The Determinants of the Reproductive Behavior during the Pre-Transitional Period: the Case of the Rural Hinterland of Bologna in XIX Century

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Abstract

This work examines the evolution of the reproductive behaviour in two parishes of the rural hinterland of Bologna during the period between 1818 and 1900. The research studies the effect of the socio-economic transformation on the changing mechanisms of fertility by using micro-level data with a longitudinal approach at the beginning of the demographic transition.
The results confirm the hypothesis that the premature death of the last child born reduces the interval between two consecutive childbirths, thus confirming the importance of breast-feeding. From the socio-economic point of view, the women living in the complex sharecropping households experienced a significant and higher risk of childbirth than the women in the daily wagers' families. In addition, the reproductive behavior of the sharecroppers seemed to be substantially invariant to the short term solicitations, whereas the laborers' group experienced a negative price effect. Both the descriptive and the multivariate analysis indicated a slight and gradual decrease of the fertility levels over the period in question.

The Determinants of the Reproductive Behavior during the Pre-Transitional Period: the Case of the Rural Hinterland of Bologna in XIX Century

Rosella Rettaroli – Francesco Scalone

Introduction

These pages contain some first results of a wider research project which aims to reexamine the fertility transition in Italy adopting a micro-data point of view (Breschi and alt., 2009). The present study considers the communities of San Donnino and San Nicolò di Villola, two rural parishes situated in the suburban area of Bologna. The focus is on the main determinants of the reproductive behavior during the pre-transitional period spanning from the natural fertility regime to the onset of the fertility decline. In the area under study important social and economic transformations were about to take place. Thus it might be extremely useful to better highlight the effects of these transformations on the leading mechanisms of the fertility decline.

Before the fertility transition, the reproductive behavior was determined by the combined action of both bio-demographic and socio-economic factors. On the one hand, the fertility career of a woman was strongly conditioned by several biological determinants that were connected to fecundity, exposure to sexual intercourse and breastfeeding. On the other hand, couples were able to adopt norms and behaviors according to their own material conditions and their family and socio-economic context. In our view, the reproductive decisions of the couples were determined by conscious and active choices constantly revaluating needs and sources.

In this context, the rural hinterland of Bologna offers a very interesting socio-economic profile, since it was characterized by the typical Italian sharecropping economy based on large-scale families (Barbagli, 1984). So our purpose is to confirm the hypothesis that even in the pre-transitional era the reproductive behavior was significantly shaped by the specific features of the domestic economy and the family context. Previous studies have already shown the kin influence on the female reproductive behavior in pre- and post-transitional periods (Tymicki, 2004) and the peculiar fertility level of the sharecropper families (Breschi, Manfredini and Rettaroli, 2000). From this point of view, in the sharecropper families a newborn represented an economic value since light agricultural tasks were carried out by childreen (Kertzer and Hogan, 1989). On the other hand, the younger and older women living in the large complex families could offer an immediate support in child caretaking reducing the opportunity cost of the childbirth. In addition, it is important to test if the socio-economic transformation of the late nineteenth century impacted on the family context and consequently – according to our hypotheses - on the reproductive behaviors.

Because the aggregative approach is definitely unfit to focus the attention on the in-depth mechanism of the reproductive behaviors, a micro-analytic approach is adopted basing on a combination of parish registers and Status Animarum. The process of longitudinal reconstruction

here proposed goes beyond the traditional family reconstitution, since it takes into account not only the sequence of events in the individual life history, but it also determines the female population at risk of experiencing the childbirth. Moreover our reconstruction matches the birth of a child with the maternal reproductive history, the socio-economic status and the household structure.
The results will be compared to the findings from another study on the reproductive behavior in two central Italian villages, Madregolo in Tuscany and Casalguidi in the area of Parma (Breschi, Manfredini and Rettaroli, 2000). The comparison is possible since the other two communities were studied by using the same sources, longitudinal approach and discrete event-history model.

In the following paragraphs we summarized the main background studies and the brief description of the study area. Then the used parish data will be presented. Afterwards we discuss the longitudinal reconstitution process and the adopted event history approach. Finally we present the empirical findings followed by a concluding discussion.

Background

According to the results obtained more than twenty years ago by the Princeton Project (Coale and Watkins, 1986), as regards Italy and the most part of the European countries it is difficult to point out a unique set of factors and causes that lead to the fertility transition. In fact, the Princeton Project recognized that in conjunction with the different historical and demographic contexts more than one demographic transition could exist. In addition it was concluded that macro analysis and short temporal scales are not adoptable to find out the timing of the fertility transition.
Regarding Italy, more recent aggregative studies (Del Panta et al. 1996, 2002; Dalla Zuanna et al. 2004) have confirmed that the timing of the Italian transition was considerably different from area to area, and that great differences could exist even inside the same regional areas. Such variability included the fertility patterns. Thus from a micro level point of view, our approach hypothesizes that reproductive behavior was conditioned not only by the biological factors but also by more complex decision processes involving the couples, the extended families and the network of relatives. Moreover, it is expected that all these micro contexts interacted with the economical and social frameworks of the communities. Consequently, our analysis is focused on the various mechanisms which provoked the great passage from the episodic post-birth control towards a more conscious planning of the births outcome involving the entire reproductive career.
According to the hypothesis that we intend to verify in our analysis, a brief synthesis of the main reproductive determinants in the pre-transitional Bologna's area is given in this following section.

Socio-economic conditions and domestic economy

Before the industrialization, the plains close to Bologna were mostly populated by two social groups tied to the agricultural sector: those who were bound by sharecropping contracts and those engaged in wage labor. Nonetheless, after the national unification of 1861, the traditional sharecropping economy steadily reduced under the impact of a rapid development of large-scale, capitalist agriculture which took place in the plains to the north-east of the town. However, important contingents of traditional sharecropping households still remained well into the twentieth

century in the southern hilly area and in the northern zone bordering on the city (Bellettini and Tassinari, 1977; Kertzer and Hogan, 1989).
Since the economy played a strong role in the household settlements, the large complex-family household was common for centuries on these lands (Barbagli 1984). Indeed, under the pressure of their landowners, the sharecroppers could not abandon the multiple-family household living and they continued to have large numbers of children and to live in large complex-family households (Poni, 1977). In their study on Casalecchio, a rural village in the neighbourhood of Bologna, David Kertzer and Dennis Hogan (1989) observed that sharecroppers, for whom a large family remained an economic necessity, showed no sign of a fertility decline, despite the changed fertility behaviour of all the other groups surrounding them. While the wage earners experienced a greater decline in fertility between the nineteenth and twentieth century, that didn't occur in the sharecropper families as children contributed to agricultural activities. Furthermore, several studies on other rural European communities show that lower status group and rural laborers were characterized by lower fertility levels during the pre-transitional period (Bengtsson and Dribe, 2006).

