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Lowest Low Fertility in an Urban Context: The Role of Migration in Turin, Italy

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ABSTRACT

In countries with so-called 'lowest-low' fertility, the lowest fertility levels are seen in the cities. The main reason for this is the difference in the cost of living, combined with income constraints in cities, compared with rural areas. If we focus our attention on the centre of an urban area, migration needs to be taken into account, since migrants may have particularly low fertility levels. In this paper we use the Turin Longitudinal Study, which has data on all people who have ever been residents of Turin (Italy) during the period 1971–2001. We study the interdependencies between fertility and out-migration choices for a selected group from the 1956 birth cohort. Our findings underline the important role of economic resources and life-cycle events which seem to guide both fertility and migration behaviours. Moreover, while having a child significantly hampers long-distance migration, it has less impact on short-distance moves. Copyright © 2004 John Wiley & Sons, Ltd.

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INTRODUCTION

Fertility levels make a significant contribution to the age structure of the population, and we need to consider the potential consequences of low fertility. As Bongaarts and Feeney (1998: 285) asserted, 'declining population size would be salutary from some points of view, but rapid population aging is likely to pose profound social and economic problems'. The issue, therefore, becomes particularly important in lowest-low fertility settings (Kohler *et al.*, 2002). In this paper, we focus our attention on the urban context in a lowest-low fertility country (here represented by the municipality of Turin, Italy, the inner city of an important metropolitan area belonging to the 'industrial triangle', the major industrial area in northwestern Italy; Bonifazi and Heins, 2000), in which fertility choices appear to be different to elsewhere. Nowadays, urban total fertility rates (TFRs) in cities such as Turin, Milan, Udine and Florence are lower than for Italy as a whole (see Ongaro, 2002). For example, while the Italian TFR for the year 2000 was above 1.2, the levels for these four cities ranged between 1.0 and 1.1.

Numerous studies have dealt with urban fertility, mainly focusing on urbanisation processes in developing countries (see the early review by Zarate and de Zarate, 1975), while others compared fertility between metropolitan and non-metropolitan areas in developed countries (see Courgeau, 1989). In general, it is well known that urbanisation and industrialisation have produced many benefits for families and societies, and at the same time they have exerted pressures on the family (see United Nations, 1980). For example, in an urban context, women are more

likely to participate in the labour market, and their role within the family may be different to elsewhere. The cost of living and other income constraints make living in an urban area more expensive than living in a rural area, and this may influence family size (Stark, 1991).

As cities evolve into metropolises, this problem becomes potentially more serious. As Martinotti (1993) underlined, many changes in the morphology of the major cities of Europe have occurred during recent decades, following the pioneer experience of the US (Bogue, 1955; Frey and Speare, 1992). After a period of rapid urbanisation (which started in Italy during the 1950s and ended in the mid-1970s), the growth of the largest cities began to slow down. The population of Turin municipality, for example, which was approximately 700,000 people in 1951, reached 1,100,000 at the beginning of the 1960s, mainly due to the evolution of the Fiat car industry. Since the mid-1960s, the central area began to be characterised by lower (but still positive) net migration flows, while the outlying districts or urban ring grew more rapidly. Only during the early 1970s did Turin municipality begin to experience net out-migration, while the suburbs experienced small net inflows (IRES, 1994). These new migration patterns have been summarised as 'counter-urbanization' (Berry, 1976) or 'de-urbanisation'. As a result, at the beginning of 2001 the population of Turin city was approximately 900,000, which corresponds to more than half of the population of Turin's entire metropolitan area (consisting of about 1.6 million), and to two-fifths of the province (2.2 millions).

Studying urban fertility in Northern Italy is therefore particularly appealing, since we are dealing with a context of lowest fertility in a country of lowest low fertility. The aim of the present article is to analyse fertility levels in the urban context of Turin municipality (i.e. in the centre of a relatively large metropolis) as well as observing how out-migration choices can be related to fertility behaviour. The analysis also controls for the possible endogeneity of the process of urban fertility on out-migration. Primarily, if we want to understand fertility behaviour in the centre of an urban area, we also need to consider the fact that out-migration can be motivated by the current household situation, and also by desired fertility. Both processes need to be taken into account simultaneously.

In the next section we underline the reciprocal impact of migration on fertility and *vice versa*, and look at possible common factors which influence both decisions. There follows a description of the data and the types of models that will be used, and then a discussion of our main findings. Finally I present my concluding remarks.

MIGRATION AND FERTILITY AS (POTENTIALLY) INTERRELATED PROCESSES

The study of the interrelationship between fertility and the migration process has mainly focused on two different perspectives. On the one hand, researchers have been particularly interested in the impact of migration on fertility, studying the fertility of in-migrants, while on the other hand, current parity and anticipated fertility have been considered among the critical determinants for migration decision-making.

In-Migration and Fertility

Concerning the behaviour of in-migrants, the literature has focused on testing certain basic hypotheses which could shed some light on the mechanisms that influence fertility before and after migration. The major hypotheses describing different situations were *adaptation*, *disruption* and *selection*. Firstly, *adaptation* (Goldstein and Goldstein, 1983; Stephen and Bean, 1992) predicts a model where migrants gradually assimilate to the fertility norms and behaviour of the host society. Secondly, the *disruption* model assumes that migration will have a temporary effect on fertility, depressing it shortly after the move, because of spousal separation or the settling-in process (Carlson, 1985). Finally, the *selection* model (Hervitz, 1985; Kahn, 1994) stresses that migrants are selected through socioeconomic characteristics, which in turn also influence fertility behaviour: controlling for these characteristics should mean that there are no differences in fertility between migrants and non-migrants.

