Interrelationships between Childbearing and Housing Transitions in the Family Life Course

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Abstract

Research has examined the effect of family changes on housing transitions and childbearing patterns within various housing types. While most research has investigated how an event in one life domain of a family depends on a state in another domain, the interplay between the two life domains has been little studied. This study examines the interrelationships between childbearing and housing transitions. We use rich longitudinal register data from Finland and apply event-history analysis. We first investigate the effect of children on housing changes and childbearing patterns by housing type. We then model childbearing and housing transitions jointly to control for unobserved characteristic of women, which may simultaneously influence their fertility behaviour and housing choices. Finally, we investigate the timing of childbearing and housing changes with respect to each other in order to deepen our understanding of the relationship between these two domains of the family life course.

Keywords: housing, residential mobility, fertility, event history analysis, simultaneous-equations model, Europe, Finland

Introduction

There is a long research tradition that looks at the effects of family changes on spatial mobility and housing choices in Europe and North America. Most early studies were based on cross-sectional data (Rossi 1955; Long 1972); research exploiting longitudinal data has only emerged over the past two decades. Longitudinal data and event history analysis have enabled researchers to link family events to housing changes, and thus to advance our understanding of the causes of residential mobility.

The effect of family size and childbearing on moving to different housing and tenure types, especially to homeownership has received a considerable attention over the past two decades. Deurloo et al. (1994) studied the effect of family change on the tenure change in the U.S. The analysis showed that the transition from a couple to a family significantly increased propensity of moving into owner-occupied housing. Davies Withers (1998) also looked at the impact of household transitions to housing transitions. Compared to others, individuals living in couple and nuclear households were less likely to move within the rental sector, while they, especially those in nuclear households, were more likely to move to homeownership. She concluded that transitions to ownership are related to transitions to relatively stable household types.

Mulder and Wagner (1998) investigated the effect of events in the family life-course on homeownership in Germany and the Netherlands. The analysis revealed that transition to first homeownership is connected with events in the family life course: marriage, first childbirth when it occurs close to marriage, and second childbirth. This connection was stronger in Germany than in the Netherlands, where homeownership is increasingly pursued by childless couples, probably often in anticipation of having children. The subsequent study by Feijten and Mulder (2002) supported that Dutch couples increasingly move into single-family houses before the child is born, mostly during the pregnancy. Kulu (2008) observed similar patterns in his study on childbearing and residential mobility in Austria. The analysis showed that first and second pregnancy significantly raised the likelihood of short-distance housing-related moves for the Austrian couples. A study by Clark and Davies Withers (2009) on fertility and spatial mobility in the US supported previous findings: the number of moves almost doubled from the six months before the birth and declined steadily after the birth.

Studies by Clark and Huang (2003) and that by Rabe and Taylor (2010) showed the triggering effect of childbearing on residential mobility in the British context. Further, the analysis by Clark and Huang (2003) revealed some interesting contextual effects; while the birth of a child increased mobility in the national model, there was no such effect in the model for London. The authors attributed this difference in impact to the role of the local housing market: in an expensive and tight housing market such as in London, the desire to move, as indicated by room stress and changes in household composition, may be difficult to fulfil.

While family events have been shown to be important triggers of housing changes, it is less clear to what extent a change of housing conditions shapes childbearing patterns of couples. The question challenged researchers as early as in the 1930s when below-replacement fertility emerged in several European countries. For example, Goodsell (1937) examined the causes of low fertility in Sweden and argued that home overcrowding was partly responsible for low fertility in the urban areas of Sweden. Swedish architects and builders, in their zeal to re-house urban workers in modern flats, produced a standardised tenement of one room and kitchen, and this might have forced couples to consider limiting their family size, particularly as more spacious, convenient, and inexpensive housing remained unattainable for many couples. Thompson (1938) suggested that similar conditions might have existed in the U.S. The author argued that the availability of adequate housing at a desired standard was an important factor in determining the number of children reared in many families.

Based on longitudinal data, recent studies have examined the timing of family formation relative to housing-related moves in order to better understand the interrelationships between the two domains of the family life course. Mulder and Wagner (2001) examined the interconnections between first childbirth and first-time homeownership in West Germany and the Netherlands. The analysis showed an elevated risk of first birth a year after moving to owner-occupied housing. They argued that elevated fertility levels after becoming a homeowner indicate that couples bought their homes because they aspire to have children. The subsequent study by Michielin and Mulder (2005) supported increasing fertility levels for Dutch couples after short-distance moves, which the authors attributed to housing changes in anticipation of childbearing. Similarly, in a study on Finland, Kulu and Vikat (2007) found elevated fertility levels among couples who had moved together, especially to detached housing. They attributed elevated fertility after the move in the Finnish context to selective moves: couples moved in order to adjust their housing size to expected family size. Interestingly, Clark and Withers Davies (2009) reached to somewhat different conclusion in their recent study: while fertility triggered mobility among the American couples, fertility levels did not increase after moves.

Most recent research thus concludes that couples change housing in order to adjust their dwelling size to (expected) family size. However, Mulder (2006a; 2006b) provided an alternative interpretation for the observed patterns. She argued that an elevated fertility for couples after they have moved to owner-occupied housing is not so strongly related to so-called adjustment moves. Rather, childbearing is postponed until homeownership becomes possible. This is because couples prefer to secure housing of a certain quality before they have children. Ström (2010) presented a similar argument in her study on Sweden where she observed a positive relationship between the dwelling size and first-birth levels. Housing has thus been seen as a resource, which enables or hinders the realisation of childbearing plans (cf. Mulder and Billari 2010). The discussion of the effect of availability and affordability of housing on childbearing in not a new in the literature, however. A quarter century ago, Murphy and Sullivan (1985) showed that

couples who wished to become homeowners in Britain had to delay family formation until they had saved up sufficient funds for a deposit and until their income was large enough to pay for a mortgage.

To sum up, recent studies have shown that childbearing and housing transitions are closely related. Most studies conclude that a causal link runs from childbearing to housing: childbearing leads to changes in housing conditions. However, some research has suggested that the causality may also operate in an opposite direction. Under ideal circumstances housing supply equals housing demand, and most couples are able to find at reasonable cost the type of housing they find suitable (Ström 2010). In reality, however, the housing market is never perfect and most couples face financial constraints; they may not be able to find or afford the type of housing they consider proper in a certain stage of their family life. If so, the availability of proper housing or the lack of it may shape the couple's childbearing plans and behaviour. Couples may delay their childbearing (or wait before having another child) until proper housing becomes attainable rather than simply move to proper housing when they decide to have a child.

The aim of this study is to examine the interrelationship between childbearing and housing choices. We extend previous research in the following ways. First, we investigate the timing of housing changes relative to the birth of a child and childbearing relative to housing transitions. While previous studies have focussed on either fertility or housing change as an outcome process, we simultaneously examine the changes in the two family careers to gain a deeper understanding of their interrelationships. Further we base our study on large register data, which allow us for a detailed examination of the timing of childbearing and housing transition with respect to each other.

Second, we control for unobserved characteristic of women, which may simultaneously influence their fertility behaviour and housing choices. It is likely that women's long-term childbearing plans and housing aspirations are interrelated. For example, women who wish to have large families select themselves into those housing types, which suit better for family life. Further, they may move several times before their housing aspirations are eventually fulfilled. If this were true then the estimated impact of housing change on fertility would be biased; e.g. we would over-estimate the risk of birth for the women who move, particularly to 'family-friendly' housing (single-family or terraced houses, but possibly also large apartments), compared to those who do not move. The effect of fertility on housing changes would also be biased. If some women, net of their observed characteristics, are more likely to have a child (or another child) and move (to single-family or terraced houses) than others, then the risk of moving related to childbearing is over-estimated. Women who are prone to have a child or another child are also prone to change housing (because of the unmeasured factors). We thus explicitly address the issues of unobserved selectivity, which no previous research has done. A simultaneous-equations model of fertility and housing changes allows us to control for unobserved characteristics of women, which influence the two domains of their family life (e.g. long-term plans). Modelling

the timing of childbearing and housing changes with respect to each other allows us to examine how factors specific to circumstances (e.g. short-term intentions and anticipation) influence fertility and housing choices.

Finally, we also investigate whether and how do the effect of family changes on housing transitions and childbearing patterns within various housing types vary by context within a country and if they do how does this inform us about the relationships between the two domains of the family life. We contrast the patterns in large cities and those in small towns and rural areas. Previous research suggests that the patterns may differ by place of residence and so the context shapes the relationship between childbearing and housing transitions. We are particularly interested in whether and how does the impact of childbearing on housing choices vary across settlements. Whether it is easy to fulfil a desire to adjust housing size to family size in some contexts (e.g. rural areas and small towns) and difficult in others (large cities)? Whether couples move in anticipation of or rather in response to a birth? We appreciate that the detection of causal relationships between the two processes is not an easy task, but we are reassured that the outlined strategy allows us to gain a deeper understanding of the interplay between childbearing and housing transitions.

Data and definitions

Our data come from the Finnish Longitudinal Fertility Register. This is a database developed by Statistics Finland that contains linked individual-level information from different administrative registers (see Vikat 2004). The extract we used in the analysis included women's full birth and educational histories. Data on partnership, residential and housing histories, and annual measurements of characteristics of women's activity and income were collected for the period from 1987 to 2000. The extract used is a ten-percent random sample stratified by single-year birth cohort and drawn from records of all women who had ever received a personal identification number in Finland and were in the age range of 16–49 during the period between 1988 and 2000 (this includes cohorts born between 1938 and 1983). We focused on housing changes and childbearing among women who were in unions and included in the analysis all co-residential unions that were formed between January 1988 and March 2000. Foreign-born women (three percent) were excluded from the analysis.

We focussed on the childbearing and housing changes of partnered women for two reasons. First, childbearing outside a union is uncommon in the Nordic countries; if it occurs, it is mostly among teenagers who have unplanned pregnancies (cf. Vikat 2004), and that phenomenon was not the focus of this study. Second, we investigated the interrelationship between childbearing decisions and housing choices. With a focus on childbearing in unions, we know with a relatively high level of precision what the housing conditions were at the moment when a couple decided to have a child. Similarly, with a focus on the housing changes of

partnered women, we can easily examine the effect of childbearing on housing transition of couples. We included in the analysis both cohabitations and marriages. The definition of cohabitation was based on the following criteria: 1) two (unmarried) individuals of the opposite sex and not relatives; 2) 18 years and older with age difference no more than 20 years; 3) registered in the same dwelling / at the same address for 90 or more days. The analyses by the Statistics Finland and recent studies have confirmed that the data on partnerships are reliable (Jalovaara 2011).

We built two multi-episode data-sets: one for housing changes and other for births. Women were 'at risk' of moving from union formation or since the previous move (if they had moved together with their partner). Episodes outside the union were excluded from the analysis (but the data on events were used to update information on the women's characteristics). If a move occurred in the month of union dissolution, we assumed that the move occurred after separation. This definition was used to exclude moves related to separation. If a woman formed a new union, she was again 'at risk' of housing changes; the duration variable (or the 'clock') was set to zero at union formation, for two reasons. First, for many cases (although not for all) a union formation involved moving of both partners. Second, and more importantly, we assumed that a new partnership meant a new stage in a woman's life where some previous factors including 'time since move with previous partner' or 'time since move alone' had lost their importance. For the birth data, women were 'at risk' from union formation (for the first conception) or since the previous birth (for the second and third conception). The final censoring took place in March 2000 (9 months before the end of our observation period), at third conception, at age 50 or at death of the woman whichever came first[1]. Again, episodes outside the union were excluded from the analysis. If a conception occurred in the month of move, we assumed that the residential change occurred first. Simultaneous conceptions were thus assigned to the destination housing.