Influences of the family context

It was observed that the co-resident domestic group performed the function of providing security for the individuals and this could be the case of the Italian "mezzadria" sharecropping households (Laslett, 1988). It is so conceivable that the household support was not limited to the survival of the individuals, but it involved all the aspects of the family life. From this point of view, it is possible to suppose that the so called "nuclear-hardship" hypothesis could play some direct roles even in the decision process concerning the childbirth. It may be assumed the wives in the nuclear families did not benefit from any kind of support in childcare, whereas the mothers living in large-scale domestic groups could rely on the solidarity of the other female residents. Moreover, recent studies on a Polish historical parish have suggested that the fertility risks were strongly influenced by various kin groups with a strong effect at higher parity (Tymicky 2004, 2008). In these terms, our purpose is to provide further evidence of the way in which the family system was able to shape the demographic processes since the decisions about marriage and reproduction were often made in the context of family and reflected the structural characteristics of the household (Skinner, 1997).

Short term economic variations

It is also necessary to verify the possible short term relationship between annual variations in grain prices and annual fluctuations in fertility. Indeed, some scholars presented evidence that fertility was deliberately controlled also before the fertility transition (Bengtsson and Dribe, 2006) by taking into account a rural area characterized by natural fertility and using survival analysis on a longitudinal data at the individual level combined with food prices. Previous macro-aggregative research found that fertility was significantly negatively correlated with grain prices in Northern Italy (Breschi and Malanima, 2002). However, variations in fertility resulting from fluctuations in grain prices may be caused by several determinants which can be grouped according to biological or behavioral criteria. This theme of the possible deliberate control before the fertility decline will be also tested.

Period effect and the onset of the fertility transition in a suburban hinterland

During the nineteenth century, the pre-transition fertility rate of married women in the region of Emilia-Romagna was very stable and it showed initial signs of decline only after the first decade of the twentieth century (Del Panta and Scalone, 2002). In contrast, the province of Bologna was the only one of the region which saw the beginning of a slight fertility decline from the last decades of the nineteenth century (Del Panta, 1997). However, when the process of demographic transition took place in the province of Bologna, the fertility decline began earlier in the centre of the town than in its rural surroundings. In Bologna the marital fertility of the elite declined first as was the case in much of Europe, whereas the fertility of artisans, merchants, and wage earners declined later (Schiaffino 1993). Substantially the processe of fertility decline could be considered a behavior diffusion which propagated within different territorial zones and social strata. As showed by Bongaarts and Watkins (1996), some populations entered the transition process more as consequence of a diffusion of reproductive behaviours from neighbouring areas than for their own specific conditions.

Bio-demographic factors

Finally, we have to control the effect of the bio-demographic factor since prior to the modern fertility decline the reproductive behavior was driven largely by human biology. So varying fertility levels were consistent with a "natural fertility" regime in which the control of fertility was not related to family size. Indeed, also in pre-transitional populations marital fertility rates could vary considerably according to mother's age, maternal health, length of breastfeeding, or post-partum abstinence (Henry 1961; Coale 1986). These factors could reduce the family size but were not considered acts of deliberate fertility control (van de Kaa 1996; Mason 1997; Saito 1996). In a preceding work, for two rural villages in Tuscany and Emilia-Romagna, other authors showed that the "substitution effect", which means the probability of having another child within a year, appears as being very strong but with a certain decrease in the inter-genetic interval when the death of the first child occurs, thus confirming the importance of breast-feeding, weaning and spacing out births (Breschi, Manfredini and Rettaroli 2000). In situations where breastfeeding is rare and short, the relationship will be far weaker than where breastfeeding is common and it has a long duration (Knodel 1988). Assuming that in the rural area of Bologna the proportion of breastfed infants was consistent, a strong relationship of this kind is expected.

Area

We will focus our attention on the reproductive behavior from 1819 to 1910 of two rural parishes situated in the north-eastern hinterland of Bologna, in the Emilia-Romagna region. Both the parishes, San Nicolò di Villola and San Donnino, demonstrated some features that make them of historical and theoretical interest: these two rural communities are included in a context widely studied at a macro-analytic level. In previous studies, various areas of the Emilia-Romagna region have been already analized in term of long run demographic development (Bellettini 1987; Schiaffino 1993; Del Panta and Scalone 2002).

In addition, another micro-analytical study on Casalecchio offers many precious results to compare (Kertzer and Hogan, 1989). This community is located on the south-western hills zone bordering to Bologna, in the same suburban area less than ten kilometers from the two parishes under study.

The suburban territorial area of Bologna was defined by the Catholic Church in order to organize the ecclesiastic activities outside the urban center and it included all the bordering rural parishes. This area was named "suburbio" and it circumscribed the close countryside within a distance from 5 to 12 kilometers. For many centuries, there were strong and important relationships between the town and its bordering rural zone. From the demographic point of view, the rural hinterland continuously originated the migration flux that fed the population of Bologna. On the other hand, the agricultural economy of the suburban territory provided the foodstuffs and rural manufactured products for the urban market. Actually, during the nineteenth century the suburban zone was entirely dedicated to the agricultural activities and it experienced the urbanization process only after the beginning of the twentieth century.
In order to provide a brief summary of the population trends in San Donnino and San Nicolò, table 1 shows the total amounts of population, the number of families and the average dimension of the households during the period in question. It is possible to see that in 1820 there were 881 inhabitants in the two considered parishes. This figure rose up to over 1000 in 1840, and reached 1158 units in 1900. On the other hand, the number of families increased from 134 to 182 household. However, the parishes of San Donnino weighed more than San Nicolò of Villola in terms of population. At the beginning of the examined period the difference between the two parish populations measured about 90 inhabitants whereas it increased until 250 at the end of the interval.

Table 1 around here

The population and the families of San Nicoló remained stationary during the whole period in question. In contrast, the population of San Donnino grew from 487 to 704, and experienced a higher population increase which was equal to + 44.6 per cent.
In both parishes (again table 1) the augmentation of the family components appears equal to the registered increase of the families. Thus the average dimension of the families remains stable during the entire period in question, varying from 6.6 in 1820 to 6.4 in 1900.