The literature has mainly tested these three hypotheses with respect to the urbanisation process itself by focusing on urban and rural differentials in in-migrant fertility, in both developing and industrialised countries. In addition, some studies have focused on multicultural countries, such as the US and Australia, where consistent international migration flows make a

significant contribution to overall fertility levels. For instance, Ware (1975), Carlson (1985) and Abbasi-Shavazi and McDonald (2000, 2002) studied the fertility behaviour of Australian immigrants; Ford (1990), Stephen and Bean (1992) and Kahn (1994) focused their attention on the US; while Hervitz (1985) dealt with Brazil; and Goldstein (1973) and Zarate and de Zarate (1975) considered the urbanisation process in developing countries.

In the context of lowest-low fertility, the fertility of in-migrants is particularly interesting. This analysis allows for an understanding of the impact of in-migrants' fertility on the overall national level. It considers how different fertility models are, or are not, applicable when the external conditions change due to migration.

Fertility and Out-Migration

In the literature concerning migration, particular emphasis has been given to life-cycle events as possible determinants of the decision to move (Courgeau, 1984). This follows the pioneering idea expressed by Lee (1966) that migration can be considered as an instrumental behaviour for achieving specific goals in some other parallel career. In this respect, the 'household career' acts as a push and pull factor for the decision to move. The household career can, therefore, constrain migration decisions (Mulder, 1993). Long (1972) demonstrated that married couples without children are more geographically mobile than married couples with children, whose mobility is particularly restricted when the children are of school age. And, of course, if a family is considering a move, the net family gain will be evaluated, rather than simply the potential personal gain of the adult who is considering a migration opportunity (Mincer, 1978). On the other hand, the need to adjust housing to changes in the household composition is an important source of mobility (Grundy, 1986; Baizan, 2002), and residential mobility can thus be a possible response to fertility.

The latter push factor can be important in central urban areas, where spacious single family dwelling units are often not available and, when available, may be expensive. Gentrification processes may also result in rising costs of home ownership in certain areas (Zukin, 1987). Moreover, related to the expansion of the urban service economy, some residential buildings have been converted to service use, resulting in a further reduction in dwellings.

Common Factors

Besides the direct effects of fertility on migration decisions, we also need to take into account some unobserved factors that could potentially influence both processes at the same time. Speare (1974) and Landale and Guest (1985) show, for instance, that residential preferences may play an important role. According to Mulder and Hooimeijer (1999), the importance of the residential environment increases as the family grows, since married couples, and especially those with children, increase their financial investment in the family. As family commitments grow, the desire for higher quality dwellings may also increase and, as a consequence, ownership is preferred to renting.

Rather than minimal requirements for health and safety, housing preferences reflect the existence of some commonly held norms. For most people, housing should preferably be owned by the occupants, be of an independent structure, and have sufficient outdoor and indoor space, given the age and sex composition of the family (Morris *et al*., 1976; McAuley and Nutty, 1982). Cultural and family sequential norms require, moreover, that the family is residentially stable before children are born (Baizan, 2002).

All of these elements discourage family formation in the central city, which remains the preferred location for young singles and couples with no children, but loses its attraction during family formation, childbearing and child-rearing life stages. Many researchers in the US believe that housing market conditions, high levels of crime and segregation all contribute to outflows from the central city of important metropolitan areas. This is especially so for families rather than for single persons (Frey and Kobrin, 1982; South and Crowder, 1997). Despite the fact that American cities are different to European cities, this provides additional support to the argument that migration can become a strategy for those who desire or intend to have children. At the same time 'a reluctance or inability to move to larger accommodations may, in some circumstances, depress fertility, and the availability of housing may affect any relationship between

mobility and fertility' (Grundy, 1986: 404). It is well known that 'changes in residence represent endogenous determinants in an interdependent system of demographic relevant processes' (Flöthmann, 1993: 54), but we focus here only on the interrelationship between migration and fertility.

In other words, some decisions to migrate are part of the strategy that might lead to a family having children. This means that moves are not only influenced by current household situations, but also by individual desires for children and by the importance attached to cultural and social norms. We might also draw on the ideas of *familism* (Sabagh *et al*., 1969), whereby we expect more family-oriented households may be more active in their search for locations that are suitable for child welfare and family living.

DATA AND METHODS

The Turin Longitudinal Study (TLS) is a longitudinal database (Creeser, 2001) which consists of register data linked to 1971, 1981 and 1991 census data. It has been used extensively for epidemiological studies (Costa and Demaria, 1988; Costa *et al*., 1994; Faggiano *et al*., 1994; Kunst *et al*., 1998) and, in a limited way, for socio-demographic studies (Billari *et al*., 1999).

The data-set covers the entire period starting from 1971 (the year in which the register was computerised) to the end of 2000. Therefore, we have information on all people who have ever resided in the Turin municipality since 1971. Being an exhaustive source, the TLS allows us to consider fertility and migration behaviour for the entire population we are interested in, without sample selection problems.

For the present study, we focus our attention on women born in 1955 and 1956, for whom we can follow their entire reproductive period (at the beginning of the 1970s they were 15 years old, and 44–45 in 2000). Since our main goal is to study urban fertility and to concentrate on the impact of forming a family and having children on migration behaviour, we selected only those women who were resident in the Turin municipality on their fifteenth birthday, amounting to 11,143 women. In this way we can be assured that at the (theoretical) beginning of the reproductive period, all the women were in Turin, and their fertility choices will have been influenced by that urban context (as are other behaviours such as searching for a partner or finding a job). Some of these women will have moved into Turin during their childhood, while others will have lived there all their lives.

For these women we focus attention on the period following marriage, explicitly selecting those 7623 women (70% of women of the 1956–1957 birth cohort) who lived in Turin at least until marriage and following them from that time. Since fertility in Italy is almost completely marital, this allows us to capture their entire fertility history (Castiglioni and Dalla Zuanna, 1994; Billari *et al*., 2002). We are also interested in the first trigger for migration which for the majority of women will coincide with marriage (Billari, 2001).