We studied the interplay between childbearing and housing choice. We included in the analysis first three parity transitions and distinguished between the housing categories as follows: *single-family house*, *terraced house*, and *apartment*. A dwelling for one or two families is defined as *single-family house* (or 'detached house' or 'semi-detached house'). *Terraced house* (or 'rowhouse') is a dwelling with three or more houses in a row of houses and sharing a wall with its adjacent neighbour. *Apartments* ('flats') are housing units in a dwelling that have three or more residential units, with at least one unit being on top of another. Residential episodes of couples in all other housing units (and abroad) were excluded as they formed a negligible share of all couple-years. Tables 1 and 2 present the distribution of person-years (exposures) and events (occurrences).

[1] For the data on housing changes the final censoring took place in March 2000, at fourth conception, at age 50 or at death of the woman. This allowed us to also examine the risk of housing change when couples had three children.

In total, there were 43,820 moves made by partnered women. 12,431 moves were to single-family houses, 9,589 to terraced houses and 21,800 to apartments (Table 1). There were 14,258 first births for 35,391 women, 12,097 second births for 23,154 women and 4,120 third births for 17,246 women in the data (Table 2). The number of women for the risk of second or third birth was thus larger than one would have expected based on the number of first or second births, correspondingly. Childless women who formed a union between 1988 and 2000 made up the population 'at risk' for first birth. The data-set for second and third birth additionally included women who had their first or second conception (leading to birth) in 1988 or later, but did so before union formation as well as women who had their first or second conception (leading to birth) before 1988 but formed another union in 1988 or later.

We controlled for a set of demographic and socio-economic variables when examining the interplay between childbearing and housing choice. First, we included in the analysis *union duration* and for the models on housing choice also a variable showing whether the union was a *marital union or not*. Second, we controlled for *the woman's age* and time since previous birth (if any) for models on childbearing and time since previous residential change for models on housing. Third, we also included in the analysis *calendar time*, *language* (Finnish- or Swedish-speaker), and *settlement of residence* (large urban, medium urban, small urban or rural)[2]. Fourth, we controlled for *educational enrolment* (not enrolled or enrolled) and *educational level* (lower secondary, upper secondary, vocational, lower tertiary, or upper tertiary) of the woman and her *annual earnings* (none, low, medium, high, or very high). Finally, we included in the models on housing choice the number of children and in the models on fertility behaviour the current housing type. The current housing type was also included in the models on housing choice.

Methods and modelling strategy

We used an event-history analysis (Hoem 1987; 1993; Blossfeld and Rohwer 1995), fitting a series of regression models for the hazard of housing change (any change including the moves within the same housing type) and for the risk of having a child. The basic model for housing transitions can be formalised as follows:

[2] We distinguished the types of settlement according to the size of the municipality of residence: 1) large urban – the capital city of Helsinki with 500,000 and more inhabitants; 2) medium urban – other cities with a population of 50,000–250,000; small urban – towns with 10,000–50,000 inhabitants; and 4) rural areas – municipalities with less than 10,000 inhabitants. We also considered that all cities and many towns extend beyond their administrative borders and we defined suburban municipalities to cities and towns with more than 30,000 inhabitants as part of the urban region. We assigned a municipality to the urban region if a least 10% of its labour force commuted to work in the neighbouring city or town in 2000.

$$
\begin{aligned}
ln\,\mu_{im}^{D}(t) &= y^{D}(t) + \sum_k z_k^{D}(u_{imk} + t) + \sum_j \alpha_j^{D} x_{imj} + \sum_l \beta_l^{D} w_{iml}(t) + \varepsilon_i^{D} \\
ln\,\mu_{im}^{T}(t) &= y^{T}(t) + \sum_k z_k^{T}(u_{imk} + t) + \sum_j \alpha_j^{T} x_{imj} + \sum_l \beta_l^{T} w_{iml}(t) + \varepsilon_i^{T} \quad , \qquad (1) \\
ln\,\mu_{im}^{A}(t) &= y^{A}(t) + \sum_k z_k^{A}(u_{imk} + t) + \sum_j \alpha_j^{A} x_{imj} + \sum_l \beta_l^{A} w_{iml}(t) + \varepsilon_i^{A}
\end{aligned}
$$

where $\mu_{im}{}^{D}(t)$, $\mu_{im}{}^{T}(t)$, $\mu_{im}{}^{A}(t)$ denote the hazard of mth move of individual i to single-family housing, terraced housing and apartment in the competing risk framework[3]. $y(t)$ denotes a piecewise linear spline that captures the baseline log-hazard (union duration for first move and time since previous move for the second and subsequent moves). We used a piecewise linear spline specification instead of the widely used piecewise constant approach to pick up the baseline log-hazard. Parameter estimates are thus the slopes for linear splines over user-defined time periods. With sufficient nodes (bend points), a piecewise linear-specification can capture any log-hazard pattern in the data (for further details, see Lillard and Panis 2003)[4]. $z_k(u_{imk} + t)$ denotes the spline representation of the effect of a time-varying variable that is a continuous function of t with origin u_{imk} (the woman's age, calendar time and union duration for the second and subsequent moves). x_{imj} represents the values for a time-constant variable (language), and $w_{iml}(t)$ represents a time-varying variable whose values can change only at discrete times (parity and all other variables). $\varepsilon_i{}^{D}$, $\varepsilon_i{}^{T}$ and $\varepsilon_i{}^{A}$ are woman-specific time-invariant residuals for the moving to single-family housing, terraced housing and apartment equations, respectively.

We also fitted a model for childbearing, which can be formalised as follows:

$$
\begin{aligned}
ln\,\mu_{i}^{B1}(t) &= y^{B1}(t) + \sum_k z_k^{B1}(u_{ik} + t) + \sum_j \alpha_j^{B1} x_{ij} + \sum_l \beta_l^{B1} w_{il}(t) + \varepsilon_i^{B} \\
ln\,\mu_{i}^{B2}(t) &= y^{B2}(t) + \sum_k z_k^{B2}(u_{ik} + t) + \sum_j \alpha_j^{B2} x_{ij} + \sum_l \beta_l^{B2} w_{il}(t) + \varepsilon_i^{B} \quad , \qquad (2) \\
ln\,\mu_{i}^{B3}(t) &= y^{B3}(t) + \sum_k z_k^{B3}(u_{ik} + t) + \sum_j \alpha_j^{B3} x_{ij} + \sum_l \beta_l^{B3} w_{il}(t) + \varepsilon_i^{B}
\end{aligned}
$$

where $\mu_i{}^{B1}(t)$, $\mu_i{}^{B2}(t)$, $\mu_i{}^{B3}(t)$ represent the hazard of the first, second and third conception (subsequently leading to a birth) of individual i, respectively. $\varepsilon_i{}^{B}$ is a woman-specific time-invariant residual for the fertility equations.

[3] – The reason behind considering the destination and not the origin of move was that the effect of most variables was similar across the housing of origin. We thus studied the destination-specific risks where all housing episodes that end with moves to other destinations (e.g. apartments) than that of our interest (e.g. single-family houses) were censored at the moment of move. However, an individual (whether moved to the destination of our interest or elsewhere) remained under the risk after the move as we did have multi-episode data.

[4] The value of the linear spline function between the points (t_n, y_n) and (t_{n+1}, y_{n+1}) is computed as follows: $y(t) = y_n + s_{n+1}(t - t_n)$ for $n = 0, 1, 2 \ldots$, where s_{n+1} is the slope of the linear spline over the interval $[t_n, t_{n+1}]$. To compute the linear spline function we thus need to define nodes and estimate from the data constant y_0 and slope parameters $s_1, s_2, \ldots$.

There may have been unobserved factors which influenced women's childbearing and housing choices over their family life. In order to control for such factors, we next built a simultaneous-equations model to estimate jointly three equations for fertility and another three equations for housing choices according to the type of destination housing. The model can be formalised as follows:

$$
\begin{aligned}
ln\,\mu_{im}^{D}(t) &= y^{D}(t) + \sum_k z_k^{D}(u_{imk} + t) + \sum_j \alpha_j^{D} x_{imj} + \sum_l \beta_l^{D} w_{iml}(t) + \varepsilon_i^{D} \\
ln\,\mu_{im}^{T}(t) &= y^{T}(t) + \sum_k z_k^{T}(u_{imk} + t) + \sum_j \alpha_j^{T} x_{imj} + \sum_l \beta_l^{T} w_{iml}(t) + \varepsilon_i^{T} \\
ln\,\mu_{im}^{A}(t) &= y^{A}(t) + \sum_k z_k^{A}(u_{imk} + t) + \sum_j \alpha_j^{A} x_{imj} + \sum_l \beta_l^{A} w_{iml}(t) + \varepsilon_i^{A} \\
ln\,\mu_{i}^{B1}(t) &= y^{B1}(t) + \sum_k z_k^{B1}(u_{ik} + t) + \sum_j \alpha_j^{B1} x_{ij} + \sum_l \beta_l^{B1} w_{il}(t) + \varepsilon_i^{B} \\
ln\,\mu_{i}^{B2}(t) &= y^{B2}(t) + \sum_k z_k^{B2}(u_{ik} + t) + \sum_j \alpha_j^{B2} x_{ij} + \sum_l \beta_l^{B2} w_{il}(t) + \varepsilon_i^{B} \\
ln\,\mu_{i}^{B3}(t) &= y^{B3}(t) + \sum_k z_k^{B3}(u_{ik} + t) + \sum_j \alpha_j^{B3} x_{ij} + \sum_l \beta_l^{B3} w_{il}(t) + \varepsilon_i^{B}
\end{aligned}
, \qquad (3)
$$

ε_i^{B}, ε_i^{D}, ε_i^{T} and ε_i^{A} are woman-specific time-invariant residuals for the fertility, moving to single-family housing, terraced housing and apartment equations, respectively. The residuals are assumed to follow a multivariate normal distribution:

$$
\begin{pmatrix} \varepsilon_i^{D} \\ \varepsilon_i^{T} \\ \varepsilon_i^{A} \\ \varepsilon_i^{B} \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{\varepsilon^D} & \rho_{\varepsilon^T\varepsilon^D} & \rho_{\varepsilon^A\varepsilon^D} & \rho_{\varepsilon^B\varepsilon^D} \\ \rho_{\varepsilon^D\varepsilon^T} & \sigma^2_{\varepsilon^T} & \rho_{\varepsilon^A\varepsilon^T} & \rho_{\varepsilon^B\varepsilon^T} \\ \rho_{\varepsilon^D\varepsilon^A} & \rho_{\varepsilon^T\varepsilon^A} & \sigma^2_{\varepsilon^A} & \rho_{\varepsilon^B\varepsilon^A} \\ \rho_{\varepsilon^D\varepsilon^B} & \rho_{\varepsilon^T\varepsilon^B} & \rho_{\varepsilon^A\varepsilon^B} & \sigma^2_{\varepsilon^B} \end{pmatrix} \right), \qquad (4)
$$

where $\sigma^2_{\varepsilon^D}$, $\sigma^2_{\varepsilon^T}$, $\sigma^2_{\varepsilon^A}$ and $\sigma^2_{\varepsilon^B}$ denote the variances of the person-specific residuals and ρ^{DT}, ρ^{DA}, ρ^{DB}, ρ^{TA}, ρ^{TB} and ρ^{AB} are the covariances between the residuals. A positive value of ρ^{DB} suggests that women with an above-average risk of having a child (or another child), net of their observed characteristics, had also an above-average propensity of moving to single-family housing. The same logic applies for ρ^{TB} and ρ^{AB}, which denote covariances between the residuals of the birth and terraced housing equations and the birth and apartment equations, correspondingly. The identification of the model was attained through within-person replication (see Lillard 1993; Lillard *et al.*1995; Kulu 2005; 2006; Steele *et al.* 2006). Many women gave several births, and some women made several moves to the same housing type (see Table 1). We also tested robustness of the results by including and excluding various socio-economic variables from the

equations of the two processes; the results were robust to different specifications. The models were estimated via maximum likelihood using aML (Lillard and Panis 2003).