By adopting the same classification scheme proposed by Peter Laslett, table 2 shows that the nuclear type prevailed during the entire period in question. However, the percentage of nuclear structure was lower than the universal levels that were registered in other parts of Italy and Europe (Barbagli, 1984) in that period. In fact, it is also possible to note the fair proportion of multiple households which were the typical structure of the sharecroppers' families. Although this kind of household remained widely spread in these territories during the period of observation, his percentage reduced slightly in the last decades of the century in consequence of the agrarian economy transformation.
Besides this, at table 3 we consider the socio-economic profile of the two parishes. Unfortunately, the occupational condition was not always reported in the Status Animarum, since it was not necessary for the ecclesiastical purposes. Indeed, the registration of this important information depended on the sensitivity of the parson and the proportion of the "unknown" professions varied

visibly during the period of observation. However, for the three years from 1859 to 1861 we registered the lowest proportion of unknown cases. As table 3 shows, the sharecroppers' families prevailed (44.5 per cent) on the others and the most part of them lived in complex-multiple households. As it was already observed for the nearby community of Casalecchio, the sharecroppers are confirmed to be the group with the most traditional system of family organization (Kertzer and Hogan, 1989).

Table 2 around here

Table 3 around here

In addition, the demographic system of these two parishes presents the typical features of sharecropping societies. Late marriage for men and women and high levels of permanent celibacy, TFR around 5 children per woman, and e_0 values about 40 years in both parishes.

Table 4 around here

Turning to the fertility levels, the rates of the two parishes in the Bologna hinterland area are reported at table 5. A comparison is also provided with regard to Madregolo in the Emilian province of Parma, and Casalguidi in Tuscany (Breschi, Manfredini and Rettaroli, 2000).
According to table 5, the total fertility rates of the two suburban parishes were around 5 (4.6 for San Donnino and 5.2 for San Nicoló). Focusing on the total marital fertility rate from age 20, San Donnino registered 6.6 children per married woman, whereas San Nicoló was characterized by a level of 7.3. However, both observed values are consistent with the typical pre-transitional fertility levels. Even if San Nicolò experienced the same total fertility rate of Casalguidi (5.2), the parish of San Donnino shows lower levels of fertility. This difference could be explained by considering that San Donnino was situated at the border of the urban area which was already characterized by a lower reproductive outcome (Schiaffino, 1993). From this point of view, the lower fertility of San Donnino could be due to the urban proximity, implying a tighter relationship with the town, like fluxes of female servants.

Table 5 around here

Table 6 around here

Considering the household type and the socio-economic status, it is possible to register further differences in the marital fertility levels (see table 6). The multiple families and the sharecroppers group stand out for their higher marital fertility (7.3). This occupational difference in fertility levels is consistent with the previous findings from Casalecchio where sharecroppers, for whom large families and children were an economic necessity, showed higher fertility levels.

Comparing the two periods 1819-1860 and 1861-1900, it is also possible to see a slight reduction in the marital fertility level (20 to 49 years). Indeed, the total marital rate declines from 7.1 to 6.6. According to these measures, this slight reduction in fertility seems to have occurred earlier than in

the other areas of the region (Del Panta and Scalone, 2002). For the second period from 1861 to 1900, the marital fertility rates decline at the later reproductive ages, involving women that had probably achieved their desired family size and were actively preventing the birth of additional children. Actually, the deliberate stopping was the main behavioral mechanism that led to the fertility control regime and it also was the most important change in the reproductive behavior during the onset of the fertility transition. These considerations lead us to test the possible existence of deliberate fertility control in the two suburban parishes. At table 7 the Coale and Trussell's indices (1974; 1978) are reported. Both suburban communities show m figures in 1819-60 around or below 0.2, proving that the natural fertility regime still exists in this area during the first half of the nineteenth century. In the period following the Italian unification (from 1861 onwards), these parishes show higher m figures, which support the idea of the existence of a fertility pattern shaped by early signs of parity specific-control.

Table 7 around here

Data

The data available in the two parishes of San Nicolò di Villola and San Donnino are based on the Status Animarum and the registers of births, deaths and marriages from 1819 to 1900. Indeed, the ecclesiastic registers represent the main available demographic sources in the area of Bologna during the modern age (Bellettini e Tassinari, 1977). Until the National Unification of 1861 and with the only exception of the short period of the French domination, the registration of the population and the demographic movement was exclusively managed by the Catholic Church as it was on the entire Papal State. Considering the vital events, all the registers of deaths and marriages are still available in the parish archives for every year of the period in question. Regarding the registrations of the births, these data were recovered from the baptismal font of the Cathedral of Saint Pietro in Bologna and from the parish of Corticella bordering to the two parishes under study. On the other hand, the used Status Animarum was collected directly from the Bishop Archive of Bologna, where they are still kept.

It is worth to briefly summarize the main characteristics of the used sources. First, the parish registers provided the necessary nominative information about all the births, deaths and marriages that took place in the territory of the parishes. The acts report individual names and surnames, other information concerning paternity and maternity, as well as the date of the event. On the other side, during the entire modern age, the Status Animarum represented the main demographic documentation to evaluate the amount and the evolution of the population in Italy. For this reason, it remained the most important source until the end of the nineteenth century as well, while the administration of the new national state was still trying to organize the modern statistical service. This source was a sort of census drawn up by the parish priest each year, during the Easter period. It reported information by household, listing member name, sex, age, marital status, paternity and maternity for each family. In some cases, before the period under study, it was possible that the parson did not register all the children since they were excluded from the Holy Communion. However, the most severe underestimation could affect the people of other religion, the Jews or the soldiers in the garrisons which were not reported in the list. However, all these lacks are not able to produce evident biases on the fertility estimates.

The data of San Donnino and San Nicoló stand out for quality and completeness, since the annual series of the registers cover a very long period with trivial interruptions. For San Donnino, during the period from 1819 to 1900, Status Animarum is not available only for the 1823. In the San Nicoló case, in the few years when the Status Animarum was not compiled, the parson listed all the variations concerning the population, permitting to recover the necessary information.