For all women we have information on both migration and fertility history until censoring occurs (which corresponds to death, out-migration or the end of the year 2000). Their fertility history can be reconstructed by linking each person to his/her parents, and using both register and census information. As shown in Fig. 1, out-migration leads automatically to the censoring of the observation and, since we hypothesise that the two processes are linked, the censoring event may be correlated with the phenomenon under study. One solution for dealing with this problem, and the existence of other heterogeneous factors in the analyses, is to use a structural equation for event history models. This allows us to consider more equations simultaneously, including in each some unobserved component that in principle can also be correlated with the phenomenon under study (see, for example, Lillard, 1993; Lillard and Waite, 1993; Lillard and Panis, 2000).

Since we study two processes (fertility and out-migration) we will use two simultaneous equations; the first equation will describe fertility, the second out-migration. Fertility can be considered as a process with repeated events, and the 'baseline hazard' (which describes the hazard depending on the duration of the exposure) can also be calculated for each birth. In general, we model the logarithm of the hazard rate as follows:

$$\ln h(t) = y(t) + \sum_k z_k(u_k + t) + \sum_j a_j x_j + \sum_i b_i w_i(t) + \varepsilon \quad (1)$$

where $y(t)$ is a linear spline[1] that captures the impact of the baseline duration on the intensity;

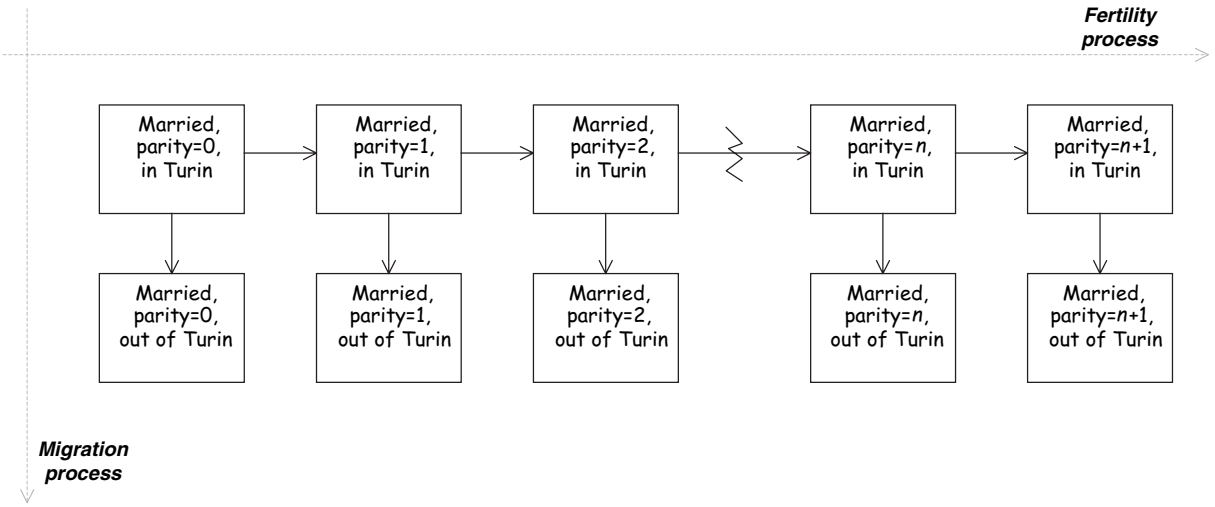

Figure 1. The processes under study.

each $z_k(u_k + t)$ denotes the spline representation of the effect of a time-varying variable that is a continuous function of t with origin u_k. (As an example, we may consider the age of the woman. If at the beginning of the exposure period the woman has age u_k, after a period of time t we know she is $u_k + t$ old.) Moreover, we also consider other time-constant covariates (x_j) and time-varying covariates ($w_i(t)$) whose effect will be to shift the baseline hazard proportionally.

The final component (ε) denotes an unobserved component which is constant over time and specific for each unit. If we assign ε^p and ε^q to the two components for the processes p and q, we can write their joint distribution since it is assumed to follow a bivariate normal distribution:

$$\begin{pmatrix}\varepsilon^p \\ \varepsilon^q\end{pmatrix} \sim N\left(\begin{pmatrix}0 \\ 0\end{pmatrix}, \begin{pmatrix}\sigma_p^2 & \sigma_{pq} \\ \sigma_{pq} & \sigma_q^2\end{pmatrix}\right) \tag{2}$$

Both the variances (σ_p^2, σ_q^2) and the correlation between heterogeneity terms (ρ_{pq}, which follows from the covariance) are estimated in the model.

This particular way of describing each process allows the inclusion of unobserved factors that might influence fertility and migration in the different models. Concerning migration, the idea of the existence of heterogeneity between individuals is not new. In 1955, for example, Blumen, Kogan and McCarthy developed the mover–stayer model (Blumen *et al.*, 1955), in which the population was divided into two groups (a decision that allowed the problem to be kept mathematically tractable), representing those who remain permanently in their state of origin, and those who move during their life. Later on, extensions of the model considered different (even continuous) heterogeneity distributions (e.g. Spilerman, 1972; Davies *et al.*, 1982).

Many scholars pointed out the existence of unobserved heterogeneity, especially in the fertility process (Gini, 1924; Heckman and Walker, 1992). In general, it is supposed that differences among women in unobserved fecundity result in unobserved heterogeneity. In modern societies, where fertility is perceived as a real choice, we can additionally think about people's attitudes toward the family, that is, the amount to which people are actually family-oriented.

We return here again to the idea of *familism*, associated now with fertility behaviour (for a discussion on perverse effects of *familistic* norms in the Italian case, see Dalla Zuanna, 2001). In the present article, however, we are dealing with urban fertility, and therefore we have to consider the meaning of 'unobserved' in this peculiar context (heterogeneity does not directly describe a lower or higher propensity for having children in general, but of having children in the Turin municipality). Allowing for the presence of potentially correlated unobserved heterogeneity, we can check whether endogeneity also acts via these components.

