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Migration and Fertility: Competing Hypotheses Re-examined

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Abstract

Competing views exist concerning the impact of geographical mobility on childbearing patterns. Early research shows that internal migrants largely exhibit fertility levels dominant in their childhood environment, while later studies find migrants' fertility to resemble more closely that of natives at destination. Some authors attribute the latter to adaptation, but others claim that selection of migrants by fertility preferences may be the cause. Moreover, the short-term fertility-lowering-effect of residential relocation has also been proposed and challenged in the literature. This paper contributes to the existing discussion by providing an analysis of the effect of internal migration on fertility of post-war Estonian female cohorts. We base our study on retrospective event-history data and apply intensity regression for both single and simultaneous equations. Our analysis shows that first, the risk of birth decreases with increasing settlement size and the decrease is larger for higher-order parities. Second, it shows that migrants, whatever their origin, exhibit fertility levels similar to those of non-migrants at destination. Our further analysis supports the adaptation hypothesis. We find no evidence on strong selectivity of migrants by fertility preferences, although we observe elevated fertility levels after residential relocations arsing from union formation.

Keywords: fertility, internal migration, intensity regression, simultaneous equations, Estonia

During the past century, many nations witnessed increasing population spatial mobility and its concentration in the major centres of the country (Woods 2003). While the peak of rural-urban migration in (economically) more developed countries passed a long time ago, and the level of urbanisation has reached close to its maximum today, the overall spatial mobility does not seem to exhibit any signs of decreasing. Considering Zelinsky's (1971) 'theory of the mobility transition', the different forms of spatial mobility simply replace urbanisation when a country proceeds from 'transitional' to 'advanced stage' in its demographic development. Increasing inter-urban movement, trends of sub-urbanisation and counter-urbanisation experienced by many European and North American countries in the past (Geyer and Kontuly 1996), give support for Zelinsky's general argument, despite the fact that the theory had not been able to foresee all these trends (Cadwallader 1993).

Needless to say, moving from one place to another is an important life event, accompanied by both short and long-term changes in an individual's life. While the effect of migration on different life domains of an individual seems rather self-evident, different views exist concerning the impact of a new social environment on childbearing preferences and behaviour of migrants. Earlier research has proposed four partly complementary, partly contradictory hypotheses about how the patterns of fertility might appear following migration (Hervitz 1985; Rundquist and Brown 1989; Lee 1992; Singley and Landale 1998).

The *socialisation hypothesis* relies on the premise that fertility behaviour of migrants reflects the fertility preferences dominant in their childhood environment. Therefore, migrants exhibit similar fertility levels to stayers at origin and the convergence towards fertility levels of population at destination occurs only in the next generation (given that the differences exist). The *adaptation hypothesis*, in contrast, premises on an individual's re-socialisation possibility, and suggests that the fertility behaviour of migrants, sooner or later, comes to resemble the dominant behaviour at the destination environment. The *selection hypothesis*, in turn, argues that changing behaviour is not a question, yet rather the fact that migrants are a specific group of people whose fertility preferences are more similar to those of people at destination than at origin. Finally, the *disruption hypothesis* suggests that immediately following migration, migrants show particularly low levels of fertility due to the disruptive factors associated with the migration process.

This paper contributes to existing discussion, providing an analysis of fertility of internal migrants in Estonia. The objectives are as follows: First, to examine the fertility differences between people who move and those who stay at various origin and destination environments. Second, to look at the role of various factors proposed in the literature in accounting for observed fertility patterns of migrants. The study uses retrospective event-history data, and applies intensity regression for both single and simultaneous equations, with the aim to arrive at a more comprehensive insight into the causes of fertility behaviour of migrants. The paper proceeds as follows: First, we will give an overview of previous research, and specify arguments of different views. Then, we will briefly describe the study context, and introduce the data, methods and variables. Thereafter, we will present the results of multivariate analysis. This leads us finally to the discussion on the role of migration in shaping an individual's fertility behaviour.

Views on the impact of migration on fertility

The rise of the socialisation hypothesis in internal migration-fertility literature is largely associated with Goldberg's (1959, 1960) two studies. Goldberg's main interest was to examine the socioeconomic differences in fertility in urban areas, which many previous studies had found. While research had established an inverse relation of fertility to socioeconomic status – white-collar families were smaller than blue-collar families, Goldberg hypothesised that in reality this relationship might not be so simple as it appeared. Namely, the larger fertility of blue-collar workers might result from occupational selectivity of rural migrants whose fertility was expected to be higher than that of native urban residents because of different childhood socialisation. To test the hypothesis, Goldberg examined fertility of populations of Detroit and Indianapolis. Both studies showed that people with a rural background exhibited significantly higher levels of fertility than native (two-generation) urbanites, and the overall socioeconomic differences in fertility could be attributed primarily to the fertility behaviour of rural migrants and their concentration in lower social and economic positions in the city.

Several other papers studying the socioeconomic differences of fertility in the U.S. gave indirect support for the socialisation hypothesis. Inspired by Goldberg's research, Freedman and Slesinger (1961) analysed the data on the U.S. total population and found that a traditionally observed negative correlation between, either income or education with fertility, disappears when we consider only a native urban population. Thus, overall socioeconomic differences in fertility within an urban population did result from the differences among rural-urban migrants and their over-representation in lower income and educational groups. Duncan's (1965) research confirmed previously observed patterns and led him to conclude that a ‘modern fertility pattern’ could be reached either by non-rural rearing or by prolonged contact with the educational system. Later, however, McGirr and Hirschman (1979) showed that significant socioeconomic differences did exist among earlier cohorts of rural-urban migrants, but not among more recent generations. Their research also indicated that despite decreasing socioeconomic differences, rural-urban migrants had slightly higher fertility in most educational groups.

Surprisingly, however, from later literature on fertility of internal migrants, we can find very few studies dealing with the socialisation hypothesis. One notable exception is a study on fertility of inter-regional migrants in Brazil by Hervitz (1985), where he found only limited support for the hypothesis. Meanwhile, many studies dealing with fertility of immigrants have supported the main arguments of the socialisation hypothesis, although using different rhetoric (the assimilation hypothesis). Rosenwaite’s (1973) study showed that first-generation Italian-Americans maintained their specific fertility behaviour, while the second generation exhibited similar behaviour to native Americans. More recently, Stephen and Bean (1992) found similar inter-generational differences for Mexican-Americans, and Kahn’s (1994) research showed no evidence of changes in fertility behaviour for most immigrant groups in the U.S.

While the socialisation hypothesis received support mainly in early internal migration-fertility literature, the adaptation hypothesis seems to be widespread and popular later on as well. Examples of early studies supporting the adaptation hypothesis are research by Myers and Morris (1966), and Goldstein (1973). The former examined fertility of internal migrants in Puerto Rico using the census data on current residence and place of birth. As opposed to dominant research at that time, their study showed that migrants from rural to urban areas exhibited the same levels of fertility as the native urban population. Goldstein (1973) arrived at largely similar results when examining fertility of rural-urban migrants in Thailand. She found that the fertility levels of migrants, especially in the capital city of Bangkok, were well below those of the non-migrants in the rural areas from which most of the migrants came. Later, Hiday (1978) showed that previous findings also applied to fertility of internal migrants in the Philippines. While all of these studies found the fertility levels of migrants to be more similar to those of the population at destination than at origin, the authors were still careful to give their full support for the adaptation hypothesis, as it remained unclear whether migration did operate as a cause or an effect of low fertility.

More recently, the adaptation hypothesis has been tested and supported by several authors. Farber and Lee (1984) examined the effect of rural-urban migration on fertility in Korea. To control the possible preference selectivity, a model was constructed where they compared fertility paths of individuals who had already migrated (post-migrants), and people who had not yet migrated, but were known to migrate later (pre-migrants). The authors found two significantly different paths, and concluded that rural-urban migration slowed down the fertility rate of Korean women. Later Lee and Pol (1993) showed a significant rural-urban adaptation in Mexico, but not in Cameroon, which they attributed to the specific context of African fertility transition (the fertility increasing effect of urban residency due to reduced infertility).

Brockeroff and Yang (1994), however, found support for the adaptation hypothesis in the African context as well. Their comparative study on fertility of rural-urban migrants in six countries indicated that migrants' risk of conception declined dramatically in all countries around the time of migration, and remained low in the long run among most migrant groups. Additional analysis has shown that the decline in migrants' fertility could be largely attributed to a pronounced improvement in the standard of living after migration and the increasing use of modern contraceptive methods. Brockeroff's (1995) subsequent study on fertility of rural-urban migrants in thirteen African countries confirmed previous findings. Clear evidence supporting the adaptation hypothesis can likewise be found in Hervitz's (1985) research on fertility of inter-regional migrants in Brazil, and in a recent paper by Umezaki and Ohtsuka (1998) on fertility of rural-urban migrants among the Anjangmui dialect group in Papua New Guinea.

The selection hypothesis has been discussed in many papers, but examined in only few studies. Myers and Morris (1966), and Goldstein (1973), raised the question of migrant selectivity in the final sections of their papers. Still, some studies at that time also addressed the issue. Macisco et al. (1970) compared fertility of migrants and non-migrants in San Juan, Puerto Rico. While both groups exhibited significantly lower levels of fertility than the rural population, the fertility of migrants was even lower than that of urban natives. The analysis showed that a higher activity rate and education level of migrants explained some of the differences, but not all. This led the authors to conclude that the rural-urban migrants in Puerto Rico were more oriented toward achievement and innovation, as were the stayers. Early marriage and children in rural areas might be viewed as obstacles to upward mobility, and the response was to delay marriage and fertility, favouring higher education and migration to the capital city (Zarate and Zarate 1975, 125). Hendershot's

(1971) similar analysis showed lower migrant fertility at older ages, but higher fertility among younger migrants to Manila in the Philippines. The author attributed the differences largely to changing migration streams: While in early stages of urbanisation, rural-urban migration was difficult and therefore selective, whereas in later stages it was less difficult and therefore also less selective (Zarate and Zarate 1975, 137).