Unfortunately, the occupational status of the head of the household was not systematically registered in the Status Animarum, since this information was not considered so necessary for the Catholic Church purposes. As a result, the available information on the occupations varies considerable on each period. After the middle of the nineteenth century, the occupational condition in the Status Animarum of San Nicolò was registered every year. In contrast, the problem persists in San Donnino, where the professional information was available for every case only in the Status Animarum of 1859, 1860, 1863, 1875.
In order to classify the socio-economic status, a basic classification scheme was adopted. First, the "laborer and daily wager" group includes the rural and unskilled workers that were named "braccianti" and were employed on daily basis. They were the poorest and lowest social group, since their condition was precarious. The second category was composed by farmers who possessed small size farm and sharecroppers who could rely on a stable contract with their own landlord (Poni, 1977). Then, the "middle class and bourgeoisie" category is a mixed group that contains local business men, innkeepers, teachers and landlords. Finally, we decided to locate the artisans into a separated category since they were not directly involved in the agricultural sector.
In many cases, the occupation of the household head was reported only once. It is highly probable that the parson did not report the information in the next years because the household head did not change professional status. In these cases we inferred the information on the following years by assuming the known occupation of the first year.

After collecting the data, the information contained in the various sources was preliminary linked on nominative basis in order to reconstitute the individual biography. It was also possible to include the childbirths into the histories of the married couples. It is important to underline that the procedure of nominative reconstitution considered everyone who lived in the two parishes and was registered in the Status Animarum during the observed period.
Since all the events were dated with a good approximation, it was possible to calculate the durations in which every woman experienced the risk of giving a child. From a methodological point of view, it means that it is possible to carry out an event history analysis in order to model the risk of giving a child.
So by using the nominative information in the Status Animarum and in the other parish registers of the births, deaths and marriages, it has been possible to reconstitute longitudinally the reproductive biography of the resident women. Moreover, all the female histories were completed by taking into account the specific characteristics of the family context and the death episodes regarding all the children ever born.

It is worth to report some basic measures of the longitudinal reconstitution process. In both parishes, during the period from 1819 to 1900, overall 11,809 individuals have been registered at least 1 year in the Status Animarum. Among these individuals, 3.261 persons experienced a longer

permanence, remaining in the parish at least 9 years. The observed average and median permanence were respectively 7.9 and 3 years. Concerning the female population, 5,239 women were observed in the Status Animarum at least 1 year, whereas 1,537 females stayed in the parish at least 9 years.

Scheme 1 around here

This reconstitution has surpassed over the traditional methods of the nominative family reconstitution proposed by Louis Henry (1980), because in Italy the historical studies of micro demography can be also supported by the additional information from the Status Animarum (Manfredini, 1986).
The following scheme shows the number of individual linkages among the different available sources. A part of the scheme is encompassed by a dotted line and it could be intended as the traditional nominative reconstitution of the families. Indeed, our method is based on two phases. First, all the individual biographies have been created by using the series of the Status Animarum on each observed year from 1819 to 1900. Next, all these reconstituted biographies have been linked to the information from the parish registers of the births, deaths and marriages. Consequently it has been possible to improve the outcome of the nominative reconstitution by reducing the effects of the migration fluxes. Moreover, from the informative point of view, the Status Animarum represents a precious source since it reports all the individuals already grouped by their household, offering a set of information about the family typology. More important, the Status Animarum contained some basic information that can be extremely helpful to complete the left truncated individual biography in case of immigration. For example, it is possible to estimate the date of birth of the woman basing on the registered age, or to calculate the age difference between the spouses. In case the woman contracted marriage in another parish and there is no registration of the act in the available source, it is possible to estimate the age at marriage by assuming the calendar year in which she changed the civil status. Furthermore, a number of births were inferred from the Status Animarum by taking into account all the children under 2 years without linkage to the information in the parish registers.

Scheme 2 around here

A discrete-time event history model

More specifically, this study analyzes the determinants of the reproductive behaviour adopting the reconstituted longitudinal data for the period in question. Consequently a multivariate statistical analysis has been carried out by using the event-history techniques in order to estimate the odds of having a child within a year. In fact the characteristics of the source material suggest using discrete-time models with person-year as the unit of analysis. Since in many cases we do not know the precise timing but we can identify whether or not the events in question occurred during a given year (e.g. the case of the estimated birth without linkage in the parish register), we employ the discrete-time event history analysis model (Allison 1982). The general form of the model is the following expression:

$$\ln\left(\frac{p}{1-p}\right) = \alpha + \beta\, x_{ij}$$

where p denotes the probability that a woman gives birth during the calendar interval between t and $t+1$ year; α represents just a set of constants; β is the vector parameters for the individual covariates X covariates, which may be either time-constant or time-varying.
In the case of quantitative covariates, the coefficients express the variation of the odds ln(p/1-p) for each unit increment of the variable; on the opposite case with qualitative covariates, β represents the variation in comparison with a single category of the covariate assumed as reference. The dependent variable is a dummy variable which is equal to 1 if the woman gives a child birth in the calendar year t, otherwise it values 0.
Furthermore, the analysis includes important bio-demographic variables which are able to capture some important aspects of the reproductive process (marriage age of mother, mother age, interval between consecutive births), but also variables which are more closely related to the economic and social conditions of the family (type of family, socio-economic status, migrating status).
Finally, we consider all the married women between age 14 and 49 years, and it is limited to the second or higher order births. Indeed, first births are related to the marriage decision itself and thus the study of the interval between marriage and first birth requires a separate and different model.

First of all, we need to control the effects of the bio-demographic variables. So the first two main predictors are the distance from the last birth and the survival of the last child. As described above, the interaction of these two covariates is useful to test the hypothesis: whether the death of a child could increase the probability of giving birth since the breastfeeding interval was interrupted. Indeed, previous studies clearly pointed to the importance of termination of breastfeeding for the chance of having another birth (Knodel, 1998). Indeed, breastfeeding delays the return of ovulation and postpones the next birth. So the effect of breastfeeding on fertility can be detected by comparing women who suffered an infant death to women with surviving children. Actually, the sooner an infant dies after birth, the greater the impact of its death should be on shortening the interval. Intervals following the births of children who survived past the age of weaning will reflect the full influence of breastfeeding on the interval, while intervals following births of children who died prior to weaning will be shorter.
Moreover, the analysis includes the age of the mother and her age at marriage. In fact, in a preceding study on two other villages in Northern Italy which was carried out adopting the same covariates and the same discrete event history approach (Breschi, Manfredini and Rettaroli 2000), it was already observed that the risk of giving birth reduced after the age of 30. In addition, a dummy variable measures the status of migration within the preceding three years supposing that immigrants were affected by a sense of precariousness which depressed their fertility.