In our model, allowing correlation between unobserved heterogeneity terms, we state that the two choices (of leaving the city and of having an additional child) are not independent. In particular, a positive correlation between unobserved heterogeneity terms would mean that, net of the observed characteristics, women who have a propensity to bear more children also have a higher propensity to migrate. On the other hand, those who have less interest in moving will also have a lower propensity to have children. If we can interpret heterogeneity in the fertility process as a measure of the amount to which people are actually family-oriented, we would say that more family-oriented people would willingly leave the city than less family-oriented people, according to Mulder's interpretation (1993). In this case, the positive effect of fertility on migration acts also through the unobserved components, in such a way that whoever desires more children is also more prone to leave the city.

Similarly, a negative correlation would mean that if we consider two women with the same observed characteristics, the one with a higher propensity to have children would also prefer to stay longer in Turin. In contrast, people who would prefer to migrate would also be less prone to bear children. This is related to how people perceive the quality of life in the Turin municipality. We might expect that those who like the city more will see it as a good place for bearing children, while those who dislike living in the city may choose not have children, thereby confirming Grundy's (1986) theory.

Since the estimated correlation coefficient represents only the net impact of these two contrasting forces, a null correlation would mean that these two factors cancel each other out.

The Equation Describing Fertility

Births are repeatable events, but each birth occurs within a complex decision-making strategy. The decision-making model used here hypothesises that women act rationally to realise a plan of desired family size (Becker, 1981). Since different strategies can be compatible with the same number of children, women can choose to act in different ways (Yamaguchi and Ferguson, 1995; Rosina, 2001). Therefore, when describing fertility, information concerning the past needs to be considered in order to predict future behaviour.

The basic event of interest is a new birth, and therefore we analyse the hazard of having an additional child. In fact, we keep the hazard relative to first parity distinct from transition to higher parities, since the former event represents entry into motherhood while, for the others, the fertility process has begun (unlike Yamaguchi and Ferguson, 1995, we also consider transition to first birth). The first baseline is associated with the length of marriage, and it is possible that a number of marriages occurred because of a pregnancy.

Apart from the first child, the *length of previous interval* gives additional information for understanding subsequent fertility. Murphy (1992: 148), for example, included various possible meanings of the interval between births:

> 'physiological difficulties in conceiving, continuity in terms of contraceptive usage, possible episodes of spousal separation, low coital frequency, stable attitudes to appropriate birth-interval length, and constraining and socialization factors due to differing educational and employment histories.'

In this case we also distinguish the first interval between marriage and first birth from the subsequent intervals which are between births. We assume that a short interval between two births is likely to predict a shorter spacing to the next one (see Yamaguchi and Ferguson, 1995). If the interval between marriage and first birth is very short, as in the case of a pregnancy-caused marriage, it is possible that there was no real intention to start the reproductive period, and hence the interval to subsequent children may be longer.

The *age of the woman* at the beginning of each birth interval may also be significant (Marini, 1981). One possible reason is that a woman who started to be at risk (that means who married or had a child of parity j) at a young age will have a long time to conceive an additional child. She will also have a higher fecundity, and we can expect a higher probability of progression to a higher parity. On the other hand, she may decide to postpone the event, since she has more time to make a decision.

Generally, it has been found that if a woman is very young when she has her first child, she will have relatively short intervals between her births and a high level of completed fertility (e.g. Hoem

and Hoem, 1989). The latter phenomenon is known as the 'engine of fertility' (Rodriguez *et al*., 1984) and it can be associated with a strong investment in family formation. This is due to family building that begins at very early ages, or to a conscious desire to attain a larger family size by a certain age (Yamaguchi and Ferguson, 1995).

We model the effect of age at marriage on first birth, as a linear spline. We distinguish three groups of women: women who married very early in their life with respect to other women (i.e. before age 23), women who marry at 'normal' ages (between age 23 and 26), and finally women who marry very late (i.e. after age 26). We expect that if a woman has married very early in her life, the earlier she married the higher her probability of conceiving a first child. On the other hand, if a woman married very late, we expect that the older the woman the lower the probability of becoming a mother.

For subsequent births, we expect that the older the woman, the lower her probability of conceiving a child, and that this effect differs according to parity. The woman's age at the beginning of the exposure to bearing the j-th child (i.e. 9 months after the birth of the child of order $j - 1$) will therefore be considered as a linear spline, specific for each order of birth.

We also consider the possibility that the last pregnancy led to *twins*, because in this case women may have a strong wish to wait for a long time before a new pregnancy (Standberg and Hoem, 2002). Rosenzweig and Wolpin (1980) demonstrated, for example, that having had twins at parity one results in delayed subsequent fertility, although it has a negligible impact on completed family size.

All the variables included up to this point refer to the history of the fertility process, and their effects are thought to be analogous to other contexts. The following characteristics are particularly important in this specific context. We consider if the woman was an *in-migrant*, and we also control for her *educational level*. Both variables are interacted with parity.

We expect higher fertility rates for in-migrants (since most in-migrant women come from regions in which fertility is higher than in Turin). This effect may be constant with respect to parity, as in-migrants maintain their fertility preferences in the new society, or may these vanish gradually over time as in-migrants adapt to the host society.

Concerning the educational level, the result is, in principle, difficult to predict for two reasons. Firstly, the relationship between educational level and fertility is itself quite ambiguous, since it is the result of the balance between the costs of rearing children and the possibility of doing so (Becker, 1981). Women with a high educational level have a higher earnings potential in the labour market, which in turn increases the relative cost of children and therefore reduces the demand for children. Women may spend more time in education, and this delays their entry into marriage (Blossfeld and Huinink, 1991), although it is not clear whether entry into motherhood is affected directly.