Finally, we extended our previous model on housing choices and childbearing, allowing the risk of moving to vary over age of the youngest child and the hazard of childbearing to vary since move to a new housing instead of assuming a constant risk (that we did so far). Technically, this was achieved by substituting the categorical representation of the effect of childbearing on housing change (and vice versa) with the linear-spline representation. The effect of childbearing on the log risk of housing change was thus captured by the linear spline, $z(t - b_i)$, where b_i is the time of conception (first, second or third) at basic duration t for individual i. $t - b_i$ measures the time since event; $t - b_i < 0$ until the event (conception) has happened and $t - b_i \geq 0$ after the event has occurred.The linear-spline is thus conditional spline, i.e. conditional on the occurrence of an event of birth; it activates when $t = b_i$. The similar logic also applies to measure the hazard of childbearing since move. $z(t - m_i)$ is a conditional spline where m_i is the time of move at basic duration t for individual i. The spline activates (or "kicks in") when $t = m_i$. In our analysis, we examined separately how the hazard of childbearing varies since moves to single-family housing, terraced housing and apartment.

R**esults**

Housing choice

Table 3 (Model 1) shows that the birth of a first child raised the couples' risk of moving to single-family houses by 51%[5]. Further the risk of moving to single-family houses increased with the number of children. The second and third child increased the likelihood of moving to single-family houses by 86% and 2.1 times, respectively. We also see that couples who already lived in single-family houses had a significantly lower propensity of making another move (to a single-family house) than couples who lived in apartments or in terraces houses. The likelihood of moving to single-family houses was the largest in rural areas and the smallest in the capital city of Helsinki, as expected.

The birth of a first child raised the risk of moving to terraced houses by 67% (Table 4, Model 1). The birth of a second and a third child increased the propensity of moving to terraced houses by 57% and 53%, respectively. The likelihood of moving to terraced houses thus slightly decreased with an increase in the family size. Again, the propensity of moving (to terraced houses) was significantly lower for couples in single-family houses than for those who lived in terraced houses or apartments. Similarly to the patterns observed for single-family houses, the

[5] – The relative change in the risk has been calculated as follows: $(\exp(\beta) - 1) \times 100\%$, where β is parameter estimate for the first, second or third conception/birth. The reference category is parity zero.

risk of moving to terraced houses decreased with an increase in the settlement size, which was expected as in Finland and other Nordic countries terraced houses are more common in smaller than in larger settlements where apartments are dominant housing.

The results on the effect of childbearing on moving to apartments are also interesting (Table 5, Model 1). The birth of a first child raised the couples' risk of moving to apartments by 28%. The second and third child increased the propensity of moving to apartments for couples by 17% and 16%, respectively. The relative increase was thus much smaller than it was for single-family or terraced houses. Still, we should note that overall the risk of moving to apartments was higher than that to terraced houses and apartments for all couples (compare the estimates for baseline in Model 1 across the Tables). Couples who lived in single-family or terraced houses had much lower propensity of moving to apartments than those who lived in apartments, as expected. The risk of moving to apartments was the largest in the capital city of Helsinki and the smallest in rural areas, which was also expected.

Fertility

In the models on fertility, we distinguished between the first (common) residential episode of a couple (*non-movers*) and the second and subsequent episodes (*movers*), and we also included in the analysis other moving-related variables. Couples in single-family houses had the highest risk of first conception, while couples in apartments had the lowest risk (Table 6, Model 1). Couples who had moved together had a significantly higher risk in all three housing categories (the group differences were tested separately). We also investigated whether or not previous housing had an effect on fertility levels for movers in various housing types, but we did not find any effect. First-birth levels were the lowest in the capital city of Helsinki, as expected.

The patterns for the second birth were similar to those of first birth. Couples living in single-family houses had the highest risk of second conception while couples residing in apartments had the lowest risk (Table 7, Model 1). Couples who moved (before or after first birth) had a significantly higher risk in all three housing types. The fertility variation between various residential categories was smaller for second than first birth, however. Still, the second-birth rates were higher in rural areas and small towns than in other settlements.

Finally, we present the models on third birth. Couples residing in single-family houses had a significantly higher risk of third conception than couples living in apartments, while the risk of couples in terraced houses did not differ from that of couples in apartments (Table 8, Model 1). Again, couples who had moved together (before or after second birth) had a significantly higher risk of third birth. The risk of third conception was significantly higher in rural areas and small towns than that in towns and cities, as expected.

Controlling for unobserved co-determinants of fertility and housing transitions

There may have been unobserved factors, which simultaneously influenced a woman's childbearing and housing choices over her entire family life. Ignoring these might have led to biased estimates of the effect of children on housing transitions and the fertility differences by housing type. In order to control for such factors, we fitted a simultaneous-equations model to estimate jointly three equations for housing choices and another three equations for fertility. The model fit improved significantly (LR = 146.6, with 6 degree of freedom, with a *p*-value < 0.001). The significant positive correlation between the residuals of the three housing equations and between the residuals of the fertility equations indicates that women who were more likely to have children, net of their observed characteristics, were also more likely to change housing during their family life whatever the housing of destination (Table 9, Model 2). This suggest that long-term family plans and housing aspirations were closely related; women who wished to have a large family were prone to move; obviously these moves were steps towards reaching desired housing. Controlling for the effect of unobserved women-level characteristics changed the estimates of previous models. The effect of children on the risk of housing-related moves decreased as did the fertility differences by housing type (compare Model 2 to Model 1 in Tables 3 to 8). All effects were thus overestimated in the model were unobserved co-determinants of women's family and housing careers were not controlled for.

Modelling relative timing of childbearing and housing transitions with respect to each other

We corrected our estimates for time-invariant unobserved characteristics of women, which influenced their childbearing decisions and housing choices. Next, we investigated the timing of two processes in respect with each other to further detect possible selection effects. We allowed the risk of moving to vary over time since conception and the risk of conception to vary over time since the change of dwelling, instead of assuming a constant risk. Technically, this was achieved by substituting the categorical representation with the linear-spline representation of the effect of fertility on housing change and the impact of housing change on childbearing. The model fit improved significantly (LR = 573.6, with 72 degree of freedom, with a *p*-value < 0.001).

Figure 1 presents the results on moving to single-family houses. We see that, first, the risk of moving to single-family houses increased significantly during a pregnancy and reached its peak in the middle of pregnancy. Thereafter the risk slightly decreased, but remained relatively high also after the birth of a child. As already shown in previous models, the propensity of moving to single-family houses increased with the number of children. The results on moving to terraced houses were similar (Figure 2). Again, we observed a significant increase in the risk of moving during a pregnancy. The risk was the highest in the middle of pregnancy and thereafter gradually decreased. The levels remained high also after the birth of a child. The patterns of

moving to apartment were also interesting (Figure 3). The propensity of moving to apartments increased during a pregnancy and reached its peak in the middle of the pregnancy. Thereafter the risk levels significantly decreased and after the birth of a child (or another child) the risk of moving to apartments was at the same risk level when the couples did not have any children (and she was not pregnant). The results of the analysis of timing of moves with respect to childbearing thus showed that many couples changed their housing when they were waiting their child to be born. The likelihood of moving to single-family and terraced houses was a relatively high also after the birth of a child.

Finally, we also analysed the timing of births with respect to moves. Figure 4 presents the results on first conception (leading to birth). We see that, first, the risk of first conception increased significantly during the first three months after moving regardless of housing at destination. In the following months, the risk further increased and reached its peak about a year after the move, and only then began to decrease gradually. Second, couples in single-family houses had the highest risk over the entire duration, while couples in apartments had the lowest. The patterns of second conception were not very different (Figure 5). Again, the risk of conception significantly increased during the first months after moving to a new housing, although only couples in single-family houses showed also a relatively high fertility during the second part of the first year. Figure 6 presents the patterns of third conception. The risk of conception increased during the first months after the move. The increase was particularly large for couples who had moved to single-family houses. Thereafter the risk decreased significantly and became stable about a year after the move. Again, the differences between the movers in various housing types were significant over the entire duration. We also see that couples in single-family houses still had a relatively high risk of third conception two, three, and four years after the move to a new dwelling. The analysis of timing of childbearing with respect to housing changes thus showed that many couples had a child (or, more precisely, she became pregnant) within a year after the move.

Fertility and housing transitions by place of residence

As the last step, we investigated whether childbearing patterns by housing type varied by place of residence. We observed no significant differences in the patterns by residence. In all settlement types, the couples who lived in single-family houses had the highest fertility levels, while those who lived in apartments had the lowest. The couples who had moved together had a higher risk of conception (leading to birth) than those who had not moved. We then examined the effect of childbearing on housing change by place of residence. Figures 7a and 7b present the risk of moving to single-family houses by parity and settlement of residence; in the former Figure, the risk levels for all couples are presented relative to those of childless couples in ‘other cities’; in the latter, the levels for couples with a child (or children) are relative to those of childless couples

in the same settlement type. We simplified our model and estimated the risk of moving during a pregnancy and after the childbirth; we thus assumed a constant risk during the pregnancy and after a child was born. (Our previous analysis showed that the main differences existed between these two life-episodes of couples; the simplification was also necessary in order to keep the model manageable and the results understandable.)

First, we see that the likelihood of moving to singe-family houses increased with a decrease in the settlement size; on average, the risk of moving to single-family houses was about 2 times higher in rural areas and small towns than that in the capital city of Helsinki (Figure 7a). This was expected as single-family houses are more common in rural than urban areas. Second, the effect of childbearing on moving to single-family house was significantly stronger in larger than in smaller settlements; in the capital city, the risk levels increased with an increase in the family size, while there was no such a pattern in rural areas and small towns (Figures 7b). This suggest that in large cities, couples mostly moved to single family houses when waiting for a child to be born or after the childbirth, particularly a second and third child, whereas in rural areas and small towns, many couples moved to single-family houses when still being childless. The patterns in other settlements were in-between these two.