Many subsequent papers discussed the issue of migrant selectivity (Goldstein and Goldstein 1981; Murphy and Sullivan 1985). Yet, the study by Courgeau (1989) on fertility of rural-urban and urban-rural migrants in France also provided clear evidence supporting the hypothesis. The multivariate analysis of longitudinal data showed that migration to the city significantly reduced a woman's fertility, whereas migration to rural settlements increased it. However, further analysis revealed that migration to rural areas attracted women whose fertility before the move was similar to that of other women in the urban area, while migration to urban areas attracted women whose fertility was similar to that prevailing in the urban areas. Thus, urban-rural migrants adapted to the behaviour dominant in the rural areas, while rural-urban migrants were a selective group, according to their fertility preferences. Recently, White et al. (1995) found evidence supporting the selection hypothesis when analysing fertility of internal migrants in Peru. More specifically, the new residents in larger locations in general, and in the capital city in particular, were more likely to arrive with lower lifetime fertility preferences.

The disruption hypothesis, assuming the short-term fertility-lowering-effect of migration event, has found direct or indirect support in many studies. Goldstein's (1973) early analysis on migrant fertility in Thailand showed that fertility levels of lifetime migrants were not very different from those of non-migrants at destination, while the fertility of recent migrants (those who have been living in a new destination less than five years) was considerably lower. She attributed this phenomenon to possible cohort changes or disruption effect, resulting from spousal separation. In her later study, however, she and her collaborator tended to favour the disruption hypothesis, although they alternatively proposed that the phenomenon might also be related to a low overall fertility of migrants that later "caught up" to the corresponding levels of urban population (Goldstein and Goldstein 1981). A few years later, Hervitz (1985) brought clear evidence supporting the disruption hypothesis in his study on migrant fertility in Brazil. More recently, Brockerhoff (1995) demonstrated a very low fertility of urban-rural migrants during their first few years in cities in several African countries, which he attributed to the unmarried status of migrants and to high levels of spousal separation among married migrants. White et al. (1995) analysed migrant fertility in Peru using longitudinal data, and showed that residential relocation lengthened the birth interval of migrants.

Recently, however, several authors studying immigrant fertility have implicitly or explicitly challenged the disruption hypothesis. Singley and Landale (1998) compared the risk of the first birth of several groups of Puerto Rican women (born in Puerto Rico, but residing in the U.S., residing in Puerto Rico and the U.S.-born Puerto Ricans) using longitudinal data. Their analysis revealed that single women migrating to the U.S. were much more likely than their non-migrant counterparts in Puerto Rico to form unions and experience a conception, either in unions or outside. The authors concluded that migration to the U.S. should be seen as a part of the family building process for many Puerto Rican women. Andersson (2001) arrived at very similar conclusions when examining immigrant fertility in Sweden. The analysis of risk of the first birth showed elevated levels of childbearing during the first couple of years after immigration to Sweden. Moreover, the author found migration to trigger, rather than disrupt the process of childbearing, also for higher birth orders. The study by Mulder and Wagner (2001) on family formation and home ownership in West Germany and the Netherlands, in turn, demonstrated increasing rates of first childbirth shortly after a couple had moved to their own house.

To sum up, different hypotheses have been proposed to predict and explain fertility patterns of migrants. Each of these hypotheses has received support in the literature, and has also been challenged. Each perspective draws upon some theoretical view, assuming a variety of factors to be more important than others in shaping migrant's childbearing behaviour. Socialisation hypothesis emphasises the critical role of the childhood environment. The norms and values dominant in a migrant's childhood environment guide her/his later actions in other places as well. To the contrary, the adaptation hypothesis assumes that what matters most in shaping a migrant's fertility behaviour is her/his current sociocultural and economic environment. Selection hypothesis also seems to emphasise the importance of the childhood environment. However, norms and values differ across population subgroups, and the "minority" later moves to locations where values similar to theirs dominate. Finally, the disruption hypothesis argues that economic and psychological costs of residential relocation cannot be underestimated when studying fertility patterns of migrants.

Contradictory conclusions of studies often arise from different time, context and types of migrations investigated. Various methodologies used may also account for some differences. In this context, some critical remarks on dominant research methodologies are inevitable. First, most studies use cross-sectional (usually census) data while studying the effect of migration on fertility. Longitudinal data have found only limited use, despite their dominant position in many areas of population research. Clearly, the lack of information on the precise timing of migration, fertility and other factors restricts any causal inferences to be made about the migration-fertility relationships. Second, most recent studies have successfully controlled for selection of migrants by various socioeconomic factors, while assessing the impact of migration on fertility. However, the possible unobserved selectivity of migrants by fertility preferences has been addressed only in a few studies (e.g. Courgeau 1989; Montgomery 1992; Michielin 2002). This fact has further intensified the difficulties when drawing conclusions about migration-fertility relationships. Therefore, using retrospective event-history data, and controlling for unobserved selection of migrants when examining the effect of various factors on migrant fertility, should be seen as major contributions of this paper. Before we introduce the data and methods, however, we will briefly outline the context of the research.

Fertility and migration trends in Estonia

The beginning of the fertility transition in Estonia can be traced back to the mid-19th century. The 1850s–60s signifies a period when fertility levels began to decrease and gradually approached levels characteristic of a 'modern fertility regime'. By the late 1920s, period fertility had already reached below replacement level in Estonia (Katus 2000, 215–216). With its relatively early fertility transition, Estonia (and neighbouring Latvia) has been associated with the group of 'pioneering nations' of demographic transition, along with France, Switzerland, Sweden and Norway (Katus et al. 2002, 143). While earlier fertility development in Estonia followed patterns common in Western and Northern Europe, the post-WWII trends differed. Estonia did not experience a post-war baby boom, and period fertility remained below replacement level until the mid-1960s. Thereafter it slightly increased among its native population, and stayed above replacement level until the late 1980s, when a rapid fertility decrease, characteristic of the post-socialist transition period, began. Cohort fertility, based on the Estonian Family and Fertility Survey, show relatively stable and low levels among cohorts of native people born from the 1910s to the 1940s, and a slight increase among the cohorts born in the late 1940s and the 1950s (Katus et al. 2002, 145).

While fertility levels remained rather stable in post-war Estonia, the trends in population migration were far more dynamic. Besides the intensive immigration from other parts of the Soviet Union (Kulu 2003), intensive urbanisation also characterised the post-war period. In 1939, 33% of the Estonian population lived in urban areas. The share of urban population increased to 56% in 1959 and to 71% in 1989 (Tammaru 2001a, 580). The cities grew both as a result of (internal) rural-urban migration and immigration that was overwhelmingly destined for urban areas. While external migration fed the urban growth until the late 1980s, trends in internal migration were different. Since the late 1970s, urban-rural migration increased, and in the following decade, rural areas in Estonia witnessed a positive net migration for the first time in the country's history. The migration turnaround has been attributed to increasing investments by the state in agricultural production, and also to the changing preferences of people (cf. Marksoo 1992, 134). During the 1990s, the concentration in major centres again became the dominant trend among the working age population, and was later accompanied by increasing sub-urbanisation. The share of the urban population, however, decreased from 71% in 1989 to 67% in 2000, mostly as a result of emigration of Russians and other ethnic minorities (Tammaru 2001a).

The fertility of internal migrants in Estonia has not been studied, nor is much known about regional variation in fertility levels and urban-rural differences. In this context, a follow-up of the recent census (2000) data on the Estonian native population is highly informative. We see significant differences that exist in fertility levels of population across settlement hierarchy (Figure 1). Fertility in rural areas is clearly above replacement levels in all birth cohorts who have already passed, or are about to reach the end of their childbearing ages. Fertility in the urban population, however, remains below replacement level, comprising about 80% and 65% of rural levels in towns and the capital city of Tallinn, respectively. (Very similar picture also applies for the immigrant population.) It is also striking that fertility differences are rather stable, and do not change much across the cohorts, as one might assume.

Data and research population

The data for our study come from the Estonian Family and Fertility Survey. The Estonian FFS was carried out in 1994 among 5,021 women born between 1924–73 (see Katus et al. 1995), using the 1989 census as a sample frame. The share of those surveyed was 81% (5,021 from 6,212), or 86%, leaving aside over-coverage (those who had died or had left Estonia in 1989–94). A comparison between women who were surveyed with those who were not, and the total female population by major sociodemographic variables, showed that there were no significant differences (Katus et al. 1995, 18–21). As part of the Europe-wide FFS program, the survey was based on the collection of event histories. All major demographic events that had taken place in the life of the respondent were identified (to the accuracy of a month), including births, co-residential unions and residential changes since age 14. In the FFS program, collection of migration histories was optional, and only a few countries implemented this module. The high response rate, the multiple retrospective histories collected, and the high quality of the collected retrospective information in the Estonian FFS provide a good basis for studying the effect of migration on fertility in more detail.

Our research population consists of the native female population born from 1944–73. We focus on only native people because we wish to have a homogeneous population when testing competing hypotheses. In total, there are 1918 native women in the data set. However, we exclude 43 women who have not indicated the date of their union dissolution for some reason or other. Therefore, our final research sample consists of 1875 native females born from 1944–73. We study the impact of migration on their first, second and third conceptions (leading to births). There are 1556, 1005 and 358 such events, respectively. We define migration as a residential change that crosses the border of an urban settlement or rural municipality, and lasts for more than three months. We go beyond traditional urban-rural-dichotomy and distinguish three types of settlements of origin and destination of migration: 1) rural areas (less than 2,000 inhabitants); 2) small and medium-size towns (2,000–100,000); and 3) a large city or the capital (the capital being Tallinn, with more than 400,000). The distribution of the sample population across settlement-type is as follows: 46% of women lived in rural areas at age 14, 36% in small towns, and 18% in the capital city. The corresponding figures at the time of interview were 37%, 38% and 25%. The share of migrants was 80%, 74% and 54%, respectively.