On the other hand, high levels of education are usually associated with high incomes, which defines the economic context for fertility. While in the past, the opportunity costs of childbearing for women were assumed to more than compensate for the income effect (and the opposite for men), in recent years a positive effect of a mother's education on fertility has been found, at least for high parity. For the birth of the first child, Marini (1984) and Liefbroer and Corijn (1999) demonstrated that both educational attainment and labour force participation have a negative impact on women, which is stronger for entry into motherhood than for entering a union. Other studies (see, for example, Hoem and Hoem, 1989; Kravdal, 1992) pointed out that for the second and the third parity, controlling for other covariates, women who have higher education also have higher relative fertility. The latter effect seems, however, to disappear when the existence of unobserved components is taken into account (Kravdal, 2001).

Beyond these general considerations, we also need to take into account the fact that in the urban context the availability of economic resources is more important than elsewhere, and therefore we can expect that a high level of education raises the probability of having an additional child for high parities.

The Equation Describing Migration

Above, we have suggested that current parity and desired fertility may influence migration decision-making. However, demographic variables will also influence migration. In particular, we focus on how the migration choices of married couples are related to their fertility.

The main variables will therefore deal with the household situation. The baseline risk will measure the risk of migrating as a function of *marriage duration*. The shorter the marriage, the higher the probability of migration, since the new household situation is likely to have altered residential preferences and needs (Mulder, 1993), and since marriage very often coincides with leaving the parental home in Italy (Billari, 2001). Delays in registering the residential changes can cause strong dependence with duration of marriage.

Residential adjustment may also be necessary when the current location is no longer suitable to family size. Thus, we might expect families with a larger *number of children* to be more likely to move for better and cheaper accommodation (Mulder and Hooimeijer, 1999). On the other hand, families may be reluctant to move if children are of school age (Long, 1972).

We also include a variable which records the *current age of the woman*. We would expect a general resistance to migration as age increases. And, since all the women in our sample are married, young women may have relatively few economic resources, making migration difficult. Landale and Guest (1985), for example, found that when controlling for both family life-cycle stages and residential satisfaction, those over 46 years of age were significantly less likely to move than younger people.

We also consider additional information, such as whether the women are *in-migrants or not*, and distinguish between *provenance of in-migration* (Turin province, North-Central Italy or South Italy and foreign countries). In general we would expect that those who have moved previously would be more likely to make subsequent moves, at least partly because they have fewer ties in the Turin municipality, but this effect may vary by provenance.

Women's *educational level* is also controlled for. This variable may be related to the probability of moving, influencing the extent to which people wanting to move can fulfil their wish and representing, on the other hand, the possibility of staying. Moreover, it may happen that women with high educational levels are more interested in staying in the city, since only there can they find a suitable job. Therefore, the effect of educational level is not easily predictable. Education is also associated with *job position* (seniority of the post within the organization), which will also influence migration behaviour (Long, 1974; Da Vanzo, 1981; Sandefur and Scott, 1981).

RESULTS

Table 1 summarises of the explanatory variables used in the following models; the results are shown in Tables 2, 3, 4 and 5. In Table 2 we present the parameters for the fertility process; in Table 3 and Table 4 we report the analysis for out-migration (first considering out-migrations as a whole, and then distinguishing by destination of the moves); and in Table 5 we consider fertility and migration as interdependent processes, allowing also for correlation between the unobserved components.

In interpreting the parameters, note that a negative and significant parameter means that, compared with the reference category, the group considered shows a *lower* probability of experiencing the event; while a positive and significant parameter means a *higher* probability of experiencing the event.

Fertility

In Table 2 we present the estimated parameters of the model which considers fertility. The basic event of interest is a new birth, and therefore we analysed the hazard of having an additional child. Since we included in the analysis variables referring to previous fertility history, such as the age at previous birth and the length of the interval between marriage and first birth, the effect of the number of existing children is not significant.[2]

Concerning the effect of the length of the interval between marriage and the first birth and between each subsequent birth, we distinguished between protogenesic and intergenesic intervals. As expected, the longer the previous interval between births, the lower the probability of conceiving a new child. Aside from the protogenesic one, this is true only for intervals longer than 9 months, reflecting the fact that for premarital conceptions, the lower the interval, the lower the probability of conceiving again (which is consistent with our hypothesis concerning unintended fertility, and with the results for Italy obtained by Rosina, 2001).

We expected the birth of twins to discourage women from having more children soon afterwards. This was confirmed to some degree, as the

Table 1. Explanatory variables for the models concerning fertility and out-migration choices.

Variable	Kind of variable	Reference category	Knots
Fertility process			
Current parity	Discrete	Parity = 1	
Age at marriage	Continuous		Age 23, 26
Age at previous birth	Continuous		None
Length interval between marriage and first birth	Continuous		9 months
Length interval between previous births	Continuous		None
Immigrant	Discrete	Not immigrant, whatever parity	
Twin as last parity	Discrete	No twins	
Educational level	Discrete	Low educational level, whatever parity	
Variance of heterogeneity component			
Out-migration process			
Current parity	Discrete	Parity = 0	
Current age of the woman	Continuous		Age 17, 30, 40
Having school-aged children	Discrete	No school-aged children	
Educational level	Discrete	Low educational level	
Provenance of immigration	Discrete	Not immigrant	
Variance of heterogeneity component			

Note that in each model there is a baseline risk described through a spline function.

results show that if the last pregnancy led to twins this has a negative effect on subsequent fertility, but the effect was not significant.

We also considered the age of the woman at previous childbirth or at marriage, and this was considered separately for each order of birth. Similarly to previous results (for example, Hoem and Hoem, 1989) we found that those who married young had the highest probability of having a first child, while women who married quite late (at least later than 75% of the same cohort) delayed motherhood.

As far as age at previous childbirth was concerned, we showed that, as expected, the older the woman, the lower the probability of bearing a second or, especially, a third child (as in Murphy, 1992).