In several previous studies, the inclusion of the grain price in the event history model allowed to evaluate the demographic response to the fluctuations of the macro-economic system. Indeed it was assumed that the price of grain could be considerably representative of the general economic trend and living standards. In the present study, it has not been possible to include the grain price, since series of Bologna have never been published. Even if the series relative to the close town of Parma and Ferrara are available, their lengths do not cover entirely the period in question. Thus it was

chosen to use a consumer index price of Northern Italy which was calculated by Robert Allen (2001). This index is based on an interpolation of prices of several primary goods, which were preliminary standardized in silver grams. So we have included into the model a covariate of the price level. Indeed, we calculated the residuals from the Hodrick-Prescott filter with a smooth parameter of 100 (Hodrick and Prescott 1997). These residuals represent the deviations from what could be considered as normal years. In addition, the model included the price residuals for the current year and for one lagged year.

Considering the main covariates, we intend to test the effect of the socioeconomic characteristics of the family context. Thus a categorical covariate considers the specific structure of the household adopting the same classification scheme of Peter Laslett. It is possible to hypothesize that the large complex families limited the opportunity cost of children, raising the fertility of the spouses. Indeed, many young girls and older women of the extended family could provide assistance in child care. As we have already underlined, we expected that this kind of domestic solidarity was able to raise the fertility risk in this kind of families. Moreover three specific dummy variables take into account the presence in the same household of other women 9-20, 21-49 and over 50 years old.

As a second main variable, we include the social-economic status of the household head assuming that occupational differences conditioned significantly the fertility risk of childbirth. As it was told, the domestic economy of the sharecroppers was also based on the size of the families. Moreover, in these households children represented an economic value. It is important to underline that the socio-economic status is time-variable since it refers to the occupation of the head of the household in which the woman lived. As it was already told, unfortunately there is a certain amount of cases with missing profession, since this information was not systematically reported in the Status Animarum.

Results

At table 8, we consider the estimates from four different event history models: a basic model (1) including only the control variables; another one (2) taking also into account the presence of other women with different ages; a third model (3) considering the type of the household; the full model (4) with the occupational status of the head of the household and a final model (6) including the interaction between socio-economic status and prices.

Before turning to the household type and socioeconomic status effect, something should be said about the control variables. First of all, it needs to be observed that the most elevated significance were obtained for the bio-demographic variables, which result to be still the main determinants of the reproductive behavior for the period in question. The age effect remains significant in the all the estimated models starting from the category “less than 20” to the class “30-34”, whereas, as it was expected, from the 20-24 class the risk gradually declines. Moreover, the probability to have another child is higher when the woman is married with a younger husband. However, the behavior of the immigrant women appears difficult to be interpreted on the base of these results, since the estimated coefficients have no significance. A similar result was already found for Casalecchio,

where there were no statistically significant differences in the family-building behaviors between migrated natives and couples (Kertzer and Hogan, 1989).
Considering the effect of the infant mortality on the reproductive behavior, it is clear that the risk of having another child increased considerably and significantly as a consequence of the previous child death. Looking at the interaction between the two consecutive births interval and the death of the previous child, it is clear that an important breastfeeding effect on fertility worked in this area. Indeed, the risk of childbirth was significantly higher if the previous child died within two years, while the breastfeeding was supposed to be still practiced.

Confirming the descriptive analysis by fertility rates, it is possible to see that the resident women in San Nicolò experienced approximately a 14% higher risk of having another child than in San Donnino. This interesting result confirms the existence of different behaviors even within the same rural area. Since San Donnino was closer to the town of Bologna, it is likely that its resident women had tight relationship with the urban environment (e.g. domestic service) and somehow they were more exposed to the urban behavior. According to this result, a propagation factor of behaviors seems to be at work.

As it was expected, the mothers of the more complex families could always rely on the support of the other resident women living in the same household, reducing considerably the opportunity costs of raising a child. This interpretation is confirmed by the significant positive effect of the presence of other women over 50 in the same household (see model 2 at table 8). In addition, the fertility risk was higher within the multiple structure households (see model 3 table 8) than the reference category of the nuclear family. This evidence is consistent with the previous result from Madregolo and Casalguidi, where the odds by family type were similar to the estimated ones of the two parishes under study (see figure 1).
Turning to the effect of the professional status, clear differences in fertility become visible between the considered socio-economic groups: the women in the sharecroppers and famers families register significantly higher odds of giving another birth than the laborers and daily wagers. The artisans have also higher birth risks, even if their relative coefficients appear lower. Furthermore, it is interesting to note that the distribution of the risk of childbirth by professions is very similar to the observed pattern of Casalguidi that was also characterized by the higher fertility of the sharecroppers (see figure 1). A similar result was found in the nearby centre of Casalecchio almost on the same period: the wives of sharecroppers have the highest life-course fertility, with rates of parity progression one-quarter higher than those of the wives of the wage earners (Kertzer and Hogan, 1989). Since in model 4 the family type covariate loses its significance, it seems that the higher risk of having a child was experienced by the sharecroppers that used to live in large and multiple families. In these terms, the higher fertility connected to the complex families could be considered a consequence of the economic assurance due to the sharecropper contracts (Kertzer and Hogan 1989).

In addition, in the medium term it is possible to observe some differential tendencies by socio-economic status. In the model 1 at table 8, the risk of having a child decreases progressively since each period registers lower and lower fertility risks than the reference category “1819-1840”. However, the statistical significance almost disappears as soon as we included into the model the

socio-economic covariates. Thus in order to control the existence of a possible differential effect, we have implemented an interaction model considering only two macro socio-economic categories: the first class includes only the farmers and the sharecroppers, and the second one takes into account all the other remaining social groups. So the model 2 at table 9 shows evident signs of a different fertility trend. In fact, for the reference category of the sharecroppers, the risk level remains stably equal to 1 on each period. On the other hand, the odds ratios of other groups are evidently lower than the one related to the first period "1819-1840". More specifically, for the periods 1841-1860 and 1861-1880 the reduction is stronger (-20 per cent) and more significant (model 2 at table 9). So it seems to be confirmed the substantial invariance of the reproductive behavior of the sharecroppers with respect to the middle term trends.