The likelihood of moving to terraced houses increased with a decrease in the settlement size, but the differences were smaller than those we observed for single-family houses (Figure 8a). Again, the effect of childbearing on moving was stronger in larger than smaller settlements (Figure 8b). Interestingly, the propensity of moving to terraced houses was the highest during the first and second pregnancy. The patterns of moving to apartments had also a specific character. First, the risk levels were the highest in the largest city and the lowest in small towns and rural areas, as expected (Figure 9a). Second, the variation by parity was somewhat stronger in urban than in rural areas, although the differences were small (Figure 9b).

Conclusion and discussion

In this study we examined the interrelationships between childbearing and housing transitions. We controlled for unobserved factors of women, which simultaneously influenced their childbearing and housing careers. We also investigated timing of childbearing and housing transitions with respect to each other. Our analysis showed that, as expected, the birth of a child raised significantly the propensity of moving to a new housing, particularly to a single-family or terraced house. We also observed an elevated fertility after a couple had moved to a new housing, especially to a single-family house. Our further analysis showed that there were unobserved factors that influenced both women's childbearing and housing careers. We interpreted the results of simultaneous-equations analysis that women's long-term childbearing plans and housing aspirations were closely related. Women who wished to have a large family were prone to move; obviously these moves were steps towards reaching a desired housing.

Ignoring the unobserved factors would have led us to an overestimation of the effect of childbearing on housing-related moves and the fertility differences by housing type. This is a first study to demonstrate a change in the results when controlling for unobserved co-determinants of childbearing decisions and housing choices. Although the substantive findings were not challenged this time, the analysis suggested that a caution is needed even when interpreting obvious results, e.g. so-called adjustment moves.

Our analysis of timing of childbearing and housing transitions with respect to each other showed that many housing-related moves took place when couples were waiting their child to be born and that many children were conceived during the first months after the move to a new housing. More precisely, three patterns of timing were observed: first, a couple moved to a new housing and she became pregnant after the move; second, she became pregnant, the couple moved to a new housing where the child was born; and third, a child was born first and only then the couple moved to a new housing. How to interpret these patterns? In general, we might say that the three patterns of timing support the importance of so-called adjustment moves; some couples moved in anticipation of family change while others moved in response to an actual change in family size. This explanation, however, is not sufficient in the light of the results. Our further analysis showed significant differences by residential context. Most importantly, the moves occurring during a period when she was pregnant or after the childbirth were more common in larger than smaller settlements; in the latter, many couples moved first and only then had a child. The effect of childbearing on moving thus varied across settlements being the strongest in large cities and the weakest in small towns and rural areas.

Therefore we may argue that couples in rural areas and small towns can afford to move to a relatively large housing, particularly to single-family houses, before or when planning to have a child. In large cities, in turn, the housing changes occur close to childbearing indicating a constant need to optimise housing size to changes in the family size. This suggest that the issues of housing costs and affordability play much more important role in larger than smaller settlements, which is not surprising. While our analysis did not provide a direct evidence of whether and how this influenced couples' fertility behaviour, the results suggested that in cities, especially in large cities, some couples might have to delay childbearing or having another child until proper housing became available and affordable. Eventually, the postponement of childbearing might result in a smaller family size, e.g. because of fecundity problems with increasing age.

This study showed an importance of joint modelling of fertility decisions and housing choices. It also showed how a careful examination of timing of childbearing behaviour and housing changes with respect to each other allows us to gain a deeper insight into the interrelationship between the two careers in the family life course. The analysis supported that childbearing leads to housing changes, and also showed when precisely those moves take place. The results also suggested that the availability of a proper housing or the lack of it may influence

childbearing behaviour of couples. We believe that the future research would benefit much from a comparative approach. Previous research suggests that the housing regime in a country may moderate the childbearing-housing relationship; it may either promote adjustment moves or hinder them depending on the quality and variety of existing housing stock in a country and on how easy or difficult is to access various housing types (Mulder and Billari 2010). Eventually, as suggested, the housing availability may also shape childbearing patterns.

Table 1: Person-years and Moves by Parity, Housing Type and Place of Residence.

	Person-years		Moves to Single-family house		Moves to Terraced house		Moves to Apartment	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Parity								
No children	95468.31	41.5	3792	30.5	3693	38.5	10672	49.0
First pregnancy	11180.94	4.9	812	6.5	911	9.5	1876	8.6
First birth	49518.63	21.5	2861	23.0	2316	24.2	4494	20.6
Second pregnancy	8730.27	3.8	755	6.1	579	6.0	1022	4.7
Second birth	50334.38	21.9	3163	25.4	1628	17.0	2924	13.4
Third pregnancy	2934.74	1.3	242	1.9	124	1.3	238	1.1
Third birth	11965.56	5.2	806	6.5	338	3.5	574	2.6
Total	230132.83	100.0	12431	100.0	9589	100.0	21800	100.0
Housing type								
Single-family house	69478.25	30.2	2458	19.8	1101	11.5	1956	9.0
Terraced house	44477.63	19.3	3677	29.6	2667	27.8	2425	11.1
Apartment	116176.96	50.5	6296	50.6	5821	60.7	17419	79.9
Total	230132.84	100.0	12431	100.0	9589	100.0	21800	100.0
Place of residence								
Capital city	71100.48	30.9	2700	21.7	2119	22.1	8078	37.1
Other cities	84019.94	36.5	4514	36.3	3750	39.1	8341	38.3
Towns	49082.39	21.3	3348	26.9	2424	25.3	4242	19.5
Rural areas and small towns	25930.02	11.3	1869	15.0	1296	13.5	1139	5.2
Total	230132.83	100.0	12431	100.0	9589	100.0	21800	100.0
Moves, previous and current housing								
Non-movers by current housing:								
Single-family house	33897.95	14.7	1053	8.5	451	4.7	925	4.2
Terraced house	21951.49	9.5	1800	14.5	1372	14.3	1229	5.6
Apartment	73685.72	32.0	3544	28.5	3594	37.5	11342	52.0
Movers by previous and current housing:								0.0
Single-family house — single-family house	6086.67	2.6	304	2.4	117	1.2	141	0.6
Other — single-family house	28219.15	12.3	1047	8.4	505	5.3	861	3.9
Unknown — single-family house	1274.47	0.6	54	0.4	28	0.3	29	0.1
Terraced house — terraced house	5234.67	2.3	542	4.4	376	3.9	286	1.3
Other — terraced house	16660.81	7.2	1259	10.1	874	9.1	875	4.0
Unknown — terraced house	630.67	0.3	76	0.6	45	0.5	35	0.2
Apartment — apartment	34333.96	14.9	1774	14.3	1600	16.7	4770	21.9
Other — apartment	7393.08	3.2	912	7.3	577	6.0	1193	5.5
Unknown — apartment	764.19	0.3	66	0.5	50	0.5	114	0.5
Total	230132.84	100.0	12431	100.0	9589	100.0	21800	100.0

Notes: The table provides information on the distribution of person-years and events (according to three destinations) by parity, current housing type and place of residence. The table additionally provides information on the distribution of person-years and events by previous and current housing type. We have distinguished between the episodes when women had not moved with their current partner (non-movers) and between those episodes when they had moved with their partner at least once (movers). For the former we present the distribution of person-years and events (according to three destinations) by current housing type. For the latter we present the distribution of person-years and events (according to three destinations) by previous and current housing type (e.g. women who first lived in single-family house and then moved (with the same partner) to another single-family house belong to the category of 'Single-family house — single-family house').

Table 2: Person-years and Births by Housing Type.

	Person-years		Births	
	Number	Percent	Number	Percent
First birth				
Single-family house	17695.15	18.1	3328	23.3
Terraced house	16973.11	17.3	2956	20.7
Apartment	63273.29	64.6	7974	55.9
Total	97941.56	100.0	14258	100.0
Second birth				
Single-family house	15497.59	30.8	4149	34.3
Terraced house	10860.39	21.6	2866	23.7
Apartment	23941.04	47.6	5082	42.0
Total	50299.02	100.0	12097	100.0
Third birth				
Single-family house	23106.45	45.6	2064	50.1
Terraced house	10308.85	20.3	812	19.7
Apartment	17270.40	34.1	1244	30.2
Total	50685.70	100.0	4120	100.0

Table 3: Log-risks of Moving to Single-family House.

Variables	Model 1		Model 2		Model 3	
Birth parity						
No children	0		0		0	
Time since first conception						
First conception (constant)	0.413	***	0.399	***	0.101	
0–0.375 years (slope)					1.461	***
0.375–0.75 years (slope)					-0.971	***
0.75–1.25 years (slope)					0.326	**
1.25+ years (slope)					-0.013	***
Time since second conception						
Second conception (constant)	0.620	***	0.582	***	0.239	**
0–0.375 years (slope)					1.412	***
0.375–0.75 years (slope)					-0.401	
0.75–1.25 years (slope)					0.015	
1.25+ years (slope)					-0.013	***
Time since third conception						
Third conception (constant)	0.744	***	0.652	***	0.376	**
0–0.375 years (slope)					1.266	*
0.375–0.75 years (slope)					-0.328	
0.75–1.25 years (slope)					-0.046	
1.25+ years (slope)					-0.033	*
Housing conditions						
Housing type						
Single-family house	-1.065	***	-1.087	***	-1.088	***
Terraced house	0.099	***	0.055	**	0.056	**
Apartment	0		0		0	
Place of residence						
Capital city	-0.408	***	-0.421	***	-0.424	***
Other cities	0		0		0	
Towns	0.327	***	0.335	***	0.335	***
Rural areas and small towns	0.493	***	0.510	***	0.508	***
Demographic variables						
Union duration (baseline)						
Constant	-8.904	***	-9.126	***	-9.119	***
0-1 years (slope)	0.572	***	0.602	***	0.595	***
1-3 years (slope)	-0.007		0.017		0.011	
3-5 years (slope)	0.001		0.018		0.013	
5+ years (slope)	-0.054	***	-0.044	***	-0.043	***
Marriage						
Cohabitation	0		0		0	
Marriage	0.323	***	0.317	***	0.311	***
Time since previous move						
No moves	0		0		0	
One or more moves (constant)	-0.683	***	-0.785	***	-0.773	***
0-1 years (slope)	0.635	***	0.645	***	0.642	***
1-3 years (slope)	-0.085	***	-0.077	***	-0.078	***
3-5 years (slope)	0.098	***	0.100	***	0.100	***
5+ years (slope)	0.016		0.016		0.018	

Moves						
One move	0		0		0	
Two or more moves	0.115	***	0.010		0.025	
Age						
-24 years (slope)	-0.013		-0.009		-0.009	
25-29 years (slope)	-0.020	***	-0.019	***	-0.019	**
30-34 years (slope)	-0.040	***	-0.042	***	-0.040	***
35+ years (slope)	-0.068	***	-0.071	***	-0.059	***
Socio-economic variables						
Year						
1988-2000 (slope)	0.057	***	0.059	***	0.059	***
Language						
Finnish	0		0		0	
Swedish	0.153	***	0.145	***	0.145	***
Educational enrolment						
Not enrolled	0		0		0	
Enrolled	-0.390	***	-0.402	***	-0.393	***
Educational level						
Lower secondary	-0.059	**	-0.050	*	-0.044	***
Upper secondary	0		0.000		0.000	
Vocational	0.076	***	0.081	***	0.076	***
Lower tertiary	0.095	*	0.101	**	0.090	*
Upper tertiary	0.018		0.024		0.010	
Earnings						
None	-0.141	***	-0.137	***	-0.137	***
Low	-0.034		-0.038		-0.046	*
Medium	0		0		0	
High	0.097	***	0.102	***	0.106	***

Table 4: Log-risks of Moving to Terraced House.