The behaviour of in-migrant women is particularly interesting. At the beginning of their reproductive period their fertility behaviour differs significantly from autochthonous women, as they have a higher likelihood of bearing a first child, and also a second one. As the number of children increases, they seem to conform more closely to Turin's population and these results would support the *adaptation hypothesis* as the in-migrants' fertility preferences become more similar to the host population over time (Goldstein and Goldstein, 1983; Bean and Swicegood, 1985; Hervitz, 1985).

The effect of educational level also varied according to parity. Compared with those with low educational levels, whatever their parity, those who were highly educated had a lower probability of conceiving a first child (i.e. of experiencing a transition from parity 0 to parity 1): both the parameters associated with parity 0, medium level and parity 0, high level are significant and negative. Then, a U-shaped effect emerges for transition to parity 2 and parity 3. Indeed, among those who already have one child, those who have a medium educational level have a lower probability of having an additional child (the parameter associated with parity 1 medium level is significant and negative), while women who have a high educational level show the highest probability of having a second child; among those who already have 2 children, women with a high educational level have the highest probability of having a third child. Reaching parity 4 or higher is not dependent on educational level (the parameters associated with parity >2, medium or high level are not significant). These results support the hypothesis that

Table 2. Effect of the covariates on the log-hazard of having an additional child.

	Estimate	s.e.
Current parity (ref.: parity = 1)		
Parity = 2	–0.1135	(0.225)
Parity = 3	–0.2003	(0.398)
Age at marriage (regressor spline for 1st birth)		
Slope age 15–23	–0.0160***	(0.001)
Slope age 23–26	0.0028*	(0.002)
Slope age >26	–0.0043***	(0.001)
Age at previous birth (regressor spline, no knots)		
Effect of age at 1st birth on 2nd birth	–0.0043***	(0.001)
Effect of age at 2nd birth on 3rd birth	–0.0085***	(0.001)
Length of previous interval (regressor spline)		
Interval between marriage and 1st birth <9 months	0.0621***	(0.015)
Interval between marriage and 1st birth >9 months	–0.0073***	(0.002)
Interval between previous births Slope	–0.0166***	(0.003)
Immigrant or not (ref.: not immigrant, with any number of children)		
Immigrant, no children	0.2963***	(0.036)
Immigrant, one child	0.1972***	(0.047)
Immigrant, two children	0.0989	(0.112)
Immigrant, higher parity	–0.1939	(0.328)
Twins as last parity (ref.: no twins)		
Twins = yes	–0.2857	(0.292)
Educational level (ref.: low, with any number of children)		
Parity 0, medium level	–0.3063***	(0.054)
Parity 0, high level	–0.3404***	(0.076)
Parity 1, medium level	–0.3231***	(0.059)
Parity 1, high level	0.3302***	(0.094)
Parity 2, medium level	–0.1154	(0.131)
Parity 2, high level	0.4615**	(0.225)
Parity > 2, medium level	–0.3794	(0.292)
Parity > 2, high level	–0.7596	(0.648)
Variance of the heterogeneity component		
Sigma-fertility	0.4747***	(0.058)
Log-likelihood	–66100.9	

Note: Asymptotic standard errors in parentheses.
*Significant at 10% level; **significant at 5% level; ***significant at 1% level.

in the urban area, in order to proceed to high parities, it is particularly important to have high levels of resources.

Finally, we found that in our model the parameter associated with the variance of the heterogeneity component was significant, meaning that women are heterogeneous in respect to their propensity to have an additional child, and this propensity is not controlled for through other observed covariates.

Models for Out-Migration

Out-migration from Turin municipality is strongly conditioned by demographic events. Out-migration is most common in the very first months of marriage (see Fig. 2, representing the baseline risk for the out-migration process), which may not be a surprise as residential adjustment is often a consequence of marriage (Grundy and Fox, 1985; Mulder and Wagner, 1993). After one year the risk of leaving Turin municipality declines only slightly with the length of marriage.

Other demographic events are important determinants of out-migration (see Table 3). We see that having one child seems to discourage out-migration significantly (the parameter is significant and negative: compared with those with no children, those with one child are 88% likely to leave Turin municipality). However, there are no significant differences between those with no children and those with more than one child in the likelihood of moving away. And, if children are school-aged, this creates ties with the place of residence which make out-migration less likely.

Another factor which can discourage mobility is age: after the age of 30, the probability of

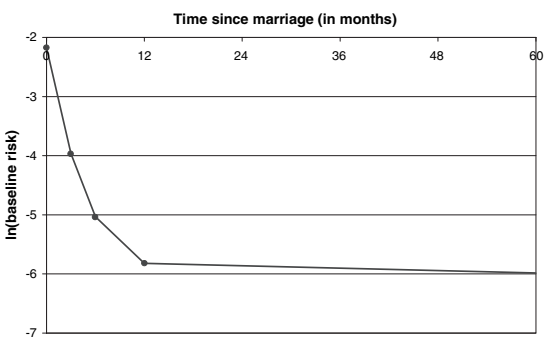

Figure 2. Baseline risks for the migration process.

Table 3. Effects of the covariates on the log-hazard of leaving Turin municipality.

	Estimate	s.e.
Current parity (ref.: parity = 0)		
Parity = 1	–0.1226**	(0.058)
Parity = 2	–0.0545	(0.077)
Parity > 2	0.0961	(0.129)
Current age of the woman (duration spline)		
Slope age 15–17	0.0814***	(0.030)
Slope age 17–30	0.0026***	(0.001)
Slope age 30–40	–0.0031***	(0.001)
Slope age >40	–0.0112***	(0.003)
School-aged children (ref.: no school-aged children)		
Has school aged children	–0.1857***	(0.066)
Educational level (ref.: low)		
Medium level	–0.4489***	(0.057)
High level	–1.7008***	(0.120)
Provenance of immigration (ref.: not immigrant)		
Turin province	0.0827	(0.069)
North–Central Italy	0.1322**	(0.061)
South Italy	–0.1880***	(0.051)
Foreign countries	0.1277	(0.139)
Variance of the heterogeneity component		
Sigma out-migration	0.7145***	(0.109)
Log-likelihood	–31356.3	

Note: Asymptotic standard errors in parentheses.
*Significance at 10% level; **significant at 5% level; ***significant at 1% level.

moving reduces with increasing age (Landale and Guest, 1985). Young women are also less likely to move, although since we selected only married women, young women in the sample are those who married early. These women may have had less resources to move with, as Grundy and Fox (1985) found in England and Wales in 1971.

