the fact that infant mortality was still very high at the end of the nineteenth century and many of the first-born sons died before being able to marry. On the other hand, in contemporary societies, nearly all the first-born sons reach the age at marriage. This latter fact explains also why there is no differences in this number of years lived by a father between the two populations with life expectancy of 73 years, with or without fertility control within marriage.

Figure 13. Mean number of years that lives a father after the marriage of his first son that marry, according to the level of nuptiality, for different demographic regimes



The same analysis can be conducted for the survival of fathers at the moment of the marriage of their last son that marry (figure 14). In a population with high mortality and fertility, the father died long before this marriage, about 10 years in the European populations of late marriage. The same happened still in nineteenth century European populations. It is only in populations with low mortality and fertility that fathers live a significant number of years after the marriage of all their sons, in part because in much case they have only one son.

Figure 14. Mean number of years that live a father after the marriage of his last son that marry, according to the level of nuptiality, for different demographic regimes



5.- Conclusions

This experiment with a microsimulation model was an attempt to gain a better understanding of some general consequences of late marriage in Europe between the sixteenth and the eighteenth centuries. It allows us to make a diagnostic of the situation of individuals and their families in this time and to study some of the possible determinants of the new nuptiality pattern. The first conclusion is that the size and composition of simple families, reduced to the parents and unmarried children, did not change much with late marriage and its effect on kinship was significant only on the number of first cousins, uncles and aunts, grandchildren an individual had at each age. The second conclusion is that the position of the old person was probably worse than in the times of early marriage, due to the reduction of the kinship network density for individuals aged 65 and more. The third conclusion is that the main hypothesis of the 'male homeostatic' model and of the 'preventive check' model are compatibles with some of the demographic dimensions of late marriage, so a pure demographic model is not sufficient to discriminate between the theories of late marriage.

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