Variables	Model 1		Model 2		Model 3	
Birth parity						
No children	0		0		0	
Time since first conception						
First conception (constant)	0.511	***	0.463	***	0.223	**
0–0.375 years (slope)					1.611	***
0.375–0.75 years (slope)					-0.630	**
0.75–1.25 years (slope)					-0.281	**
1.25+ years (slope)					-0.023	***
Time since second conception						
Second conception (constant)	0.452	***	0.353	***	0.365	***
0–0.375 years (slope)					0.849	**
0.375–0.75 years (slope)					-0.287	
0.75–1.25 years (slope)					-0.584	***
1.25+ years (slope)					-0.012	*
Time since third conception						
Third conception (constant)	0.422	***	0.245	***	-0.202	
0–0.375 years (slope)					2.260	**
0.375–0.75 years (slope)					-1.496	**
0.75–1.25 years (slope)					0.679	*
1.25+ years (slope)					-0.102	***
Housing conditions						
Housing type						
Single-family house	-1.351	***	-1.403	***	-1.396	***
Terraced house	-0.097	***	-0.093	***	-0.090	***
Apartment	0		0		0	
Place of residence						
Capital city	-0.432	***	-0.444	***	-0.447	***
Other cities	0		0		0	
Towns	0.201	***	0.211	***	0.209	***
Rural areas and small towns	0.430	***	0.449	***	0.444	***
Demographic variables						
Union duration (baseline)						
Constant	-7.584	***	-7.867	***	-7.882	***
0-1 years (slope)	0.693	***	0.718	***	0.714	***
1-3 years (slope)	-0.106	***	-0.083	***	-0.089	***
3-5 years (slope)	-0.097	***	-0.077	***	-0.073	***
5+ years (slope)	-0.088	***	-0.076	***	-0.071	***
Marriage						
Cohabitation	0		0		0	
Marriage	0.206	***	0.184	***	0.175	***
Time since previous move						
No moves	0		0		0	
One or more moves (constant)	-0.611	***	-0.687	***	-0.683	***
0-1 years (slope)	0.489	***	0.496	***	0.507	***
1-3 years (slope)	0.057	*	0.063	**	0.063	**
3-5 years (slope)	0.001		0.001		0.003	
5+ years (slope)	0.061		0.064		0.064	

Moves						
One move	0		0		0	
Two or more moves	0.258	***	0.179	***	0.207	***
Age						
-24 years (slope)	-0.049	***	-0.043	***	-0.041	***
25-29 years (slope)	-0.061	***	-0.056	***	-0.053	***
30-34 years (slope)	-0.070	***	-0.069	***	-0.060	***
35+ years (slope)	-0.062	***	-0.066	***	-0.046	***
Socio-economic variables						
Year						
1988-2000 (slope)	0.048	***	0.050	***	0.050	***
Language						
Finnish	0		0		0	
Swedish	-0.314	***	-0.316	***	-0.311	***
Educational enrolment						
Not enrolled	0		0		0	
Enrolled	-0.157	***	-0.171	***	-0.155	***
Educational level						
Lower secondary	-0.100	***	-0.082	**	-0.067	**
Upper secondary	0		0.000		0.000	
Vocational	0.192	***	0.192	***	0.177	***
Lower tertiary	0.127	**	0.126	**	0.101	*
Upper tertiary	0.330	***	0.324	***	0.293	***
Earnings						
None	-0.084	*	-0.068		-0.026	
Low	0.015		0.013		0.015	
Medium	0		0		0	
High	0.000		0.006		0.008	
Very high	0.023		0.037		0.030	

Table 5: Log-risks of Moving to Apartment.

Variables	Model 1		Model 2		Model 3	
Birth parity						
No children	0		0		0	
Time since first conception						
First conception (constant)	0.243	***	0.221	***	-0.155	**
0–0.375 years (slope)					2.440	***
0.375–0.75 years (slope)					-1.476	***
0.75–1.25 years (slope)					-0.108	
1.25+ years (slope)					-0.006	*
Time since second conception						
Second conception (constant)	0.158	***	0.110	***	-0.137	
0–0.375 years (slope)					1.768	***
0.375–0.75 years (slope)					-0.727	***
0.75–1.25 years (slope)					-0.656	***
1.25+ years (slope)					0.017	***
Time since third conception						
Third conception (constant)	0.146	***	0.056	***	-0.034	
0–0.375 years (slope)					1.194	*
0.375–0.75 years (slope)					-1.078	**
0.75–1.25 years (slope)					-0.076	
1.25+ years (slope)					-0.001	
Housing conditions						
Housing type						
Single-family house	-1.417	***	-1.453	***	-1.442	***
Terraced house	-0.904	***	-0.928	***	-0.921	***
Apartment	0		0		0	
Place of residence						
Capital city	0.058	***	0.051	***	0.052	***
Other cities	0		0		0	
Towns	-0.025		-0.020		-0.022	
Rural areas and small towns	-0.311	***	-0.298	***	-0.302	***
Demographic variables						
Union duration (baseline)						
Constant	-4.309	***	-4.462	***	-4.475	***
0-1 years (slope)	0.591	***	0.606	***	0.612	***
1-3 years (slope)	-0.197	***	-0.185	***	-0.186	***
3-5 years (slope)	-0.098	***	-0.088	***	-0.079	***
5+ years (slope)	-0.121	***	-0.115	***	-0.111	***
Marriage						
Cohabitation	0		0		0	
Marriage	0.199	***	0.186	***	0.183	***
Time since previous move						
No moves	0		0		0	
One or more moves (constant)	-0.650	***	-0.686	***	-0.682	***
0-1 years (slope)	0.594	***	0.596	***	0.609	***
1-3 years (slope)	0.008		0.011		0.011	
3-5 years (slope)	0.067	*	0.067	*	0.068	**
5+ years (slope)	0.093	**	0.095	**	0.092	**

Moves						
One move	0		0		0	
Two or more moves	0.330	***	0.289	***	0.313	***
Age						
-24 years (slope)	-0.055	***	-0.052	***	-0.051	***
25-29 years (slope)	-0.062	***	-0.060	***	-0.057	***
30-34 years (slope)	-0.053	***	-0.053	***	-0.045	***
35+ years (slope)	-0.026	***	-0.028	***	-0.031	***
Socio-economic variables						
Year						
1988-2000 (slope)	0.027	***	0.029	***	0.028	***
Language						
Finnish	0		0		0	
Swedish	-0.252	***	-0.255	***	-0.251	***
Educational enrolment						
Not enrolled	0		0		0	
Enrolled	-0.013		-0.021		-0.020	
Educational level						
Lower secondary	0.067	***	0.076	***	0.083	***
Upper secondary	0		0.000		0.000	
Vocational	0.029		0.028		0.021	
Lower tertiary	0.051		0.050		0.039	
Upper tertiary	0.052		0.049		0.039	
Earnings						
None	0.036		0.045		0.088	***
Low	0.062	***	0.062	***	0.076	***
Medium	0		0		0	
High	-0.080	***	-0.077	***	-0.085	***
Very high	-0.057		-0.049		-0.056	

Table 6: Log-risks of Conception Leading to First Birth.

Variables	Model 1		Model 2		Model 3	
Housing and moves						
Housing type						
Non-movers in single-family house	0.426	***	0.412	***	0.207	***
Movers in single-family house	0.570	***	0.506	***	0.367	***
0-0.25 years (slope)					0.651	
0.25-1 years (slope)					0.167	
1-3 years (slope)					-0.133	**
3+ years (slope)					-0.107	*
Non-movers in terraced house	0.270	***	0.259	***	0.131	***
Movers in terraced house	0.464	***	0.357	***	0.054	
0-0.25 years (slope)					1.532	**
0.25-1 years (slope)					0.036	
1-3 years (slope)					-0.044	
3+ years (slope)					-0.060	
Non-movers in apartment	0		0		0	
Movers in apartment	0.254	***	0.197	***	-0.019	
0-0.25 years (slope)					0.788	
0.25-1 years (slope)					0.172	*
1-3 years (slope)					-0.019	
3+ years (slope)					-0.141	***
Migrations						
Residential move	0		0		0	
Migrations	-0.044		-0.062		-0.025	
Moves						
One move	0		0		0	
Two or more moves	0.100	***	0.024		0.017	
Place of residence						
Capital city	-0.114	***	-0.120	***	-0.060	***
Other cities	0		0		0	
Towns	-0.010		-0.006		-0.003	
Rural areas and small towns	0.016		0.025		0.012	
Demographic variables						
Union duration (baseline)						
Constant	-0.670	**	-0.817	***	-0.740	**
0-1 years (slope)	-0.212	***	-0.194	***	-0.204	***
1-3 years (slope)	0.054	***	0.069	***	0.052	***
3-5 years (slope)	0.000		0.012		0.022	
5+ years (slope)	-0.122	***	-0.116	***	-0.091	***
Age						
-24 years (slope)	0.053	***	0.054	***	0.053	***
25-29 years (slope)	0.053	***	0.052	***	0.053	***
30-34 years (slope)	-0.069	***	-0.070	***	-0.068	***
35+ years (slope)	-0.283	***	-0.285	***	-0.285	***

Socio-economic variables						
Year						
1988-2000 (slope)	-0.018	***	-0.016	***	-0.017	***
Language						
Finnish	0		0		0	
Swedish	0.106	**	0.101	**	0.051	**
Educational enrolment						
Not enrolled	0		0		0	
Enrolled	-0.560	***	-0.566	***	-0.282	***
Educational level						
Lower secondary	0.137	***	0.139	***	0.069	***
Upper secondary	0		0		0	
Vocational	0.083	***	0.085	***	0.042	***
Lower tertiary	0.289	***	0.294	***	0.146	***
Upper tertiary	0.261	***	0.267	***	0.132	***
Earnings						
None	-0.379	***	-0.381	***	-0.190	***
Low	-0.007		-0.008		-0.003	
Medium	0		0		0	
High	0.049	*	0.049	*	0.024	*
Very high	0.064		0.066		0.033	

Table 7: Log-risks of Conception Leading to Second Birth.