Table 8 around here

Figure 1 around here

Another interesting result concerns the short term effect of the price change on the reproductive behavior (table 8). The risk of having another child decreased significantly in the year after a "high price level" year (no significance was found for the current year). In addition, from the interaction model 5 at table 8 it is possible to see a positive significant effect of the lagged price on the category "farmer and sharecroppers". As it was easy to expect, the sharecropper and farmer group could take advantage by a price increase since they are supposed to be producers, whereas it is conceivable the strong negative response of the laborers that were the consumers' group. However, we are not allowed to consider this evidence as a clear sign of deliberate control. Such a late variation in fertility resulting from price fluctuations may be caused by several determinants which can be grouped according to biological (no voluntary) and behavioral (deliberate) criteria. A one year late fertility response would include various mechanisms, like spontaneous abortion, an increment of the amenorrhea period and absence of libido caused both by physical and psychological stress without necessary involving a deliberate decision.

Table 9 around here

Conclusion

Considering these first results, the micro-biographic approach appears to be extremely useful to understand the basic mechanisms of the reproductive choices during the pre-transitional period. Indeed the longitudinal elaboration of the collected data has made possible to verify many hypothesis which come from the macro demographic analysis.
Controlling the effects of the bio-demographic factors, the existence of a relationship between fertility and infant mortality is clearly evident in this area during the period in question. Our results confirm the hypothesis that the premature death of the last child born reduces the interval between two consecutive childbirths. Since the infant mortality appears to be a determining factor of the reproductive behavior, we can suppose that the progressive improvements of the children survival could be pointed out as one of the initial causes of the fertility decline. At least in a first phase, the

slight containment of the reproductive behavior could be interpreted as a direct consequence of the lower infant mortality.
Both the descriptive and the multivariate analysis have indicated a slight and gradual decrease of the fertility levels over the period in question. It seems that in the two considered parishes the fertility decline began earlier than in the other parts of the region, reflecting the social ties with the town of Bologna, which had generally lower fertility and experienced an earlier fertility reduction. In addition, a significant difference was found even between the two examined parishes: lower fertility levels and risks were registered in the parish of San Donnino that bordered the city of Bologna. We can assume that the proximity to the urban zone facilitated the women living in San Donnino to have closer relationship with the urban community (e.g. domestic service) and to experience and adopt different behavioral models.
Next, a significant influence of the household typology on the fertility levels was found. Indeed the significant inclusion in the model of a further covariate related to the presence of women over 50 confirms this hypothesis. Moreover the women living in multiple households showed a considerable higher risk of child birth than the female residents in nuclear family. This finding confirms an equal result which was already observed in a previous study on Madregolo and Casalguidi, other two rural villages situated in Central Italy. We have interpreted this result by assuming that the other women living in the multiple households provided assistance in child care, consequently limiting the opportunity cost of the children. However, since this significance is lost as soon as the socio-economic status is included into the model, it seems that the higher risk of having a child was mostly experienced by the sharecroppers that used to live in large and multiple families.
This result can be explained remembering that in sharecropper families they were obliged to have large families by contract and moreover the children represented a value and an opportunity, considering their role in the domestic economy (e.g. light tasks in the agricultural works). In contrast, the rural laborers and wage earners had necessity to control their own offspring outcome because of the limited available sources. The same differences in the reproductive behaviors of sharecroppers and rural laborers were found even in the nearby communities of Casalecchio and Casalguidi. It is considerably clear that lower status families were able to shape their reproductive behavior in accordance with their own limited resources even before the fertility declined, during the so named “natural regime”.

In addition, the interaction models show a clear difference in the fertility response to the economic stress. The reproductive behavior of the sharecroppers seemed to be substantially invariant to the short term solicitations, whereas the laborers’ group experienced a negative price effect. It is easy to imagine that as farmers and sharecroppers were grain producers, somehow they were more protected by the market fluctuations than the other social categories. However, the timing of the fertility response was too late to be consistent with a clear interpretation of deliberate fertility control (Bengtsson and Dribe, 2006). Moreover, the interaction models have demonstrated that the sharecroppers had a stable reproductive behavior during the entire period in question. In contrast, lower fertility risks were experienced by the other socio-economic categories on the periods 1841-1860 and 1861-1880 (the odds of the 1881-1900 was lower but weakly significant). We can interpret these reductions as some first evidences of the fertility transition.

Table 1 – *Families, population and average number of family components in the two parishes of San Donnino and San Nicolò*

	San Nicolò			San Donnino			San Nicolò + San Donnino		
	Families	Popultaion	Average Components	Families	Popultaion	Average Components	Families	Popultaion	Average Components
1820	58	394	6,8	76	487	6,4	134	881	6,6
1840	64	413	6,5	100	648	6,5	164	1061	6,5
1860	65	414	6,4	95	633	6,7	160	1047	6,5
1880	63	437	6,9	122	675	5,5	185	1112	6,0
1900	65	454	7,0	117	704	6,0	182	1158	6,4

Source: our collected data from parish registers

Table 2 – *Percentages of households by type in the two parishes of San Donnino and San Nicolò, (average values on 20 years)*

	1820-1840	1841-1860	1861-1880	1881-1900
Extended	13,4	13,3	15,1	18,2
Multiple	28,7	29,1	25,5	24,3
Nuclear	53,5	53,8	55,4	53,0
Solitaries/without structure	4,5	3,7	4,0	4,5
Total	100,0	100,0	100,0	100,0

Source: our collected data from parish registers

Table 3 - *Percentage of households by profession of the head and type of household in the two parishes of San Donnino and San Nicolò (average values on 1859-1861)*

	Extended	Multiple	Nuclear	Solitaries and without structure	Total
Artisan	18,8	8,2	22,1	15,8	17,1
Well-off and bourgeoisie	0,0	2,0	4,6	15,8	3,6
Laborer and daily wager	24,6	6,1	43,8	47,4	29,5
Farmer and sharecropper	44,9	83,7	24,6		44,8
Unknown	11,6		5,0	21,1	5,1
Total	100,0	100,0	100,0	100,0	100,0
Average Number of Cases	181	192	178	184	735

Source: our collected data from parish registers

Table 4 - *Selected demographic indicators in San Donnino and San Nicolò di Villola, 1819-1900*

	Mean age at 1st marriage		Percentage unmarried 45-49		Life expectancy at birth	TFR	Mean age at 1st birth
	M	F	M	F			
San Nicolò	27,3	23,1	10,0	13,3	39,5	5,2	24,3
San Donnino	27,2	23,3	12,4	12,1	40,2	4,6	24,5