We also found that those with higher levels of education had lower probabilities of migrating away from Turin. Such individuals may be more oriented to urban ways of life, and may be more likely to find suitable accommodation in urban areas, while those with low levels of education may be forced to move outside the city to find relatively cheaper accommodation. In this respect, we have to take into account that the women we selected spent at least the entire period between age 15 and marriage in Turin municipality, and consequently they may have had strong ties with the city.

Finally, past residential history is also important. In comparison with those who have been resident in Turin throughout, in-migrants from North–Central Italy had a greater propensity to leave Turin municipality, while originating from the South hampers migration. The latter result shows that those who come from the South have greater incentives to stay longer. A possible explanation is that those in-migrants have lower incentives to move to the northern countryside, where they have no family ties, and a return to their place of origin involves a 'longest-long' distance move. We might also speculate that the consistent flows that took place in the 1950s and 1960s from the southern part of Italy towards Turin set up something like a 'southern community', which women leave less often.

Finally, also in out-migration choices women appear to be heterogeneous (the coefficient associated with the variance of the heterogeneity component is significant), meaning that although we controlled in the model for many observed covariates, some heterogeneity in the propensity to leave the city remains, which needs to be taken into account.

When we distinguish by destination (as in Table 4), the effect of some covariates changes slightly. As an example, the negative impact of having one child is only significant for long-distance migration out of the Turin province. Also, having school-aged children has a stronger negative impact on these longer distance moves than on moves within Turin province.

Also the effect of the provenance of immigration changes according to the destination of the move. Indeed, while coming from the South hampers out-migration to every destination, coming from Turin province significantly facilitates returns, while originating in the North or Central Italy encourages longer-distance moves.

Models for Fertility and Migration

Table 5 provides the parameters from a model which considers fertility and migration as linked processes. In this model, we are controlling for the selectivity of migration on the fertility process.

Unobserved factors, which we found to be significant in the models presented in Table 2 and Table 3, seem to be only slightly negatively correlated, but the correlation coefficient is not significant. There is, therefore, only partial support

Table 4. Effect of the covariates on the log-hazard of leaving Turin municipality, distinguishing by destination of the move.

	Destination			
	Turin province		Other destinations	
	Estimate	s.e.	Estimate	s.e.
Current parity (ref.: parity = 0)				
Parity = 1	–0.0892	(0.069)	–0.2091*	(0.107)
Parity = 2	–0.0567	(0.089)	–0.0218	(0.153)
Parity > 2	0.0774	(0.144)	0.1800	(0.274)
Current age of the woman (duration spline)				
Slope age 15–17	0.0875**	(0.039)	0.0749	(0.046)
Slope age 17–30	0.0041***	(0.001)	–0.0011	(0.001)
Slope age 30–40	–0.0046***	(0.001)	0.0013	(0.001)
Slope age >40	–0.0108***	(0.003)	–0.0124**	(0.005)
School-aged children (ref.: no school-aged children)				
Has school-aged children	–0.1556**	(0.074)	–0.3234**	(0.146)
Educational level (ref.: low)				
Medium level	–0.4214***	(0.068)	–0.4815***	(0.096)
High level	–1.7403***	(0.144)	–1.4920***	(0.198)
Provenance of immigration (ref.: not immigrant)				
Turin province	0.1766**	(0.078)	–0.1936	(0.136)
North–Central Italy	0.0332	(0.072)	0.3366***	(0.110)
South Italy	–0.1891***	(0.060)	–0.1764*	(0.090)
Foreign countries	0.2715*	(0.160)	–0.3137	(0.295)
Variance of the heterogeneity component				
Sigma out-migration	0.7930***	(0.133)	0.8693***	(0.315)
Log-likelihood	–23902.3		–9501.8	

Note: as Table 3.

for the hypothesis that woman who have a greater propensity to have children in Turin will also have a greater desire to stay in Turin's municipality and vice versa. A possible interpretation of this result is that unobserved components can in part be an expression of how people perceive the quality of life in Turin municipality (or in a specific neighbourhood) in each dimension of life. As Speare (1974) stated, residential satisfaction can have an independent effect on mobility, even when the effects of background variables (such as duration of residence, age of the head of the household, city or suburban location, being an owner or a renter, and so on) are taken into account. Following this interpretation, the better you feel in Turin, the more you want to have children there, and the less you desire to move. At the same time, the less you want children in Turin, the more you desire to leave.

If we examine the effect on the other coefficients, we can appreciate that the only interesting change with respect to the model where fertility choice was considered independent of out-migration choice (Tables 2 and 3) was on the parity coefficient in the migration equation. The significantly lower probability of out-migration that was associated with parity 1 is no longer significant, and the apparent trend, that the more children a person has, the higher the probability of moving, still remains. Therefore, even if we control for correlation across unobserved factors, having children does not seem directly to hamper out-migration.

CONCLUSIONS

Using data from the Turin Longitudinal Study, we analysed urban fertility in Northern Italy.

Table 5. Effect of the covariates on the log-hazard of having an additional child and of leaving Turin municipality when we consider simultaneously the two hazards (i.e. the unobserved heterogeneity terms are potentially correlated).