Variables	Model 1		Model 2		Model 3	
Housing and moves						
Housing type						
Non-movers in single-family house	0.298	***	0.270	***	0.280	***
Movers in single-family house	0.411	***	0.337	***	0.025	
0-0.25 years (slope)					1.068	*
0.25-1 years (slope)					0.188	*
1-3 years (slope)					-0.039	
3+ years (slope)					-0.034	
Non-movers in terraced house	0.144	***	0.124	***	0.131	***
Movers in terraced house	0.251	***	0.138	***	-0.055	
0-0.25 years (slope)					1.158	
0.25-1 years (slope)					-0.158	
1-3 years (slope)					0.054	
3+ years (slope)					0.003	
Non-movers in apartment	0		0		0	
Movers in apartment	0.121	***	0.064	*	-0.145	
0-0.25 years (slope)					1.386	**
0.25-1 years (slope)					-0.270	***
1-3 years (slope)					0.070	*
3+ years (slope)					-0.028	
Migrations						
Residential move	0		0		0	
Migrations	0.069	*	0.050		0.057	
Moves						
One move	0		0		0	
Two or more moves	0.022		-0.060	**	-0.029	
Moves after first birth						
No moves	0		0		0	
One or more moves	0.038		0.041		0.058	
Place of residence						
Capital city	0.008		-0.002		0.000	
Other cities	0		0		0	
Towns	-0.016		-0.008		-0.010	
Rural areas and small towns	0.067	**	0.082	**	0.079	**
Demographic variables						
Time since first birth (baseline)						
Constant	-1.816	***	-1.892	***	-1.863	***
0-1 years (slope)	2.625	***	2.640	***	2.633	***
1-3 years (slope)	-0.030		-0.023		-0.030	
3-5 years (slope)	-0.292	***	-0.291	***	-0.291	***
5+ years (slope)	-0.088	***	-0.088	***	-0.088	***
Union duration						
0-1 years (slope)	-0.089		-0.064		-0.077	
1-3 years (slope)	-0.097	***	-0.083	***	-0.088	***
3-5 years (slope)	-0.018		-0.008		-0.017	
5+ years (slope)	-0.038	***	-0.031	**	-0.029	**

Age						
-24 years (slope)	-0.017		-0.016		-0.016	
25-29 years (slope)	-0.020	***	-0.023	***	-0.022	***
30-34 years (slope)	-0.060	***	-0.062	***	-0.061	***
35+ years (slope)	-0.230	***	-0.233	***	-0.232	***
Socio-economic variables						
Year						
1988-2000 (slope)	-0.014	***	-0.013	***	-0.013	***
Language						
Finnish	0		0		0	
Swedish	-0.045		-0.051		-0.049	
Educational enrolment						
Not enrolled	0		0		0	
Enrolled	-0.371	***	-0.383	***	-0.381	***
Educational level						
Lower secondary	-0.207	***	-0.206	***	-0.206	***
Upper secondary	0		0		0	
Vocational	0.157	***	0.164	***	0.160	***
Lower tertiary	0.248	***	0.258	***	0.254	***
Upper tertiary	0.238	***	0.247	***	0.243	***
Earnings						
None	-0.332	***	-0.333	***	-0.332	***
Low	0.052	**	0.049	**	0.051	**
Medium	0		0		0	
High	0.016		0.019		0.017	
Very high	0.145		0.151		0.147	

Table 8: Log-risks of Conception Leading to Third Birth.

Third conception	Model 1		Model 2		Model 3	
Housing and moves						
Housing type						
Non-movers in single-family house	0.174	***	0.135	**	0.148	**
Movers in single-family house	0.406	***	0.330	***	0.247	
0-0.25 years (slope)					1.053	
0.25-1 years (slope)					-0.267	
1-3 years (slope)					0.002	
3+ years (slope)					0.026	
Non-movers in terraced house	-0.089		-0.109		-0.102	
Movers in terraced house	0.179	**	0.069		-0.409	
0-0.25 years (slope)					2.891	*
0.25-1 years (slope)					-0.310	
1-3 years (slope)					0.024	
3+ years (slope)					-0.029	
Non-movers in apartment	0		0		0	
Movers in apartment	0.099		0.046		-0.109	
0-0.25 years (slope)					1.399	
0.25-1 years (slope)					-0.462	**
1-3 years (slope)					0.149	**
3+ years (slope)					-0.040	
Migrations						
Residential move	0		0		0	
Migrations	0.152	***	0.131	**	0.135	**
Moves						
One move	0		0		0	
Two or more moves	0.042		-0.043		-0.012	
Moves after second birth						
No moves	0		0		0	
One or more moves	0.079	*	0.077	*	0.066	
Place of residence						
Capital city	-0.040		-0.051		-0.049	
Other cities	0		0		0	
Towns	0.026		0.035		0.032	
Rural areas and small towns	0.163	***	0.177	***	0.172	***
Demographic variables						
Time since second birth (baseline)						
Constant	-2.536	***	-2.525	***	-2.543	***
0-1 years (slope)	2.000	***	2.008	***	2.013	***
1-3 years (slope)	-0.018		-0.015		-0.016	
3-5 years (slope)	0.022		0.022		0.020	
5+ years (slope)	-0.055	***	-0.055	***	-0.055	***
Union duration						
0-1 years (slope)	-0.259	**	-0.234	**	-0.251	**
1-3 years (slope)	-0.160	***	-0.146	***	-0.144	***
3-5 years (slope)	-0.227	***	-0.215	***	-0.223	***
5+ years (slope)	-0.071	***	-0.063	***	-0.066	***

Age						
-24 years (slope)	-0.066	**	-0.064	**	-0.065	**
25-29 years (slope)	-0.048	***	-0.050	***	-0.049	***
30-34 years (slope)	-0.036	***	-0.039	***	-0.038	***
35+ years (slope)	-0.257	***	-0.260	***	-0.259	***
Socio-economic variables						
Year						
1988-2000 (slope)	-0.002		-0.003		-0.002	***
Language						
Finnish	0		0		0	
Swedish	-0.103		-0.108		-0.105	
Educational enrolment						
Not enrolled	0		0		0	
Enrolled	-0.288	***	-0.301	***	-0.298	***
Educational level						
Lower secondary	-0.089	*	-0.091	*	-0.090	*
Upper secondary	0		0		0	
Vocational	0.041		0.050		0.047	
Lower tertiary	0.308	***	0.316	***	0.312	***
Upper tertiary	0.125	*	0.142	**	0.133	*
Earnings						
None	-0.150	**	-0.152	**	-0.152	**
Low	0.151	***	0.149	***	0.149	***
Medium	0		0		0	
High	-0.030		-0.031		-0.030	
Very high	0.241	*	0.238	*	0.240	*

Table 9: Standard Deviations and Correlations Between Person-specific Residuals.

	Model 1		Model 2		Model 3	
Standard deviations						
Fertility	0.427	***	0.449	***	0.439	***
Move to detached housing	0.530	***	0.594	***	0.587	***
Move to terraced housing	0.323	***	0.393	***	0.359	***
Move to apartment	0.298	***	0.338	***	0.313	***
Correlations						
Fertility and move to single-family housing			0.241	***	0.195	***
Fertility and move to terraced housing			0.689	***	0.495	***
Fertility and move to apartment			0.455	***	0.316	***
Move to single-family housing and move to terraced housing			0.653	***	0.639	***
Move to single-family housing and move to apartment			0.430	***	0.387	***
Move to terraced housing and move to apartment			0.539	***	0.461	***

Source: Calculations based on Finnish Longitudinal Fertility Register, 1988–2000.
Significance: '*'=10%; '**'=5%; '***'=1%.
Notes: Likelihood ratio test statistic (LR)
Model 2 versus Model 1: LR = 146.6, df = 6, $p < 0.001$; Model 3 versus Model 2: LR = 573.6, df = 72, $p < 0.001$.

Figure 1: Relative Risks of Moving to Single-family House (Model 3).

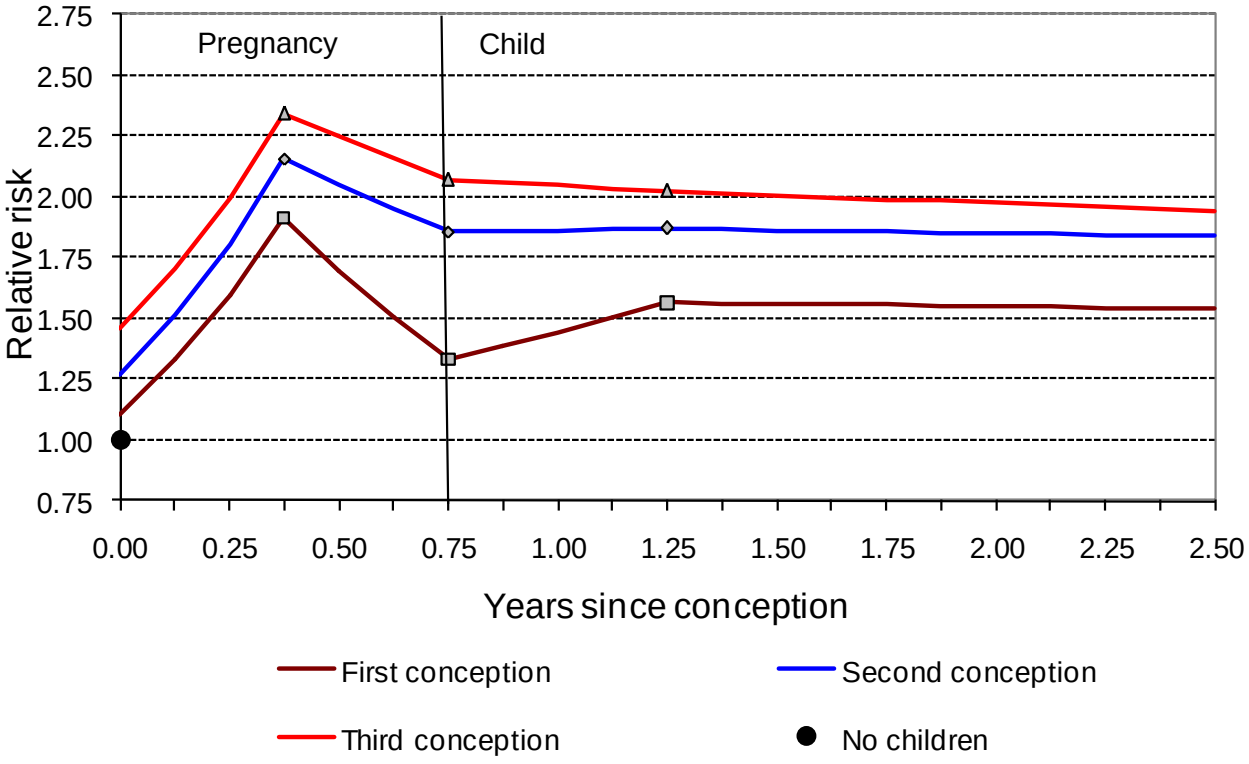


Figure 2: Relative Risks of Moving to Terraced House (Model 3).