We split the data-set by conception episode, following general logic of event-history data set up. Individuals are at risk since age 14 (for the first conception) or previous birth (for the second and third conceptions). The final censoring takes place at interview (actually, nine months before) or at age 45. Residential episodes outside Estonia are excluded from our analysis. If conception occurs simultaneously (in the same month) with migration and/or union formation, we use the sequence of events as follows: migration, union formation and conception. Thus, we assign simultaneous conceptions to the destination environment, which, as we will see later, turns out to be a reasonable solution. We also build a multi-episode data-set for migration, which we need for later simultaneous analysis. The risk of migration starts at age 14, or at the previous migration. In total, there are 3063 migration events in our data-set: 1183 of which were destined to rural areas, 1255 to small towns and 625 to the capital city.

Methods and analytic strategy

We use intensity regression or (multivariate) indirect standardisation (Hoem 1993) as a research method. We estimate several models in order to further examine various hypotheses proposed in the literature. We begin with a simple model where we look at the effect of migration on conception, controlling for only baseline duration (time since age 14 or previous birth), partnership status (in case of the first conceptions) and union duration. The results outline possible differences between migrants and non-migrants at various places of origin and destination, and therefore give us preliminary evidence about how and whether migration shapes fertility behaviour. Thereafter, we also include in our analysis other background variables of individuals to further control for demographic and socioeconomic selectivity of migrants when assessing the impact of migration on fertility. Our basic model can be formalised as follows:

$$(1)\ \ln \mu_i(t) = y(t) + \sum_k z_k(u_{ik} + t) + \sum_j \alpha_j x_{ij} + \sum_l \beta_l w_{il}(t),$$

where $\mu_i(t)$ denotes the intensity of conception (first, second or third) for individual i, $y(t)$ denotes a piecewise linear spline that captures the impact of baseline duration on the intensity. The $z_k(u_{ik} + t)$ denotes the spline representation of the effect of a time-varying variable that is a continuous function of t with origin u_{ik}. The x_{ij} represents the values of a time-constant variable and $w_{il}(t)$ represents a time-varying variable whose values can change only at discrete times.

After having outlined the basic differences between people who moved and those who stayed at various origin and destination environments, we look next at the possible role of unobserved selectivity accounting for differences between migrants and non-migrants (which we expect to find). We have built a simultaneous-equations model for that purpose, which jointly estimates three equations for fertility, and three equations for migration (according to destination of residential change). Both processes have their (person-specific) heterogeneity terms, and allowing correlation between the residuals we identify possible endogeneity of migration in the fertility process and control for the unobserved selectivity when analysing the effect of migration on fertility (Lillard 1993). The model can be formalised as follows:

$$(2)\quad \begin{aligned}
\ln \mu_i^{C1}(t) &= y^{C1}(t) + \sum\nolimits_k z_k^{C1}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{C1}{}_j x_{ij} + \sum\nolimits_l \beta_l^{C1} w_{il}(t) + \varepsilon_i^C \\
\ln \mu_i^{C2}(t) &= y^{C2}(t) + \sum\nolimits_k z_k^{C2}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{C2}{}_j x_{ij} + \sum\nolimits_l \beta_l^{C2} w_{il}(t) + \varepsilon_i^C \\
\ln \mu_i^{C3}(t) &= y^{C3}(t) + \sum\nolimits_k z_k^{C3}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{C3}{}_j x_{ij} + \sum\nolimits_l \beta_l^{C3} w_{il}(t) + \varepsilon_i^C \\
\ln \mu_i^{R}(t) &= y^{R}(t) + \sum\nolimits_k z_k^{R}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{R}{}_j x_{ij} + \sum\nolimits_l \beta_l^{R} w_{il}(t) + \varepsilon_i^M \\
\ln \mu_i^{S}(t) &= y^{S}(t) + \sum\nolimits_k z_k^{S}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{S}{}_j x_{ij} + \sum\nolimits_l \beta_l^{S} w_{il}(t) + \varepsilon_i^M \\
\ln \mu_i^{L}(t) &= y^{L}(t) + \sum\nolimits_k z_k^{L}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{L}{}_j x_{ij} + \sum\nolimits_l \beta_l^{L} w_{il}(t) + \varepsilon_i^M
\end{aligned},$$

where $\mu_i^{C1}(t)$, $\mu_i^{C2}(t)$, $\mu_i^{C3}(t)$ denotes the intensities of the first, second and third conceptions, respectively, and $\mu_i^R(t)$, $\mu_i^S(t)$, $\mu_i^L(t)$ represents the risks of migration to rural, small urban and large urban destinations in the competing risk framework. ε_i^C and ε_i^M are person-specific heterogeneity terms for fertility and migration processes, respectively, and are assumed to have a joint bivariate normal distribution. The identification of our model is attained through within-person replication: many people have given several births, and some people have also made several moves (see Lillard et al. 1995, 446).

However, there is reason to believe that the nature of selectivity may depend on the destination of migration. As the literature reviewed showed, larger cities may attract people who prefer smaller families for some reason or other, while migrants to rural settlements may desire many children. Therefore, we have to extend our simultaneous-equations model allowing separate heterogeneity terms for each migration equation:

$$(3)\quad \begin{aligned}
\ln \mu_i^{C1}(t) &= y^{C1}(t) + \sum\nolimits_k z_k^{C1}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{C1}{}_j x_{ij} + \sum\nolimits_l \beta_l^{C1} w_{il}(t) + \varepsilon_i^C \\
\ln \mu_i^{C2}(t) &= y^{C2}(t) + \sum\nolimits_k z_k^{C2}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{C2}{}_j x_{ij} + \sum\nolimits_l \beta_l^{C2} w_{il}(t) + \varepsilon_i^C \\
\ln \mu_i^{C3}(t) &= y^{C3}(t) + \sum\nolimits_k z_k^{C3}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{C3}{}_j x_{ij} + \sum\nolimits_l \beta_l^{C3} w_{il}(t) + \varepsilon_i^C \\
\ln \mu_i^{R}(t) &= y^{R}(t) + \sum\nolimits_k z_k^{R}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{R}{}_j x_{ij} + \sum\nolimits_l \beta_l^{R} w_{il}(t) + \varepsilon_i^R \\
\ln \mu_i^{S}(t) &= y^{S}(t) + \sum\nolimits_k z_k^{S}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{S}{}_j x_{ij} + \sum\nolimits_l \beta_l^{S} w_{il}(t) + \varepsilon_i^S \\
\ln \mu_i^{L}(t) &= y^{L}(t) + \sum\nolimits_k z_k^{L}(u_{ik}+t) + \sum\nolimits_j \alpha_j^{L}{}_j x_{ij} + \sum\nolimits_l \beta_l^{L} w_{il}(t) + \varepsilon_i^L
\end{aligned},$$

where ε_i^R, ε_i^S and ε_i^L are heterogeneity terms for migration to rural, small urban and large urban areas, respectively. Again, allowing correlation between (person-specific) residuals of fertility and migration equations, we test endogeneity of migration in the fertility process, and thus eliminate a possible bias while estimating the effect of residential change on fertility. To identify the model, we have no need of instruments at this time, as some people have made several moves towards the same destination.

So far our modelling strategy has focussed mostly on testing three basic hypotheses in general, and the question of adaptation versus selection in particular. However, the disruption hypothesis also needs examination. In order to clarify the effect of migration event on fertility, we have to make our static models more dynamic. Therefore, in our final models, we allow the intensity of conception at destination to vary over time since arrival in the settlement, instead of assuming a constant risk. Technically, this is achieved by using the linear spline representation to capture the effect of time at destination on fertility. We estimate our "dynamic" models both separately and jointly in order to see the difference as a result of possible selection.

Explanatory variables and hypotheses

We do have equations for both fertility and migration processes. In fertility equations, variables reflecting an individual's residential history hold a central position. In the analysis we include a (time-varying) variable showing an individual's current residence, and a variable indicating residence at age 14 (for migrants). Although the childhood settlement may have some role in later fertility behaviour, we draw upon recent internal migration-fertility literature and hypothesise the following: migrants to larger settlements exhibit lower levels of fertility than stayers at origin, and migrants to smaller places, in turn, have higher fertility than stayers at larger settlements. If the hypothesis is supported, then finding an answer to the question of adaptation versus selection becomes a major task of our further analysis. We also expect to find evidence supporting the disruption hypothesis, although as some previous studies have shown, the risk following migration may depend on the type of migration (this we can control to some extent by means of simultaneous analysis). In addition, we include a variable showing the number of migrations to capture the "interim" experience of migrants.

We control for several demographic and socioeconomic variables when testing different hypotheses concerning the impact of migration on fertility. Our duration variables are age and time since previous birth (for the second and third conceptions). We expect the probability of the first conception to be the highest in the early twenties, as previous studies have shown relatively early childbearing of post-war Estonian women (Vikat 1994; Katus et al. 2002, 154–

155). The intensities of the second and third conceptions rise rapidly in the first six months after a birth, and remain at high levels during the subsequent year or two, before they begin to decrease (Katus et al. 2002, 158; cf. Lillard 1993, 675). Second, we include in our analysis, an individual's partnership status and union duration for those in union. We expect union formation and marriage to significantly raise the probability of conception, and the risk to gradually decrease with duration of union (Baizan et al. 2003, 157). The next variable represents (calendar) time to capture the impact of changing context. We hypothesise slightly increasing fertility since the late 1960s, but a sharp decrease in fertility levels in the 1990s (Katus 2000; Philipov 2002, 7).