Source: our collected data from parish registers

Table 5 – *Fertility Rates by Age: San Donnino, San Nicoló (1819-1900), Madregolo (1800-1883) and Casalguidi (1819-59)*

	San Donnino		San Nicoló		San Don. + Nic.		Madregolo		Casalguidi	
	f(x)	fl(x)	f(x)	fl(x)	f(x)	fl(x)	f(x)	fl(x)	f(x)	fl(x)
15 - 19	7,1	317,5	5,8	275,9	6,7	304,3	7,9	435,7	12,6	530,1
20 - 24	148,0	399,6	179,7	463,0	160,0	423,8	190,9	437,7	142,4	509,4
25 - 29	272,1	360,3	297,0	374,7	281,8	366,1	311,2	381,4	264,8	428,4
30 - 34	231,1	270,2	248,2	280,2	237,9	274,2	291,9	322,1	281,4	363,2
35 - 39	168,6	189,6	198,5	219,9	180,3	201,7	229,1	248,3	224,5	272,6
40 - 44	84,9	95,8	99,0	106,6	90,5	100,3	91,3	104,2	101,6	127,6
45 - 49	11,8	13,6	19,0	22,1	14,6	17,0	4,8	5,7	19,0	25,0
TFR	4,6		5,2		4,9		5,6		5,2	
TMFR		8,2		8,7		8,4		9,7		11,3
TMFR20		6,6		7,3		6,9		7,5		8,6

Source: our collected data from parish registers for San Donnino e San Nicoló; Breschi, Manfredini and Rettaroli (2000) for Madregolo and Casalguidi

Table 6 – *Marital fertility rates by type of household, profession and period: San Donnino and San Nicoló, 1819-1900*

	Type of household			Profession of the household head			Period	
	Nuclear	Extended	Multiple	Daily Wagers/ Laborer	Sharecropper/ Farmer	Others	1819-60	1861-1900
20 - 24	410,3	442,7	421,1	416,7	425,3	423,6	416,4	433,8
25 - 29	333,7	355,8	384,1	311,0	393,2	359,2	375,6	352,5
30 - 34	259,5	257,1	298,1	231,6	294,4	272,1	284,9	260,3
35 - 39	182,0	205,3	223,9	156,8	210,3	209,2	215,6	184,4
40 - 44	92,1	97,2	115,2	47,5	113,5	107,5	109,9	89,6
45 - 49	14,9	9,0	25,3	6,7	21,6	19,3	25,5	8,6
TMFR20	6,5	6,8	7,3	5,9	7,3	7,0	7,1	6,6

Source: our collected data from parish registers

Table 7 – *Coale-Trussell indices of marital fertility in San Donnino and San Nicolò di Villola*

	Period	M	m
San Nicolò	1819-1860	0,651	0,181
	1861-1900	0,663	0,215
San Donnino	1819-1860	0,600	0,113
	1861-1900	0,610	0,309

Note: All parameters are statistically significant at $p<0.05$

Source: our collected data from parish registers

Table 8 – *Odds of giving another birth within a year for all Women, Second and Higher-Order Births. San Nicoló and San Donnino, 1819-1900*

	Mean	Model 1 Base	Model 2 with other women	Model 3 with family types	Model 4 with professions	Model 5 with interactions
Age of the Woman [Ref. 25-29 years]	21,5	1,000	1,000	1,000	1,000	1,000
< 20	0,4	0,244 *	0,245 *	0,244 *	0,238 **	0,239 **
20-24	7,0	1,129	1,123	1,117	1,110	1,105
30-34	23,2	0,761 ***	0,776 ***	0,777 ***	0,774 ***	0,770 ***
35-39	20,1	0,583 ***	0,627 ***	0,610 ***	0,606 ***	0,605 ***
40 +	27,8	0,209 ***	0,224 ***	0,222 ***	0,219 ***	0,218 ***
Age at Marriage [Ref. 20-29 years]	65,5	1,000	1,000	1,000	1,000	1,000
< 20	11,1	0,894	0,892	0,881	0,877	0,878
30 +	4,6	0,841	0,857	0,833	0,832	0,833
Unknown	18,8	0,750 ***	0,768 **	0,778 **	0,784 **	0,786 **
Age Difference Between Spouses [Ref. 0-3 years]	34,1	1,000	1,000	1,000	1,000	1,000
Wife is older	11,4	1,197 *	1,209 *	1,214 *	1,194 *	1,189 +
Husband is older by < 4 years	52,6	0,948	0,962	0,976	0,974	0,971
Unknown	1,9	1,139	1,169	1,165	1,241	1,244
Distance from the Last Birth [Ref. 2-3 years]	19,4	1,000	1,000	1,000	1,000	1,000
< 2	55,5	0,398 ***	0,396 ***	0,395 ***	0,390 ***	0,389 ***
4 +	25,1	0,192 ***	0,192 ***	0,192 ***	0,194 ***	0,194 ***
Survival of the Last Child [Ref. Still Living]	80,7	1,000	1,000	1,000	1,000	1,000
Dead	19,3	1,931 ***	1,935 ***	1,963 ***	1,949 ***	1,956 ***
Interactions Distance x Survival of the Last Child		1,000	1,000	1,000	1,000	1,000
Distance < 2 * Dead		1,548 **	1,543 **	1,531 **	1,545 **	1,541 **
Distance 4+ * Dead		0,593 *	0,599 *	0,596 *	0,591 *	0,588 *
Migrant within the last 3 years [Ref. Not Migrant]	89,2	1,000	1,000	1,000	1,000	1,000
Migrant	10,8	0,968	0,975	0,990	0,986	0,983
Period [Ref. 1819 - 1840]	26,9	1,000	1,000	1,000	1,000	1,000
1841 - 1860	26,9	0,869 +	0,875 +	0,868 +	0,878 +	0,877 +
1861 - 1880	22,5	0,874 +	0,888	0,877 +	0,918	0,919
1881- 1900	23,8	0,851 *	0,852 *	0,841 *	0,871 +	0,865 +
Index Price (t)		0,951	0,951	0,952	0,950	0,950
Index Price (t-1)		0,700 *	0,704 *	0,703 *	0,697 *	0,341 *
Parish *[Ref. San Nicoló]*	39,4	1,000	1,000	1,000	1,000	1,000
Parish San Donnino	60,6	0,845 **	0,852 **	0,865 **	0,867 *	0,868 *
Presence of other women 9-20 [Ref. Absent]	55,6		1,000	1,000	1,000	1,000
Present	44,4		1,031	0,985	0,959	0,961
Presence of other women 21-49 [Ref. Absent]	33,0		1,000	1,000	1,000	1,000
Present	67,0		1,125	0,996	0,972	0,973
Presence of other women + 50 [Ref. Absent]	67,8		1,000	1,000	1,000	1,000
Present	32,2		1,141 *	1,009	1,023	1,025
Type of Family [Ref. Nuclear]	39,3			1,000	1,000	1,000
Extended	12,6			1,223 *	1,168	1,165
Multiple	48,1			1,318 ***	1,165	1,163
SES [Ref. Laborer and daily wager]	15,5				1,000	1,000
Farmer and Sharecropper	52,0				1,426 ***	1,439 ***
Artisan	8,0				1,276 *	1,287 *
Middle class/Bourgeoisie	2,5				1,200	1,201
Unknown	21,9				1,238 *	1,241 *
*Interactions SES * Index Price (t-1)*						1,000
Farmer and Sharecropper						2,692 *
Artisan						2,200
Middle class/Bourgeoisie						1,220
Unknown						1,523