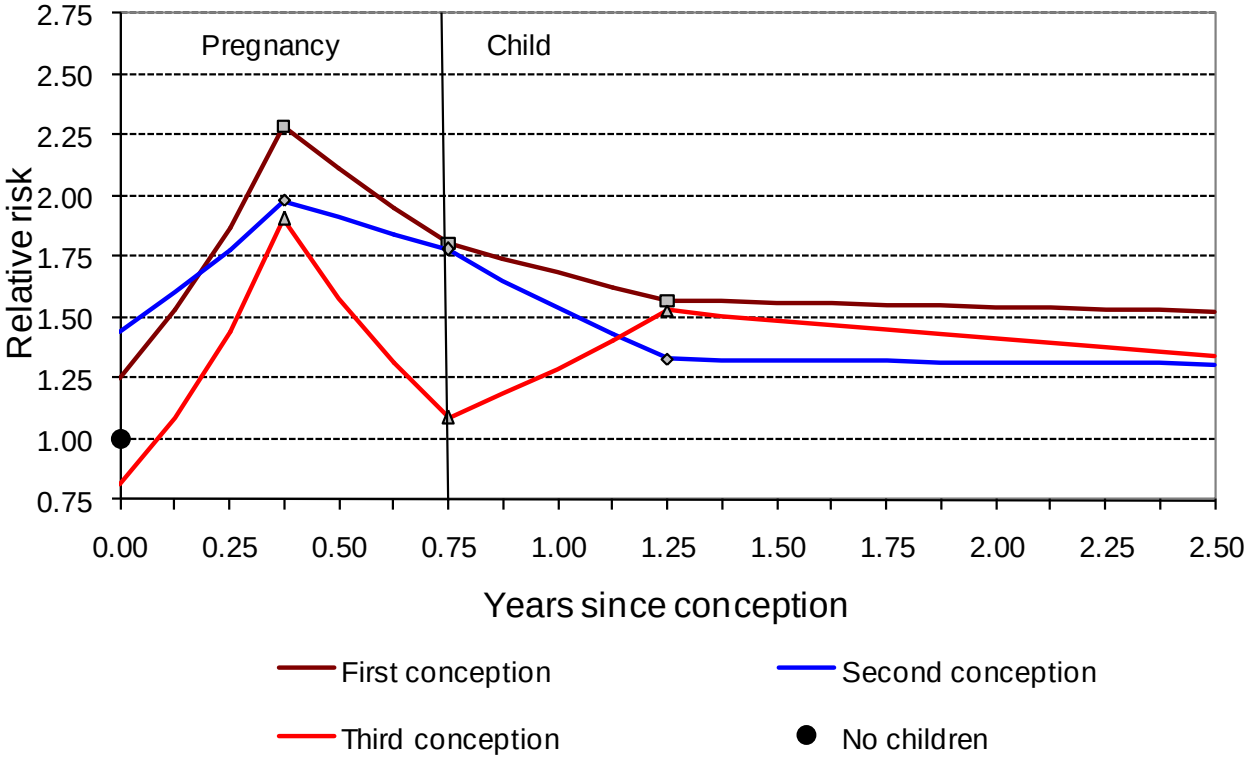


Figure 3: Relative Risks of Moving to Apartment (Model 3).

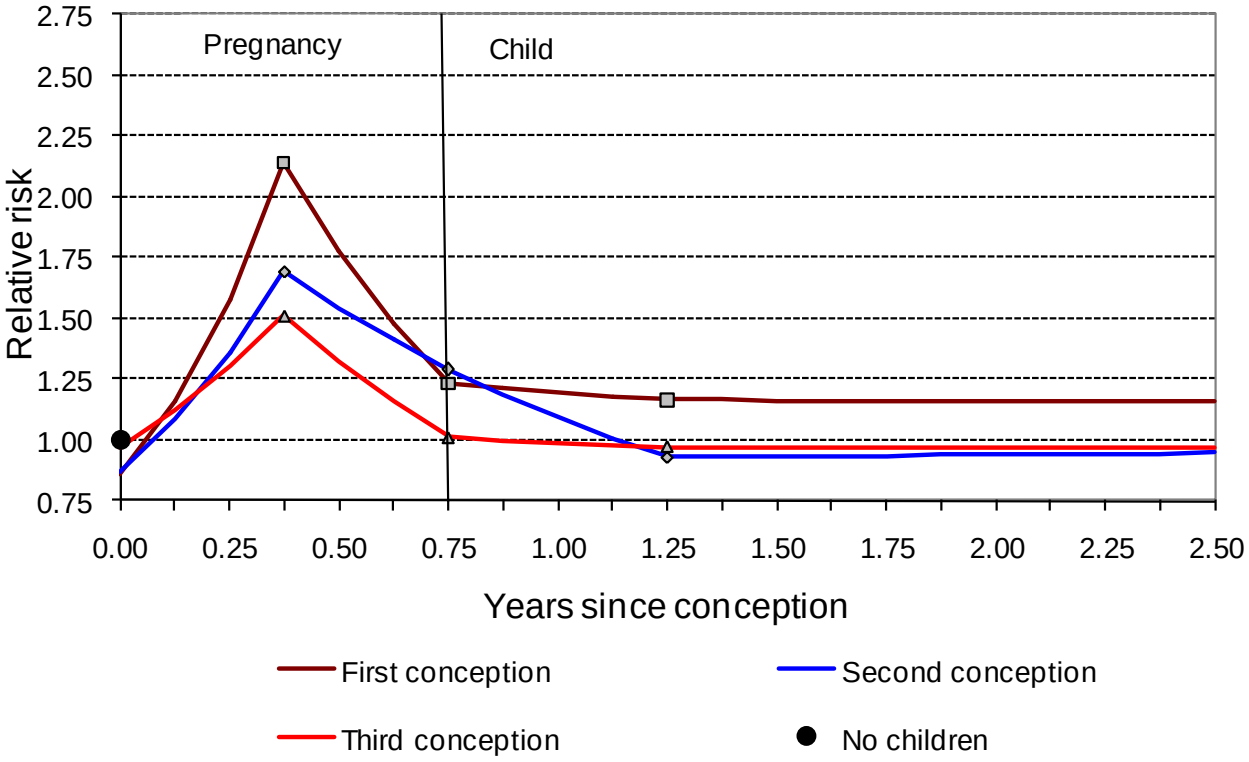


Figure 4: Relative Risks of First Conception (Leading to Birth) (Model 3).

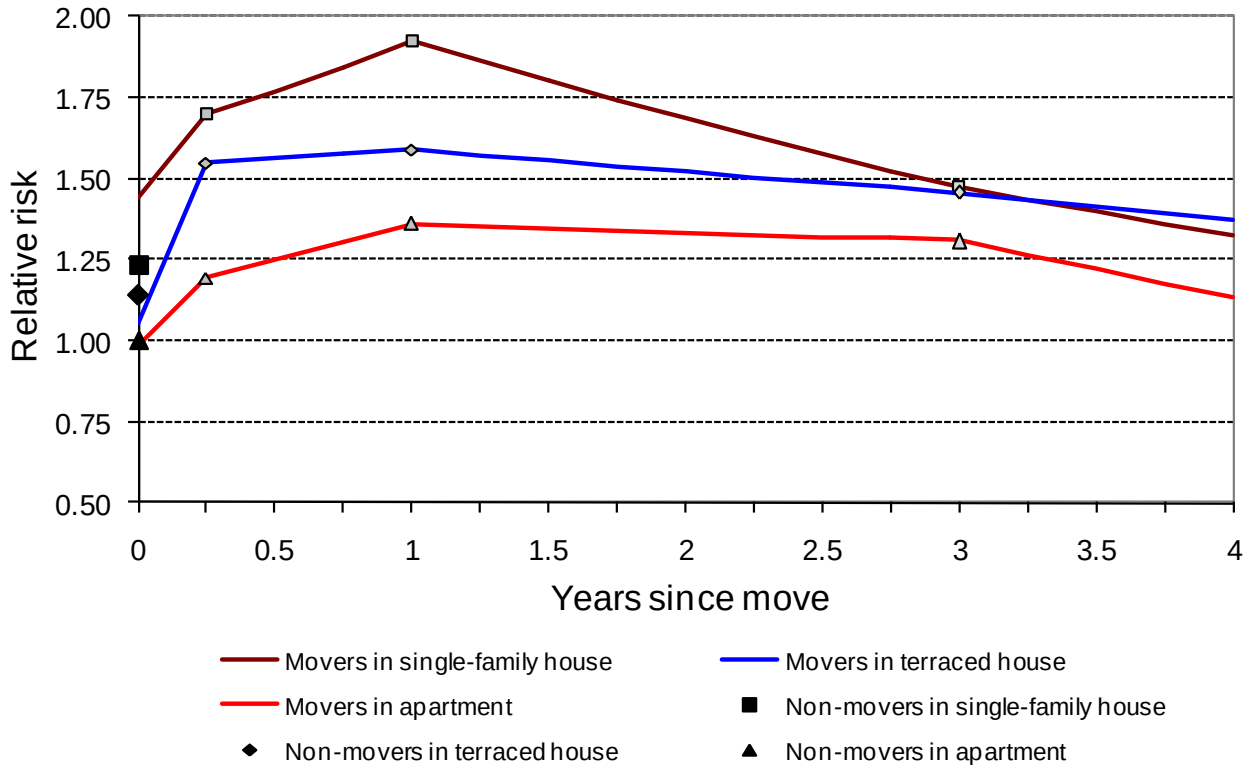


Figure 5: Relative Risks of Second Conception (Leading to Birth) (Model 3).

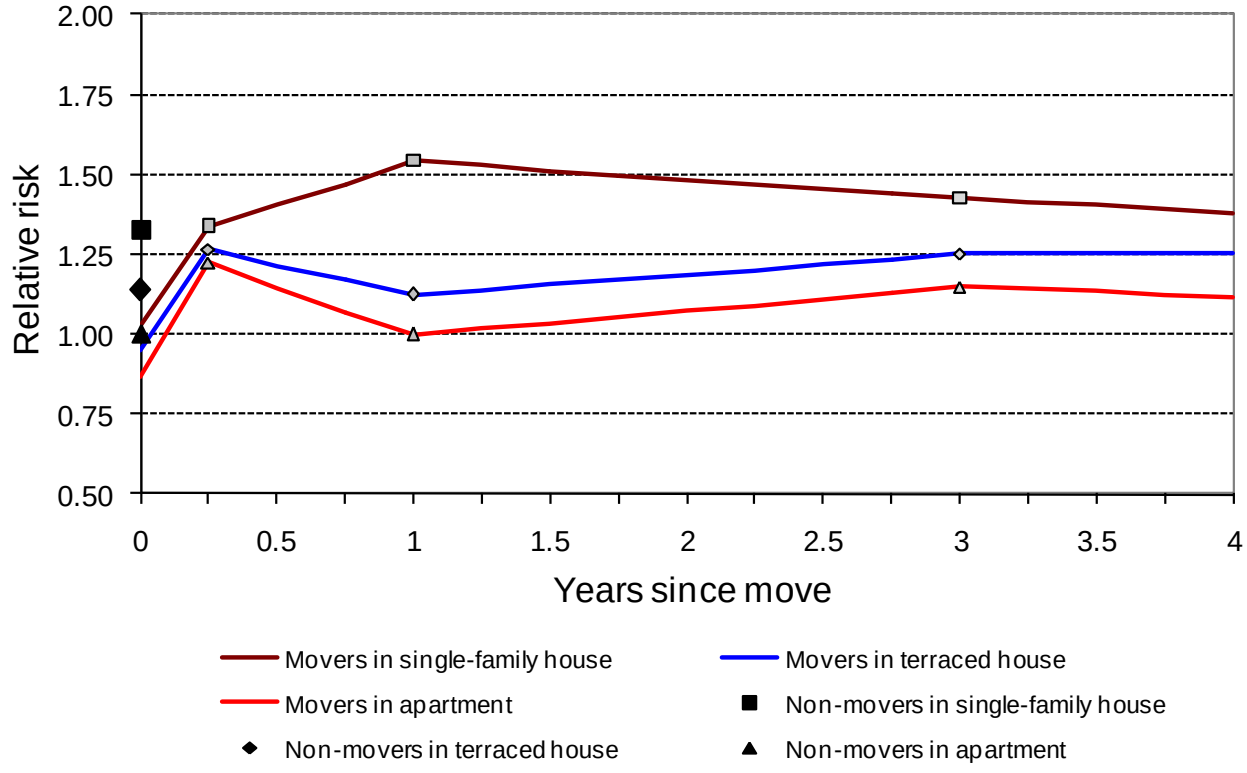


Figure 6: Relative Risks of Third Conception (Leading to Birth) (Model 3).