We include educational enrolment, employment status, and level of education to control the effect of an individual's socioeconomic characteristics. We assume the probability of conception to be higher when an individual has completed her/his studies (Singley and Landale 1998, 1459; Baizan et al. 2003, 157). We expect employed women to have a higher intensity of conception (for the first conception, at least) compared to those who are inactive in the context of full (and compulsory) employment. The possible fertility patterns across educational groups are more difficult to predict. Earlier studies showed an inverse relationship between education and fertility, while more recent research has demonstrated a relatively high risk for second and third births for educated women. However, that seems to disappear when controlling for 'relative' age of educated women, their partners' characteristics and other (usually) unobserved factors (Hoem et al. 2001b; Kravdal 2001; Kreyenfeld 2002). We hypothesise an inverse relationship between fertility and education regarding first conception, and a relatively high risk for second conception for educated women (Katus et al. 2002, 177). However, that may vanish in the course of simultaneous analysis. Finally, we assume the number of siblings to be positively related to an individual's fertility (Hoem et al. 2001a, 46; Baizan et al. 2002, 39), and women belonging to the Russian (historical) minority in Estonia to exhibit slightly lower levels of fertility (Sakkeus 2000, 278).

While our paper focuses mostly on the impact of migration on fertility, the analysis also allows us to examine the determinants of migration in post-WWII Estonia. All variables in the fertility equation may enter into the migration equation (if needed), as our models are identified through within-person replication. Our baseline variables are age and time since previous residential change (for the second and higher migrations). In keeping with the literature, we assume the intensity of migration to reach its peak at late adolescence, when the majority of cohorts complete their (secondary) education and continue their studies (often elsewhere), or enter into the labour market (Katus et al. 1999, 16; Sjöberg and Tammaru 1999, 828; see also Ma and Liaw 1997, 237). Concerning the effect of time since previous migration, we expect increasing risk during the first few years, and decreasing intensities thereafter (Gordon and Molho 1995). Second, we hypothesise singles and divorced people to be more mobile than those already in a union (cf. Mulder and Wagner 1993, 73; Newbold and Liaw 1995, 125). Third, we assume the presence of children in a family to significantly decrease the probability of urban-ward migration, yet possibly to increase the propensity to move to rural destinations (Courgeau 1989, 140).

The next variable represents (calendar) time, and we hypothesise an increasing migration risk towards rural areas in the 1980s, and decreasing overall intensities in the early 1990s as a result of economic hardship arising from post-socialist transition (Marksoo 1992; Kulu and Billari 2003). Sixth, we assume increasing migration intensities after studies have been completed, and also a higher risk when an individual is out of the labour market (cf. Fischer and Malmberg 2001, 265). Seventh, we hypothesise increasing mobility as it correlates to an individual's rising level of education. This is a result of increasing options due to education and a larger dispersion of jobs of more educated individuals (Courgeau 1985, 159; Newbold 1999, 266). Next, there is also reason to believe that the presence of siblings raises the probability of the first migration (home-leaving), at least (Courgeau 1989, 136). We also assume that ethnic Russians move less than Estonians do, to rural areas in particular (Kulu and Billari 2003). Finally, we hypothesise decreasing migration intensity with increasing settlement size for non-migrants. The pattern for migrants is likewise expected to depend on residence at age 14 and on the number of previous moves (Kulu 2002).

Results: impact of migration on fertility

We began our modelling by running a set of models to examine the effect of various destination environments on fertility of migrants with different origins (e.g. a woman with a rural background in a small town, with a large city origin in a rural settlement etc.). As we found no significant variation among migrants with different origin (residence at age 14 or previous residence) when living in the same (destination) environment, we decided to collapse the categories of origin and leave only the destination of migration in our main analysis, with one exception: the residence at 14 is included in the models for the third birth. Thus, there are six residential categories in most cases: non-migrational and migrational episodes in rural, small urban and large urban areas, respectively.

The episode is non-migrational if an individual has not moved since age 14. Migrational episodes are defined according to destination of migration, whatever the origin of migrants.

Let us now present the results of our main analysis. In the first model, we look at the effect of migration on conception, controlling only for baseline duration, partnership status (in case of the first conception) and union duration. We see that the intensity of the first conception of residents of rural settlements, both non-migrants and migrants, and those of small towns, does not differ significantly (Tables 1 and 2, model 1). The major dividing line runs between this pool of people and people living in a large city, whatever their origin. Natives in the capital city have 34% and migrants have a 28% lower risk of the first birth than the native rural population, for example. The results on the second conception are different. Here, the major division exists between residents of rural and urban areas. Non-migrants in small towns have 42% and those in large cities have a 45% lower risk of the second birth than the native rural population. Again, migrants exhibit similar levels of risk to the non-migrants at destination. Therefore, migrants from rural to urban areas also have a significantly lower intensity as compared to stayers in rural areas, while urban to rural migrants have a higher fertility rate than non-migrants in urban areas.

The results on the third conception have their specific character as well. The impact of settlement hierarchy is now clearly present – the larger the settlement the lower the risk of the third birth. Natives in small towns have 34% and those in large cities have a 58% lower risk of the third birth as compared to a non-migrant population in rural areas. At first it seems that migrants have an even lower risk of the third conception than non-migrants at destination. However, further analysis shows that the differences are not significant. Residence at age 14 also shapes the patterns of the third birth. Surprisingly, however, migrants who lived at small towns at age 14 exhibit the lowest intensity levels, whatever their later residence, while the risk for those socialised in a large city seems to be the highest. Finally, our analysis indicates that the number of previous migrations also matters. People who have moved twice or more have a higher risk of conception than those who have migrated only once. However, the differences are significant only in regards to the first two births.

Next, we have included in our analysis all background variables of individuals to further control for demographic and socioeconomic selectivity of migrants when assessing the effect of migration on fertility. The differences outlined above decrease slightly, but remain significant (Tables 1 and 2, model

2). Thus, our analysis supports previous findings that differences between residents of various settlements grow with increasing parity, and migrants (whatever their origin) exhibit fertility levels similar to those of non-migrants at destination, with a possible minor exception for the third birth. While our results give limited support for the socialisation hypothesis (regarding the third birth), it is now clear that our major task is to clarify why the fertility of migrants is similar to that of natives at destination. Does this result from migrants' adaptation, or rather further selectivity of migrants that is unobserved in this case?

In the next stage, we include person-specific residuals into fertility and migration equations, allowing for correlation between heterogeneity terms. The model fit improves significantly (the value of likelihood ratio test statistic (LR) is 191.4 with 3 degrees of freedom, p-value is < 0.01). The standard deviation of residuals is significantly different from zero in both cases (Table 1, model 3). Moreover, the correlation coefficient is positive (0.39) and significant. Thus, migrants (some of them, at least) have unobserved characteristics that increase their probability of childbearing. Controlling for this unobserved selectivity, however, does not change our previous results substantially. Only the impact of the number of migrations disappears, and the difference between rural natives and other groups (including rural migrants) increases slightly. Thus, what we have established is the fact that some migrations are directly related to the childbearing process, and/or that strong positive selection of migrants by fertility preferences operates towards some destination. As a result, the overall figures also follow this pattern. We should continue allowing possible selection to vary across destination of migration.

To further examine the issue of selectivity, we include in our analysis a person-specific residual for fertility equations and separate heterogeneity terms for each migration equation, allowing for correlation between the residuals. Again, the model fit improves significantly, as compared to the previous one (LR = 107.6 with 7 degrees of freedom, p-value is < 0.01). The standard deviations of all four heterogeneity terms are significantly different from zero (Table 1, model 4). More interestingly, while correlations between the (person-specific) residual of fertility equations and that of migration to rural and small towns are positive, the correlation with residual of equation for the large urban destination is not different from zero. Therefore, the unobserved selectivity of migrants, whatever its meaning, operates towards rural and small urban destinations. However, the coefficients of our main interest do not change as significantly – migrants exhibit rather similar fertility levels to the native population at destination. Still, comparing the current results with that of separate modelling (model 2), we notice that the coefficients for migrants to rural and small urban areas are upward biased, although slightly, in the single-equation model. Interestingly, the same holds regarding first, second and third conceptions, and applies likewise to non-migrant groups. To sum up, the simultaneous analysis largely supports our previous findings. Furthermore, it shows that unobserved selection of migrants is a reality (in some cases), but its impact to refute the adaptation hypothesis is not very strong[1].

So far, we have assumed a constant fertility risk for migrants at destination. Next, we extend our second and fourth models, allowing the intensity of conception to vary over time since arrival in the settlement. This strategy enables us not only to examine the disruption hypothesis in more detail, but also to gain further insight into the selectivity issue. We focus only on the risk of the first conception, as possible changes in time are expected to be most colourful here (and the number of events sufficient for more detailed analysis). We present our results in the graph in order to assist in interpretation of the results. The results of separate modelling are presented first. We notice different time patterns for migrants to rural and small urban destinations, on the one hand, and for migrants to large urban destinations, on the other hand (Figure 2). In the former, the risk after migration is very high (migrants to rural areas have about 44% higher risk than rural non-migrants, and those to small towns have an even higher risk, at 95%, than natives in small towns), which then quickly decreases. In the latter, the intensity is a very low right after migration (37% lower than that of urban natives) and then increases. We also see that the risk of the first conception mostly changes during the first half of a year, with no significant changes later. (The model fit, however, improves only slightly (LR = 15.0 with 9 degrees of freedom, p-value is < 0.10), pointing to the fact that not all parameter estimates are significantly different from zero.)

How could we interpret the observed patterns? Clearly, the results tell us that some (or even many) migrations to rural and small urban areas are directly related to childbearing (and family formation) in regards to women. This is not surprising, considering the recent findings by studies on immigrants' fertility. However, this is only one side of the coin. On the other side is that this conclusion applies much less for migrations to large urban destinations. On the contrary, a relatively low risk right after migration seems to give support for the disruption effect: the settling-in in a large city takes some time, and childbearing is postponed in most cases, although only for a period of a few months. While the nature of unobserved selectivity found in previous analyses is also becoming clear for us, the results of simultaneous analysis give further valuable information. We see that the risk of the first conception after migration reduce significantly, when controlling for unobserved selectivity of migrants, although it remains relatively high in regards to migrants to small towns (Figure 2)[2]. Meanwhile, the longer-term fertility patterns of movers do not change very much – migrants in different destinations still exhibit rather similar fertility levels to the non-migrants there. The risk of conception for migrants to rural areas is relatively low, but the difference (compared to natives at destination) is not significant. Thus, while some migrations are directly related to childbearing (and family formation), we find no evidence to conclude that certain areas attract people with the fertility behaviour dominant there. Rather, migrants tend to adapt to fertility levels prevalent at destination, and sometimes postpone childbearing for a period of time in order to overcome economic and psychological costs arising from a residential relocation.