Fertility	Estimate	s.e.	Migration	Estimate	s.e.
Current parity (ref.: parity = 1)			*Current parity* (ref.: parity = 0)		
Parity = 2	–0.1153	(0.225)	Parity = 1	–0.0641	(0.075)
Parity = 3	–0.2088	(0.398)	Parity = 2	0.0665	(0.128)
Age at marriage			Parity > 2	0.2836	(0.201)
Slope age 15–23	–0.0161***	(0.001)	*Current age of the woman*		
Slope age 23–26	0.0028*	(0.002)	Slope age 15–17	0.0819***	(0.029)
Slope age >26	–0.0043***	(0.001)	Slope age 17–30	0.0026***	(0.001)
Age at previous birth			Slope age 30–40	–0.0029***	(0.001)
Age at 1st birth	–0.0043***	(0.001)	Slope age >40	–0.0106***	(0.003)
Age at 2nd birth	–0.0085***	(0.001)	*School-aged children* (ref.: no school-aged children)		
Length of previous interval			Has school-aged children	–0.1782***	(0.067)
Protogenesic <9 m	0.0622***	(0.015)	*Educational level* (ref.: low)		
>9 m	–0.0073***	(0.002)	Medium level	–0.4419***	(0.058)
Intergenesic Slope	–0.0166***	(0.003)	High level	–1.7063***	(0.121)
Being immigrated (ref.: not immigrant)			*Provenance of immigration* (ref.: not an immigrant)		
Immigrant, parity = 0	0.2985***	(0.036)	Turin province	0.0757	(0.070)
Immigrant, parity = 1	0.1998***	(0.047)	North–Central Italy	0.1196*	(0.064)
Immigrant, parity = 2	0.1040	(0.112)	South Italy	–0.1922***	(0.051)
Immigrant, parity > 2	–0.1914	(0.328)	Foreign country	0.1237	(0.140)
Twins as last parity (ref.: no twins)			*Heterogeneity component:* Variances and covariance		
Twins = yes	–0.2774	(0.290)	Variance for fertility	0.4761***	(0.058)
Educational level (ref.: low)			Variance out-migration	0.7408***	(0.106)
0 child, medium level	–0.3028***	(0.055)	Correlation	–0.1868	(0.158)
0 child, high level	–0.3210***	(0.077)	Log-likelihood	–97456.5	
1 child, medium level	–0.3182***	(0.059)			
1 child, high level	0.3525***	(0.096)			
2 childr., medium level	–0.1080	(0.131)			
2 childr., high level	0.4893**	(0.226)			
>2 childr., medium level	–0.3665	(0.292)			
>2 childr., high level	–0.7296	(0.649)			

Note: as Table 3.

Since data on urban fertility are censored by out-migration, we studied both fertility and migration together, controlling for the existence of correlated unobserved components that may bias results. We selected people who were resident in the city at least since age 15, studying their behaviour after marriage. This particular selection considers people who chose to stay in the city at least until marriage. This means that changes in the decision to stay are likely to be related to family life-cycle stages.

In this context, fertility seems to be particularly conditioned by the educational level of the woman, which determines the resources for facing new births more than the rising opportunity costs of children (see Becker, 1981). The same covariate is also important for out-migration. People who have a high educational level may be more oriented to urban ways of life, and the availability of a high level of economic resources (here considered through the educational level of the woman) may enable people to find suitable accommodation in the city. People with a lower educational level (and therefore lower economic resources available) may be forced to move outside the city to find relatively cheaper accommodation.

Moreover, parity seems to have an effect on the choice of moving, as those with more than two children were more likely to move away from the city than people with just one child. When the number of children is high, the ties with the city created by them (Long, 1972) are compensated by the need to find suitable accommodation (Grundy, 1986; Baizan, 2002).

Concerning the behaviour of in-migrants, we proved their fertility model is different to those of non-migrants: at least for first parities they have a higher probability of having an additional child. Then their behaviour seems to converge to that of the host population. This supports the *adaptation* hypothesis (Goldstein and Goldstein, 1983; Bean and Swicegood, 1985) which states that in-migrants behave differently from the host society until adaptation to the host urban society occurs.

Including the unobserved component in both processes allowed for the estimation of unbiased coefficients (Lillard, 1993). Women appear to be heterogeneous with respect to their propensity to leave the city and to have an additional child. Controlling then for possible correlation across these components, we found a slightly negative (although not significant) correlation. This partially supports the idea that out-migration may be perceived as a possible solution to fertility plans which cannot be completely fulfilled in the city. This is in line with findings suggesting that people may adjust the timing of events in the family life course in accordance with the availability of appropriate housing. Murphy and Sullivan (1985), for instance, discussed the connection between home-ownership and family stages in Britain, as did Mulder and Wagner (2001) in the Netherlands and West Germany.

Our research has a number of limitations. Firstly, we can only consider fertility behaviour in Turin, but fertility history is censored whenever out-migration occurs. Then, the possible links between fertility and out-migration choices are inferred only indirectly through correlation between the heterogeneity components. In other words, we cannot measure directly the effect of out-migration on fertility, and we cannot understand whether fertility choices change once people leave Turin municipality.

Secondly, some important information could not be used, such as information relating to the working career. Indeed, only the census information is available, for those who resided in Turin municipality at the time of a census. This means that for many women this information is missing and therefore useless.

Finally, we focused on the migration behaviour of married people, but it would be very interesting to include unmarried individuals in the analysis, as this would allow us to examine whether marriage is delayed until out-migration occurs. Unfortunately, as in the case of fertility history, information is censored by out-migration.

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NOTES

(1) A linear spline is a continuous piecewise linear function, i.e. a function which is linear between fixed knots. The slopes between couples of knots have to be estimated by the model. Using a linear spline to describe the time dependence is therefore particularly flexible since entirely different shapes can be represented with the same spline.

(2) However, in another model, where only the parity was considered, the effect of parity was significant: the higher the number of previous children, the lower the probability of having an additional child.

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