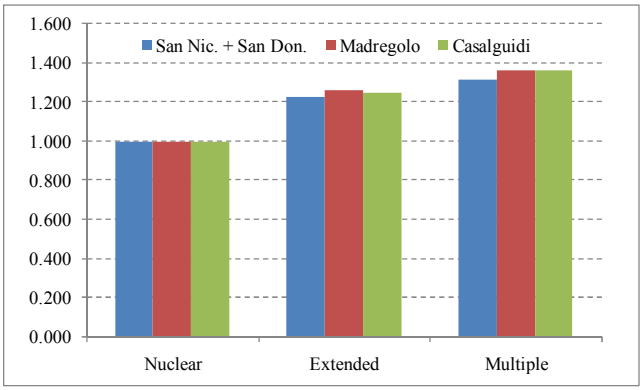
Note: 9,135 women-years and 2,115
Significance: + = 10%; * = 5 %; ** = 1%; *** = 1 ‰

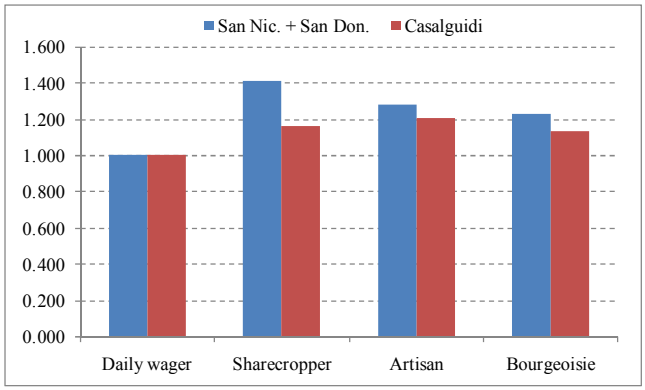
Table 9 - *Odds of giving another birth within a year by socio-economic status and periods: interaction model*

	Mean	Model 1 Base		Model 2 with inter. SES*period	
SES [Ref. Farmer and Sharecropper]	52,0	1,000		1,000	
Not Farmer and Sharecropper	48,0	0,811	**	1,034	
Period [Ref. 1819 - 1840]	26,9	1,000		1,000	
1841 - 1860	26,9	0,887	*	0,987	
1861 - 1880	22,5	0,878		1,025	
1881- 1900	23,8	0,860	+	0,967	
Interactions SES x Period					
Period 1841 - 1860				0,705	*
Period 1861 - 1880				0,709	*
Period 1881- 1900				0,753	+

Note: 9,135 women-years and 2,115. The models also include the other control variables of model 3 in table 8.
Significance: $^{+}$ = 10%; * = 5 %; ** = 1%; *** = 1 ‰

Figure 1 – *Odds of having a child in the year according to the dummy covariates "type of family" and "socio-economic status". San Nicoló and San Donnino (1819-1900), Madregolo (1800-1883) and Casalguidi (1819-59)*





Note: estimations are based on table 8 for San Donnino and San Nicoló; Breschi, Manfredini and Rettaroli (2000) for Madregolo and Casalguidi

Scheme 1 – *Number of individuals and time average of permanence in the Status Animarum*

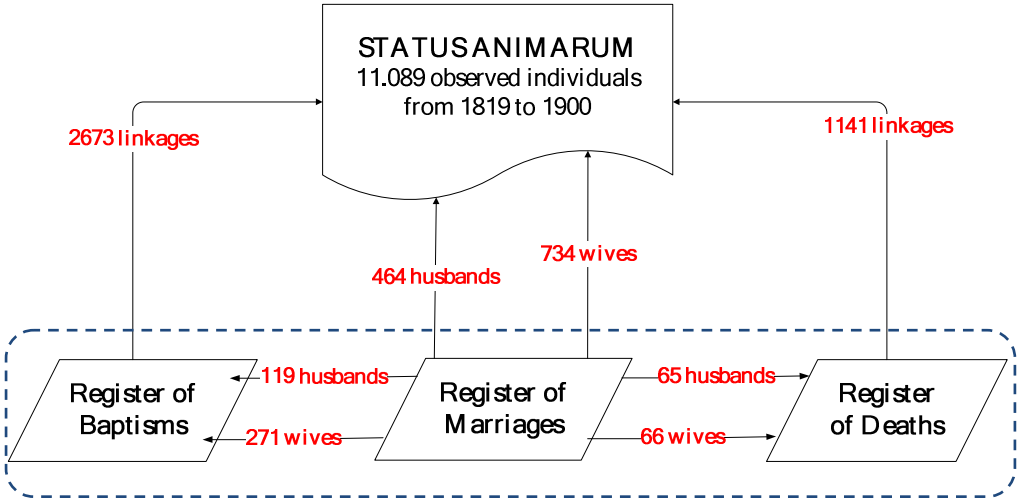
STATUS ANIMARUM
SAN DONNINO AND SAN NICOLO´

86,789 records from 1819 to 1900

11,089 observed individuals at least 1 year (5,239 observed women at least 1 year)
3,261 observed individuals at least 9 years (1,537 observed women at least 9 years)

Average length of permanence = 7.9 years
Median length of permanence = 3 years

Scheme 2 – *Linkages of the reconstitution process*



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