Results: impact of other variables

Let us now discuss the effect of other variables on fertility. The results are for the most part as expected. The risk of the first conception is the highest in the early twenties, confirming the relatively early start of childbearing of post-war Estonian women (Vikat 1994; Katus et al. 2002, 154–155) (Table 1). The baseline intensities for the second and third conceptions largely follow patterns shown in other studies: they rise rapidly during the first six months after previous birth and then decrease (cf. Lillard and Waite 1993, 666; Hoem et al. 2001a, 46). As expected, both union formation (in case of first birth) and marriage significantly increase the probability of conception. However, the rise is an extreme upward surge and the subsequent decrease rather steep, which points to a concentration of many conceptions (first two, at least) in the beginning of the union, contrary to patterns found in other countries (Baizan et al. 2002, 39). Regarding changes over time, the risk of the second birth (at least) rose in the 1970s and the 1980s, and the intensities of all parities decreased in the 1990s as expected (Katus 2000; Philipov 2002, 7). The lower risk of conception during studies also corresponds to expectation. Likewise, it is not a surprise that there is a higher risk of the first conception during employment, in the context of a planned economy where inactivity before childbearing might indicate possible health problems.

Our analysis supports previous findings on the relatively high risk of a second birth of highly educated women, showing them as 'carriers' of 'two-child norm' in post-war Estonia (Katus et al. 2002, 177). Also, a higher intensity of the third conception among less educated women corresponds to previous findings. The analysis, however, does not confirm the inverse relationship between education and the first birth found in most studies. (Our further analysis reveals that this pattern holds regarding younger birth cohorts, and also when separate (person-specific) residuals are allowed for equations of the first and second-third births. The issue, however, requires more detailed treatment, which goes beyond the scope of this study.) The analysis also supports the role of siblings and ethnic origin in shaping fertility patterns. As expected, the larger the number of siblings, the higher the fertility. Belonging to the Russian minority, in turn, decreases the probability of the second and (obviously also) the third conceptions. Finally, we also tested the effect of variables showing parental divorce, whether a previous child was conceived with the same partner or not, and whether a previous child was born in the current residence. None of these variables had a significant impact on fertility, and we excluded them from our main analysis. However, very religious women exhibited high levels of the third birth intensities, as was expected (Hoem et al. 2001a, 46), but we also excluded this variable, as there were too few cases and events in the most interesting group.

Results: determinants of migration

Next, we briefly discuss determinants of internal migration of post-war Estonian female cohorts. The analysis largely supports findings of previous studies, although some differences can also be outlined. As expected, the intensities of migration to all destinations are the highest at late adolescence, and thereafter gradually decrease (Tabel 3) (Katus et al. 1999, 16; Sjöberg and Tammaru 1999, 828). Our analysis also shows increasing mobility of migrants during the first three to four years after residential relocation, and a subsequent decrease. The fact that people in a union have a lower risk of migration to cities than singles, in addition to the higher mobility of separated people, corresponds to expectations (cf. Mulder and Wagner 1993, 73). We also find the presence of children to significantly decrease the probability of moving to urban areas in general, and to the capital city in particular, but we have not found this to affect the mobility towards rural settlements, as shown in some other studies (Courgeau 1989, 140). Still, further analysis indicates that children (especially the second or a subsequent child) increase the probability of moving to rural areas from smaller towns (but not from a large city). Decreasing migration intensities towards urban areas in the 1980s, and also to rural areas in the 1990s, are consistent with the socioeconomic changes in Estonia during the late socialist and early transitional periods (Marksoo 1992; Kulu and Billari 2003).

Lower intensity of migration during studies and employment, likewise corresponds to expectations (Fischer and Malmberg 2001, 265). Increasing mobility as it correlates with an individual's rising education is not surprising either, as well as a significantly higher risk of educated people moving to the capital city. The latter points to both better opportunities for the highly educated to achieve their ends, and the location of their (major) job-market (Newbold 1999, 266), but obviously also to a specific character of planned economies. Namely, some university graduates had been directed to work in smaller towns and rural settlements which they left (alone or with families) when their first (semi-compulsory) job-contract ended (cf. Rybakovskiy and Tarasova 1991). Concerning the effect of siblings on migration intensities, as expected we see a rising mobility (to rural and small urban areas) of people having two or more siblings (Courgeau 1989, 136). However, further analysis shows that the impact is significant only on the risk of the first migration, which actually is not surprising.

Finally, current residence, residence at age 14, and the number of previous migrations are also important determinants of mobility. Moreover, the effect of these characteristics appears to be sensitive to different specifications. The results of a separate analysis show that native urban residents have a significantly lower risk of moving to rural settlements than migrants in the cities or native rural population (Tabel 3, model 2). This is not surprising, and neither is the fact that migrants with an urban background have significantly lower migration intensities as compared to those with a rural origin (whatever their current residence). Most residential groups exhibit a significantly lower risk of moving to small towns than native rural residents. Again, the probability is the lowest for natives in the capital city, which confirms their modest desire to leave the large city (Marksoo 1990). Residence at age 14 matters: migrants with a small town background have the highest and those with a large city origin exhibit the lowest intensities of moving towards small towns. Again, migrants with two and more residential changes have a lower risk of migration than those with only one move, which may result from the fact that two migrations are often unavoidable for an individual who has no intention to leave her/his childhood settlement permanently, but decides to continue her/his studies.

Our analysis of migrations towards large cities shows that native rural and small urban residents have a higher risk of migration than migrants in rural environments. Women with a large city background have the highest probability among migrants, pointing to a returning to their childhood environment. Interestingly, however, some of the results described above, change in the course of simultaneous analysis. More specifically, the differences in risk of migrating to rural and small urban destinations increase between native residents and migrants in rural and small urban areas (Table 3, model 4). Further analysis shows that an upward-biased risk of moving to rural and small urban settlements, as we (originally) observed, results largely from strong interrelations of migrations between these areas. This is not surprising, and could also be concluded from the results presented earlier (a significant positive correlation of person-specific residuals of two migration processes) (Table 1).

Summary and discussion

Let us now summarise the major results of this study and discuss the observed fertility patterns and their significance. We began our analysis examining differences in fertility behaviour of residents of various settlements, both migrants and non-migrants. Our analysis showed that first, the risk of conception decreased significantly with increasing settlement size, and the decrease was larger for higher-order birth parities. Residents of the capital city had lower intensities of the first birth, as compared to the rural population, a much lower risk of the second conception, and even lower intensities of the third birth. Second, it became clear that migrants, whatever their origin, exhibited rather similar fertility levels to the non-migrants at destination. People moving from rural and small urban areas to the capital city showed a similar risk of birth to natives at destination. Migrants moving from a large city to rural settlements, in turn, exhibited fertility levels that were closer to those of the rural population.

Next, we controlled for demographic and socioeconomic selectivity of migrants when assessing the effect of various destinations on their fertility. Patterns observed in the previous step changed slightly, but not significantly. Thereafter, we also identified and controlled for possible unobserved selectivity of migrants. Our simultaneous analysis showed the presence of unobserved selectivity for migrants to rural and small urban destinations. However, previous results did not alter much – migrants still exhibited rather similar fertility levels to the non-migrants at destination (although in previous models we had slightly overestimated the risk of conception for migrants to rural and small urban settlements). Finally, to better understand the nature of unobserved selectivity, we allowed the risk of first conception at destination to change over time. We found elevated fertility for migrants to rural and small urban areas immediately after move, and a relatively low fertility for movers to a large city, while long-term fertility patterns for migrants remained similar to those of natives at destination. We concluded that migrations directly related to family formation and childbearing, were mostly responsible for the unobserved heterogeneity we observed, and we found no evidence on (strong) selectivity of migrants by fertility preferences.

Thus, while some evidence can be brought to support each of the four hypotheses proposed in the literature, the results of our analysis place the adaptation theory in a central position. Briefly, migrants, whatever their origin, adapt to fertility levels prevalent at the destination environment. But why do they adapt? What are the factors pushing migrants to change their behaviour that may have been originally different? At least two explanations can be offered. The first emphasises the critical role of resources in general, and the housing conditions in particular. In Estonia (as in many other European countries), most people in rural settlements live in single-family houses, while in urban areas, especially in the larger cities, flats in multi-storey dwellings dominate (Estonian… 2000). More importantly, living space is significantly larger for people living in family houses (Kulu and Tammaru 2003, 131). Therefore, it is likely that migrants moving from rural settlements (single family houses) to urban areas (flats) have less living space after migration, while migrants from urban to rural areas are usually destined to more spacious housing. Both adopt their family plans (the former more, the latter less) according to the new conditions. Besides less favourable housing conditions, higher overall living and opportunity costs can also be seen as responsible factors for lower fertility of urban residents, both natives and migrants (Michielin 2002).

The second explanation draws upon the cultural approach in fertility studies, emphasising the critical role of norms and values. It is well documented in the literature that 'modern fertility behaviour' spread first among urban elites in Europe, and only later reached lower social classes and the rural areas (Pollak and Watkins 1993, 469). While values and norms associated with the 'modern fertility regime' are equally spread among rural and urban populations in Estonia today, there is still evidence that life in rural settlements has remained more 'traditional' and the notion of family is stronger there (cf. Katus et al. 2002, 329). Furthermore, a rural population can be considered one of the major 'regional sub-cultures' in the country, distinct from other(s), such as urban one(s) (cf. Lesthaeghe and Neels 2002). Moving from one sub-culture to another has an effect. Everyday interaction with new friends and peers in a new environment moulds an individual's beliefs and desires, as well as their behaviour (Kohler 2000). Migrants assume the fertility behaviour dominant at destination.

While we believe that most of the results of this study are also valid in other contexts, some particularities arising from the post-war Estonian context should be mentioned. First, elevated fertility observed for migrants to rural and small urban areas did result (partly, at least) from the fact that the timing of union formation and first conception largely coincided in post-war Estonian female cohorts (Vikat 1994; Katus et al. 2002, 323). Therefore, conceptions accompanied migration related to union formation, which we also observed for migrants who moved to rural settlements and small towns. (Conceiving a child right after union formation has been seen as a strategy of young couples to accelerate receiving the state housing under central planning (Katus et al. 2002, 156). If so, however, then somewhat elevated fertility would have also been expected for migrants to the capital city, where the state housing was more dominant than elsewhere.) In countries where union formation did not automatically lead to conception for one reason or another, fertility patterns immediately after migration might thus be different, or if similar, they might become evident in migrating couples who are intending to have a child immediately thereafter.

Second, sub-urbanisation and counter-urbanisation, characteristic to many Western countries during the post-war period, did not spread extensively in Estonia. Many people left cities to sub-urban and rural areas in the 1980s, but most of them became employees of agricultural farms that offered relatively good salaries and often provided labour with housing (Tammaru 2001b, 1354–1355). Thus, our study does not deal with fertility patterns of migrants to sub-urban areas or rural destinations when urban-type employment continues and an 'urban lifestyle' is maintained. The effect of sub- and counter-urbanisation on childbearing, however, needs detailed research as 'urban life combined with rural environment' is becoming more extensively spread among the populations in many developed countries, including post-Soviet Estonia (Tammaru et al. 2003).

The study inspires research into two interrelated directions. First, we should continue research based on the FFS data, including in the analysis variables reflecting housing conditions of the population and extending our research beyond one country case. The inclusion of data on housing enables us to examine the validity of one explanation proposed above, at least. Comparing the effect of migration on fertility in two or three European countries with different institutional and socioeconomic development, in turn, allows us to gain further insight into patterns and causes of migrant fertility. Second, the register data from Nordic countries looks very attractive, no doubt. Rich longitudinal data on large samples would enable us to examine the effects of various migrations and time at destination on fertility of migrants more closely. Perhaps then the migrants with specific (long-term) fertility preferences (if they do exist) will also reveal themselves. 'Migration makes a difference' is no doubt the main message of this paper.

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Notes

[1] – We decided to estimate one more model (5), where we included separate (person-specific) heterogeneity terms for equation of the first birth, on the one hand, and for equations of the second and third births, on the other hand. Our different specifications (with and without further instruments) showed that the model was identified in its current form (without instruments), despite the fact that there was only one birth episode per individual in the former case. The results of analysis (not shown) were largely similar to that obtained in a previous step (model 4).

[2] – The intensity of conception right after migration to rural and small urban areas decreases further, when a separate (person-specific) heterogeneity term is allowed for the first conception (model 5, results are not shown).

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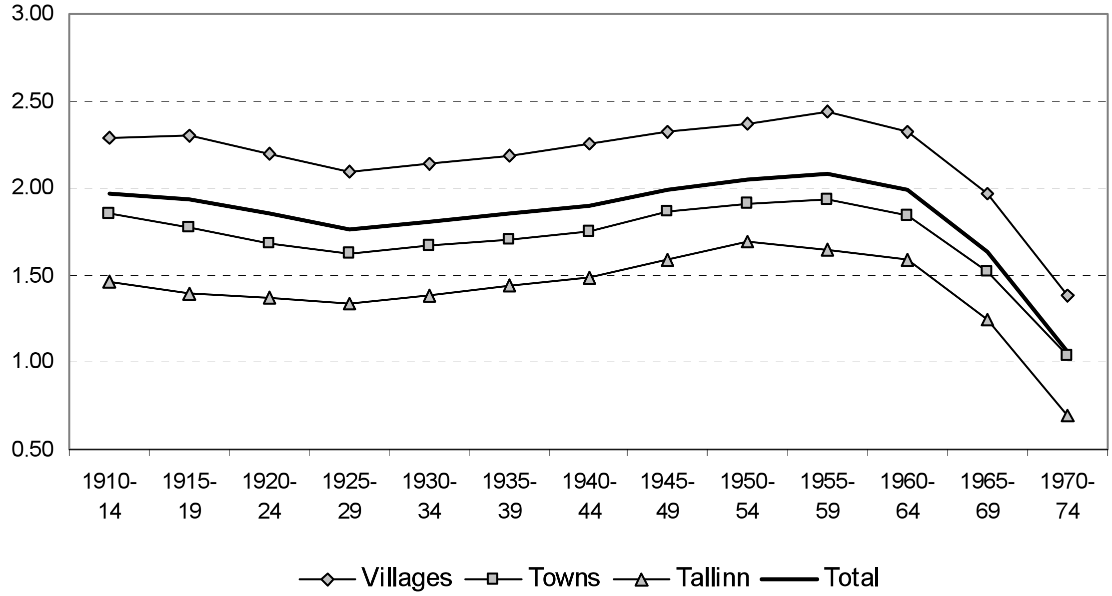
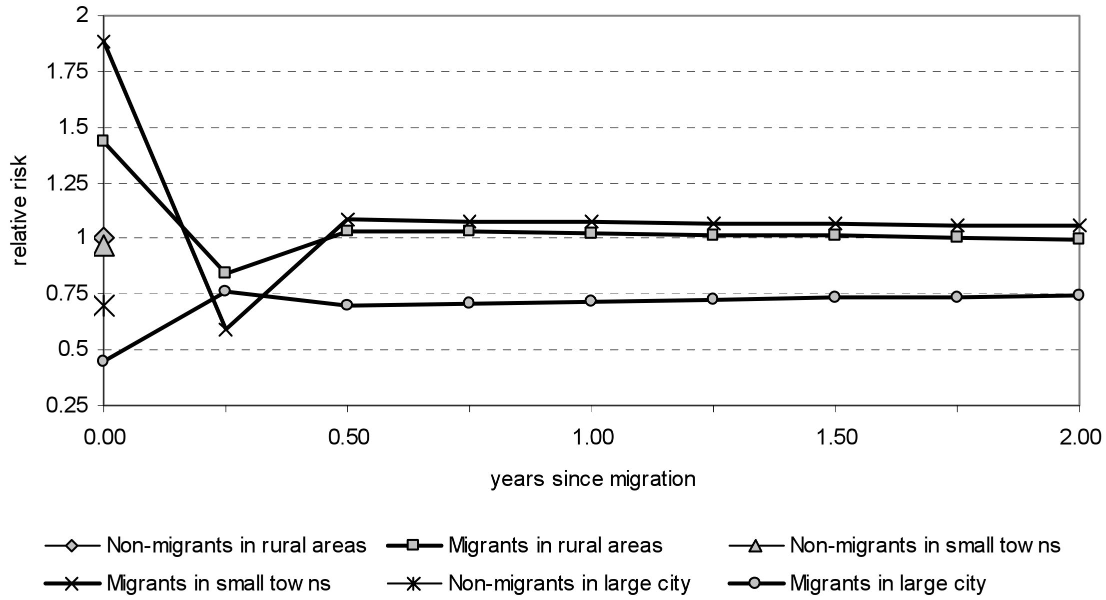


Figure 1. Cohort fertility of native population by type of settlement.
Source: Census 2000.

Separate analysis



Simultaneous analysis

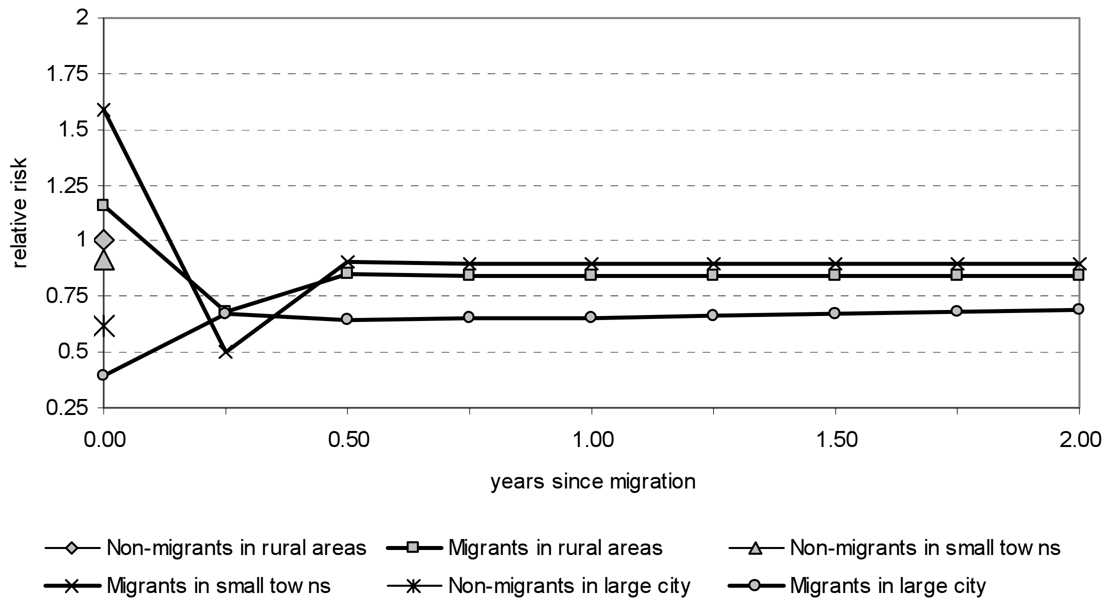


Figure 2. Effect of migration on first conception.

Table 1. Intensity of conception leading to a birth (parameter estimates).

	Model 1 [a]	Model 2 [b]	Model 3 [c]	Model 4 [d]
First conception				
Constant (baseline)	-7.041 ***	-7.402 ***	-7.575 ***	-7.578 ***
Age (baseline)				
14–17 years (slope)	1.009 ***	0.934 ***	0.932 ***	0.927 ***
18–21 years (slope)	0.065 ***	0.041	0.079 ***	0.079 ***
22–25 years (slope)	-0.004	-0.034	-0.005	-0.005
26+ years (slope)	-0.150 ***	-0.152 ***	-0.146 ***	-0.147 ***
Cohabitation (ref=single)				
Enter cohabitation (constant)	3.041 ***	2.902 ***	2.919 ***	2.919 ***
0–2 years (slope)	-0.567 ***	-0.603 ***	-0.497 ***	-0.502 ***
2+ years (slope)	-0.157 ***	-0.139 ***	-0.131 ***	-0.132 ***
Marriage (ref=cohabitant)				
Enter marriage (constant)		0.300 ***	0.302 ***	0.302 ***
0+ years (slope)		-0.033	-0.024	-0.023
Year				
–1969 (slope)		0.042	0.053 *	0.055 *
1970–79 (slope)		0.004	0.006	0.006
1980–89 (slope)		0.017 *	0.018	0.017
1990–94 (slope)		-0.116 **	-0.127 **	-0.125 **
Enrolled in education		-0.219 ***	-0.311 ***	-0.324 ***
Educational level (ref=secondary)				
Basic		0.103	0.139 *	0.138 *
Higher		0.127	0.078	0.062
Employed		0.247 ***	0.269 ***	0.279 ***
Number of siblings (ref=0–1)				
2–3		0.077	0.113 *	0.121 *
4+		0.249 ***	0.315 ***	0.320 ***
Non-Estonian ethnicity		0.130	0.129	0.118
Residential status				
(ref=non-migrants in rural areas)				
Migrants in rural areas	-0.005	0.006	-0.113	-0.159
Non-migrants in small towns	-0.066	-0.032	-0.076	-0.082
Migrants in small towns	-0.014	0.029	-0.089	-0.109
Non-migrants in large city	-0.423 ***	-0.355 ***	-0.492 ***	-0.488 ***
Migrants in large city	-0.322 ***	-0.215 **	-0.354 ***	-0.286 **
2+ migrations (ref=1 migration)	0.203 ***	0.144 **	0.040	0.023

Table 1. (continued)

	Model 1	Model 2	Model 3	Model 4
Second conception				
Constant (baseline)	-1.714 ***	-2.661 ***	-2.997 ***	-3.022 ***
Time since first birth (baseline)				
0–0.5 years (slope)	4.555 ***	4.850 ***	4.811 ***	4.809 ***
0.5–1 years (slope)	-0.513 **	-0.537 **	-0.514 *	-0.515 *
1–4 years (slope)	0.029	0.032	0.021	0.019
4+ years (slope)	-0.182 ***	-0.105 ***	-0.129 ***	-0.131 ***
Age				
16–22 years (slope)		-0.059	-0.022	-0.020
23–25 years (slope)		0.059	0.096 **	0.096 **
26+ years (slope)		-0.105 ***	-0.087 ***	-0.087 ***
Cohabitation				
0–0.5 years (slope)	-2.227 ***	-2.539 ***	-2.565 ***	-2.563 ***
0.5+ years (slope)	-0.114 ***	-0.077 ***	-0.045	-0.045
Marriage (ref=cohabitant)				
Enter marriage (constant)		0.938 ***	0.907 ***	0.904 ***
0–1 years (slope)		-0.556 **	-0.526 **	-0.527 **
1+ years (slope)		-0.047	-0.050	-0.050
Year				
–1969 (slope)		0.053	0.050	0.052
1970–79 (slope)		0.043 ***	0.055 ***	0.056 ***
1980–89 (slope)		0.020 *	0.022 *	0.022 *
1990–94 (slope)		-0.192 ***	-0.200 ***	-0.199 ***
Enrolled in education		-0.332 ***	-0.376 ***	-0.391 ***
Educational level (ref=secondary)				
Basic		0.187 **	0.215 **	0.214 **
Higher		0.267 ***	0.213 *	0.198 *
Employed		0.125	0.125	0.126
Number of siblings (ref=0–1)				
2–3		0.116	0.159 *	0.169 **
4+		0.251 ***	0.320 ***	0.334 ***
Non-Estonian ethnicity		-0.418 ***	-0.460 ***	-0.469 ***
Residential status				
(ref=non-migrants in rural areas)				
Migrants in rural areas	-0.111	-0.164	-0.240	-0.279 *
Non-migrants in small towns	-0.538 ***	-0.521 ***	-0.576 ***	-0.588 ***
Migrants in small towns	-0.387 ***	-0.399 ***	-0.496 ***	-0.515 ***
Non-migrants in large city	-0.595 ***	-0.522 ***	-0.682 ***	-0.683 ***
Migrants in large city	-0.492 ***	-0.510 ***	-0.614 ***	-0.542 ***
2+ migrations (ref=1 migration)	0.201 **	0.181 **	0.061	0.038

Table 1. (continued)

	Model 1	Model 2	Model 3	Model 4
Third conception				
Constant (baseline)	-1.525 ***	-0.495	-1.129	-1.131
Time since second birth (baseline)				
0–0.5 years (slope)	3.203 ***	3.410 ***	3.483 ***	3.478 ***
0.5–1 years (slope)	-0.422	-0.362	-0.406	-0.402
1+ years (slope)	-0.044 **	-0.009	-0.034	-0.034
Age				
18–21 years (slope)		-0.264	-0.207	-0.218
22–33 years (slope)		0.019	0.047 **	0.048 **
34+ years (slope)		-0.259 ***	-0.250 ***	-0.251 ***
Cohabitation				
0–2 years (slope)	-0.771 ***	-0.686 ***	-0.718 ***	-0.720 ***
2+ years (slope)	-0.136 ***	-0.097 **	-0.085 **	-0.084 **
Marriage (ref=cohabitant)				
Enter marriage (constant)		0.588 **	0.556 *	0.554 *
0–3 years (slope)		-0.229 **	-0.221 **	-0.218 **
3+ years (slope)		-0.022	-0.029	-0.030
Year				
–1969 (slope)		-0.114	-0.096	-0.090
1970–79 (slope)		0.004	0.017	0.020
1980–89 (slope)		0.027	0.036 *	0.036 *
1990–94 (slope)		-0.059	-0.066	-0.067
Enrolled in education		-0.065	-0.054	-0.064
Educational level (ref=secondary)				
Basic		0.246 *	0.322 **	0.321 **
Higher		0.109	0.085	0.067
Employed		-0.037	-0.030	-0.031
Number of siblings (ref=0–1)				
2–3		0.073	0.137	0.145
4+		0.125	0.224	0.234
Non-Estonian ethnicity		-0.141	-0.120	-0.132
Residential status				
(ref=non-migrants in rural areas)				
Migrants in rural areas	-0.244	-0.164	-0.303	-0.334
Non-migrants in small towns	-0.411 *	-0.302	-0.447	-0.456 *
Migrants in small towns	-0.552 **	-0.408	-0.567 **	-0.580 **
Non-migrants in large city	-0.859 ***	-0.677 **	-0.952 ***	-0.962 ***
Migrants in large city	-1.174 ***	-1.011 ***	-1.183 ***	-1.108 ***
Residence at age 14 for migrants				
(ref=rural area)				
Small town	-0.265 *	-0.267 *	-0.291 *	-0.294 **
Large city	0.232	0.244	0.172	0.122
2+ migrations (ref=1 migration)	0.170	0.152	0.029	0.001

Table 1. (continued)

	Model 1	Model 2	Model 3	Model 4
σ_{ε^C}			0.472 ***	0.471 ***
σ_{ε^M}			0.697 ***	
$\rho_{\varepsilon^C \varepsilon^M}$			0.388 ***	
σ_{ε^R}				1.121 ***
σ_{ε^S}				0.771 ***
σ_{ε^L}				0.824 ***
$\rho_{\varepsilon^C \varepsilon^R}$				0.419 ***
$\rho_{\varepsilon^C \varepsilon^S}$				0.484 ***
$\rho_{\varepsilon^C \varepsilon^L}$				0.087
$\rho_{\varepsilon^R \varepsilon^S}$				0.723 ***
$\rho_{\varepsilon^R \varepsilon^L}$				-0.043
$\rho_{\varepsilon^S \varepsilon^L}$				-0.069
Log-likelihood	-14516.9	-35323.4	-35227.7	-35173.9

Significance: '*' =10%; '**'=5%; '***'=1%.

[a] We only control for baseline duration, partnership status (for the first conception) and union duration.
[b] We also control for other demographic and socioeconomic variables (see equation 1). The log-likelihood of the model is the sum of log-likelihoods of (three) fertility and migration equations (Table 3).
[c] We estimate jointly fertility and migration equations with two person-specific residuals and correlation between them (equation 2).
[d] We estimate jointly fertility and migration equations with four person-specific residuals and correlations between them (equation 3).
σ denotes a standard deviation of the person-specific error term, ρ denotes a correlation between the person-specific error terms (the definition of subscripts is given in the equations 2 and 3).

Table 2. Effect of residential status on conception (relative risks)[a].

	Model 1	Model 2	Model 3	Model 4
First conception				
Non-migrants in rural areas	1	1	1	1
Migrants in rural areas	1.00	1.01	0.89	0.85
Non-migrants in small towns	0.94	0.97	0.93	0.92
Migrants in small towns	0.99	1.03	0.91	0.90
Non-migrants in large city	0.66 ***	0.70 ***	0.61 ***	0.61 ***
Migrants in large city	0.72 ***	0.81 **	0.70 ***	0.75 **
Second conception				
Non-migrants in rural areas	1	1	1	1
Migrants in rural areas	0.89	0.85	0.79	0.76 *
Non-migrants in small towns	0.58 ***	0.59 ***	0.56 ***	0.56 ***
Migrants in small towns	0.68 ***	0.67 ***	0.61 ***	0.60 ***
Non-migrants in large city	0.55 ***	0.59 ***	0.51 ***	0.51 ***
Migrants in large city	0.61 ***	0.60 ***	0.54 ***	0.58 ***
Third conception				
Non-migrants in rural areas	1	1	1	1
Migrants in rural areas	0.78	0.85	0.74	0.72
Non-migrants in small towns	0.66 *	0.74	0.64	0.63 *
Migrants in small towns	0.58 **	0.66	0.57 **	0.56 **
Non-migrants in large city	0.42 ***	0.51 **	0.39 ***	0.38 ***
Migrants in large city	0.31 ***	0.36 ***	0.31 ***	0.33 ***
Residence at age 14 for migrants				
Rural area	1	1	1	1
Small town	0.77 *	0.77 *	0.75 *	0.75 **
Large city	1.26	1.28	1.19	1.13

Significance: '*' =10%; '**'=5%; '***'=1%.

[a] The relative risks are obtained by performing exponentiation operations of the parameter estimates presented in Table 1.

Table 3. Intensity of migration by destination (parameter estimates).

	Model 2 [a]	**Model 3** [b]	**Model 4** [c]
Rural destination			
Constant (baseline)	-2.157 ***	-2.318 ***	-2.851 ***
Age (baseline for first migration) [d]			
14–17 years (slope)	-0.090 **	-0.049	-0.038
18–19 years (slope)	-0.355 ***	-0.232 *	-0.198
20–22 years (slope)	-0.187 ***	-0.143 ***	-0.127 ***
23–33 years (slope)	-0.128 ***	-0.129 ***	-0.143 ***
34+ years (slope)	-0.017	-0.027	-0.046
Time since previous migration (baseline for second migration)			
0.25–0.75 years (slope)	2.515 ***	2.408 ***	2.464 ***
0.75–3.5 years (slope)	0.140 ***	0.180 ***	0.218 ***
3.5–9 years (slope)	-0.199 ***	-0.182 ***	-0.167 ***
9+ years (slope)	-0.013	-0.006	0.009
Partnership status (ref=single)			
Cohabiting	-0.198 *	-0.170	-0.125
Separated	0.625 ***	0.683 ***	0.782 ***
Marriage (ref=cohabitant)	-0.264 **	-0.297 ***	-0.312 ***
Parity 1 (ref=0) [e]	-0.039	-0.107	-0.095
Parity 2+ (ref=1)	0.028	-0.103	-0.152
Year			
–1969 (slope)	0.038	0.038	0.046 *
1970–79 (slope)	0.020 *	0.031 **	0.039 ***
1980–89 (slope)	0.012	0.010	0.015
1990–94 (slope)	-0.155 ***	-0.159 ***	-0.155 ***
Enrolled in education	-2.550 ***	-2.740 ***	-2.799 ***
Educational level (ref=secondary)			
Basic	-0.049	-0.016	-0.028
Higher	0.383 ***	0.429 ***	0.392 ***
Employed	-0.557 ***	-0.523 ***	-0.471 ***
2+ siblings (ref=0-1)	0.210 ***	0.301 ***	0.398 ***
Non-Estonian ethnicity	-0.765 ***	-0.954 ***	-1.102 ***
Residential status (ref=non-migrants in rural areas)			
Migrants in rural areas	-0.001	-0.273 *	-0.701 ***
Non-migrants in small towns	-0.185 **	-0.251 ***	-0.319 ***
Migrants in small towns	-0.042	-0.288 *	-0.263
Non-migrants in large city	-0.862 ***	-1.182 ***	-1.228 ***
Migrants in large city	-0.095	-0.342 **	0.102
Residence at age 14 for migrants (ref=rural area)			
Small town	-0.574 ***	-0.639 ***	-0.810 ***
Large city	-0.864 ***	-1.164 ***	-1.656 ***
2+ migrations (ref=1 migration)	-0.404 ***	-0.935 ***	-1.051 ***

Table 3. (continued).

	Model 2	Model 3	Model 4
Small urban destination			
Constant (baseline)	-1.124 ***	-1.262 ***	-1.370 ***
Age (baseline for first migration)			
14–17 years (slope)	-0.066 *	-0.038	-0.057
18–19 years (slope)	-0.598 ***	-0.490 ***	-0.512 ***
20–22 years (slope)	-0.109 **	-0.071	-0.073
23–33 years (slope)	-0.107 ***	-0.104 ***	-0.108 ***
34+ years (slope)	-0.051	-0.061	-0.066
Time since previous migration (baseline for second migration)			
0.25–0.75 years (slope)	1.777 ***	1.674 ***	1.601 ***
0.75–3.5 years (slope)	0.050	0.085 *	0.101 **
3.5–9 years (slope)	-0.251 ***	-0.232 ***	-0.225 ***
9+ years (slope)	-0.002	0.004	0.009
Partnership status (ref=single)			
Cohabiting	-0.697 ***	-0.657 ***	-0.630 ***
Separated	0.045	0.111	0.148
Marriage (ref=cohabitant)	-0.305 **	-0.338 **	-0.334 **
Parity 1 (ref=0)	-0.168	-0.211 *	-0.232 *
Parity 2+ (ref=1)	-0.376 ***	-0.503 ***	-0.548 ***
Year			
–1969 (slope)	0.057 ***	0.059 ***	0.065 ***
1970–79 (slope)	0.003	0.009	0.009
1980–89 (slope)	-0.035 ***	-0.039 ***	-0.038 ***
1990–94 (slope)	-0.051	-0.045	-0.039
Enrolled in education	-2.784 ***	-2.934 ***	-2.945 ***
Educational level (ref=secondary)			
Basic	-0.554 ***	-0.536 ***	-0.560 ***
Higher	0.440 ***	0.467 ***	0.371 ***
Employed	-1.051 ***	-0.963 ***	-0.936 ***
2+ siblings (ref=0-1)	0.129 **	0.202 ***	0.210 ***
Non-Estonian ethnicity	-0.545 ***	-0.698 ***	-0.678 ***
Residential status (ref=non-migrants in rural areas)			
Migrants in rural areas	-0.291 **	-0.578 ***	-0.565 ***
Non-migrants in small towns	-0.134 *	-0.181 **	-0.176 **
Migrants in small towns	-0.268 **	-0.524 ***	-0.560 ***
Non-migrants in large city	-0.982 ***	-1.272 ***	-1.171 ***
Migrants in large city	0.086	-0.144	0.272
Residence at age 14 for migrants (ref=rural area)			
Small town	0.532 ***	0.482 ***	0.504 ***
Large city	-0.862 ***	-1.117 ***	-1.313 ***
2+ migrations (ref=1 migration)	-0.584 ***	-1.061 ***	-0.985 ***

Table 3. (continued).

	Model 2	Model 3	Model 4
Large urban destination			
Constant (baseline)	0.019	-0.143	-0.174
Age (baseline for first migration)			
14–17 years (slope)	-0.058	-0.026	-0.023
18–19 years (slope)	-0.744 ***	-0.583 ***	-0.585 ***
20–22 years (slope)	-0.012	0.025	-0.006
23–33 years (slope)	-0.115 ***	-0.098 ***	-0.102 ***
34+ years (slope)	-0.255	-0.291 *	-0.274 *
Time since previous migration (baseline for second migration)			
0.25–0.75 years (slope)	0.439	0.343	0.553
0.75–3.5 years (slope)	0.074	0.089	0.070
3.5–9 years (slope)	-0.051	-0.032	-0.030
9+ years (slope)	-0.045	-0.033	-0.047
Partnership status (ref=single)			
Cohabiting	-0.513 **	-0.472 **	-0.526 **
Separated	0.807 ***	1.017 ***	0.953 ***
Marriage (ref=cohabitant)	-0.073	-0.074	-0.052
Parity 1 (ref=0)	-1.661 ***	-1.746 ***	-1.802 ***
Parity 2+ (ref=1)	-0.875 ***	-1.053 ***	-0.987 ***
Year			
–1969 (slope)	-0.010	-0.009	-0.020
1970–79 (slope)	0.021	0.026	0.022
1980–89 (slope)	-0.053 ***	-0.058 ***	-0.057 ***
1990–94 (slope)	-0.147	-0.139	-0.162
Enrolled in education	-3.432 ***	-3.593 ***	-3.610 ***
Educational level (ref=secondary)			
Basic	-1.047 ***	-0.978 ***	-0.920 ***
Higher	1.328 ***	1.315 ***	1.497 ***
Employed	-2.165 ***	-2.093 ***	-2.213 ***
2+ siblings (ref=0-1)	-0.080	-0.035	-0.082
Non-Estonian ethnicity	-0.434 *	-0.496 *	-0.472 *
Residential status (ref=non-migrants in rural areas)			
Migrants in rural areas	-0.614 ***	-0.912 ***	-0.716 ***
Non-migrants in small towns	0.081	0.060	0.069
Migrants in small towns	-0.106	-0.374 ***	-0.217
Residence at age 14 for migrants (ref=rural area)			
Small town	-0.062	-0.117	-0.064
Large city	1.743 ***	1.568 ***	2.032 ***
2+ migrations (ref=1 migration)	-0.219	-0.626 ***	-0.452 ***
Log-likelihood	-35323.4	-35227.7	-35173.9

Significance: '*' =10%; '**'=5%; '***'=1%.

[a] We estimate single-equation model of migration with competing destinations. The log-likelihood of the model is the sum of log-likelihoods of fertility (Table 1) and migration equations.
[b] We estimate jointly fertility and migration equations with two person-specific residuals and correlation between them (equation 2).
[c] We estimate jointly fertility and migration equations with four person-specific residuals and correlations between them (equation 3).
[d] The variable also captures the effect of age for second and higher migrations.
[e] The values of parity change at the moment of conception.