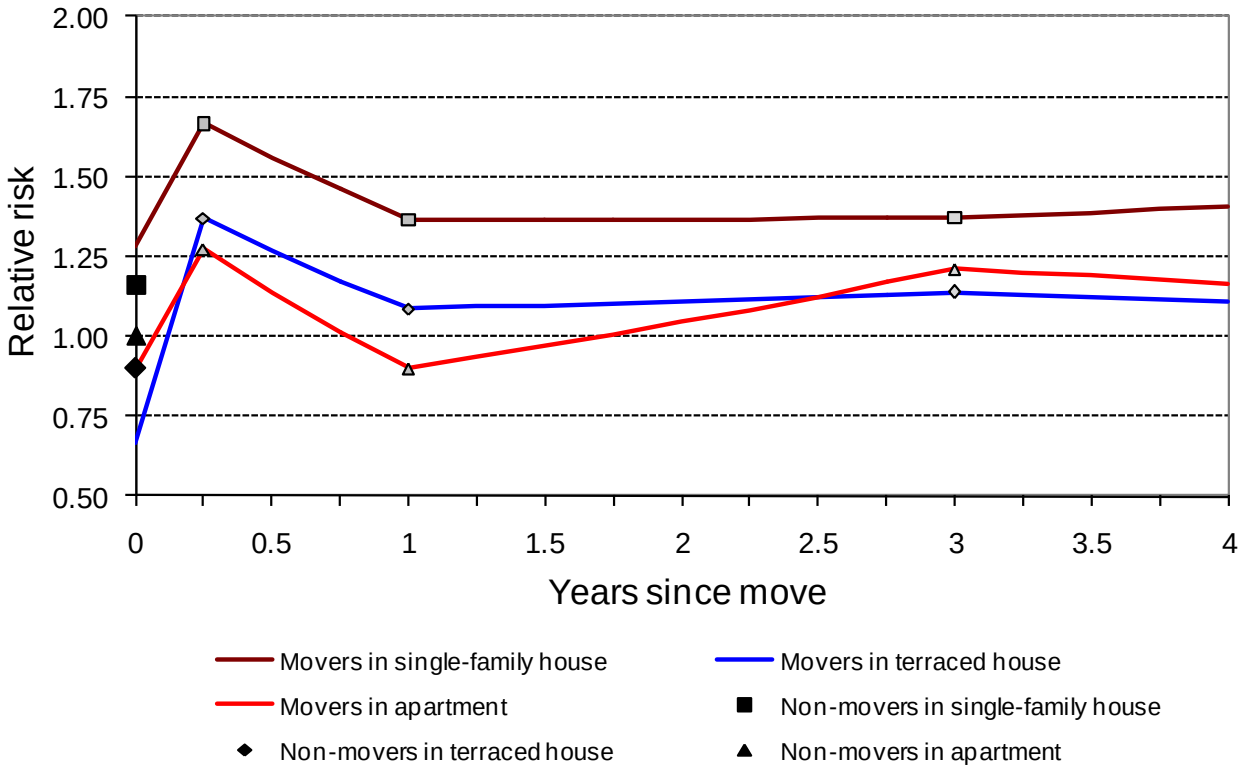
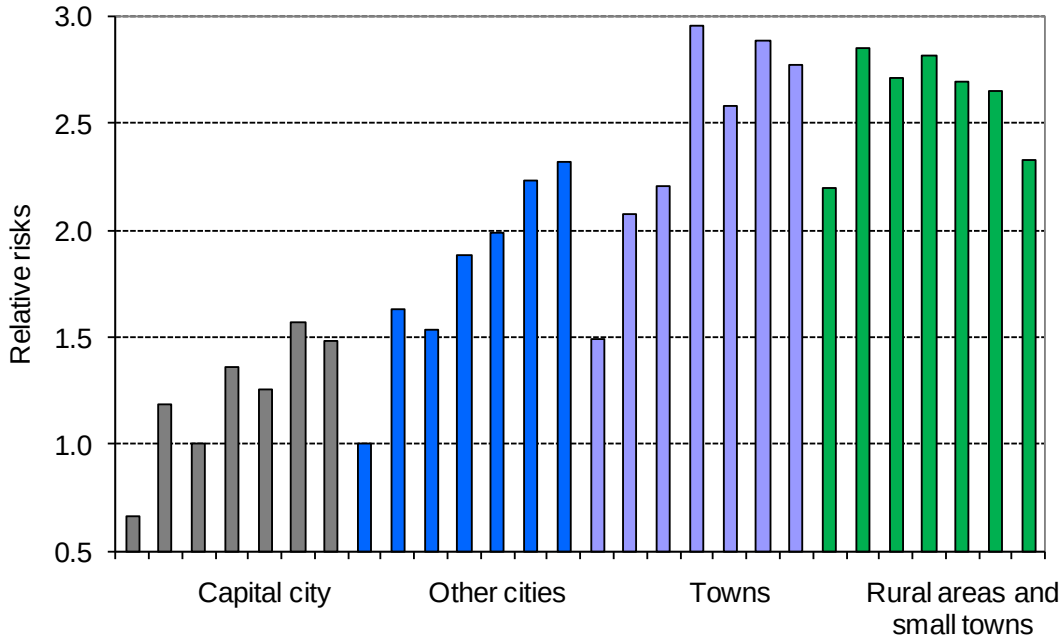


Figure 7a: Relative Risks of Moving to Single-family House by Place of Residence. (The Reference Category is 'Childless in Other Cities'.)



Note: The bars represent the (relative) risk levels for the following categories:
First bar – childless; second bar – first pregnancy; third bar – first child; fourth bar – second pregnancy; fifth bar – second child; sixth bar – third pregnancy; seventh bar – third child;

Figure 7b: Relative Risks of Moving to Single-family House by Place of Residence. (The Reference Category is 'Childless'.)

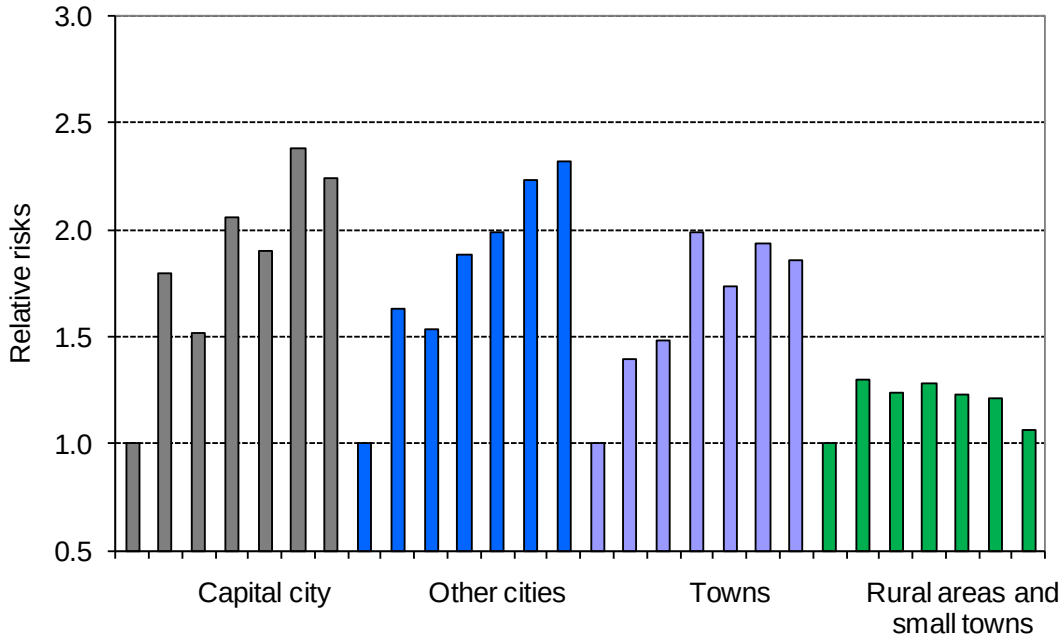
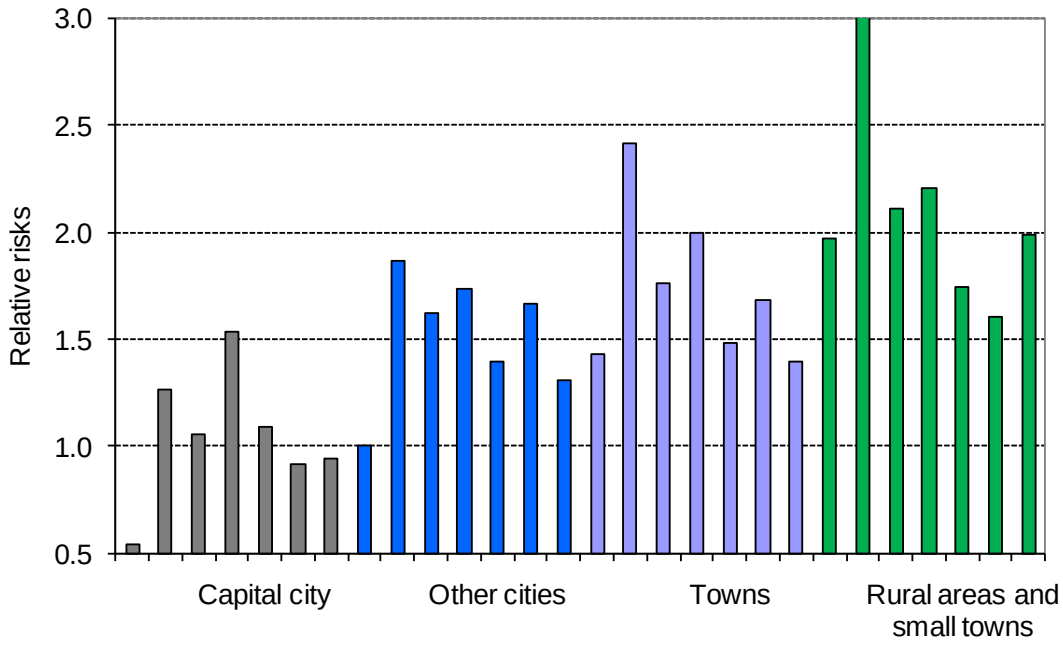


Figure 8a: Relative Risks of Moving to Terraced House by Place of Residence. (The Reference Category is 'Childless in Other Cities'.)



Note: The bars represent the (relative) risk levels for the following categories:
First bar – childless; second bar – first pregnancy; third bar – first child; fourth bar – second pregnancy; fifth bar – second child; sixth bar – third pregnancy; seventh bar – third child

Figure 8b: Relative Risks of Moving to Terraced House by Place of Residence. (The Reference Category is 'Childless'.)

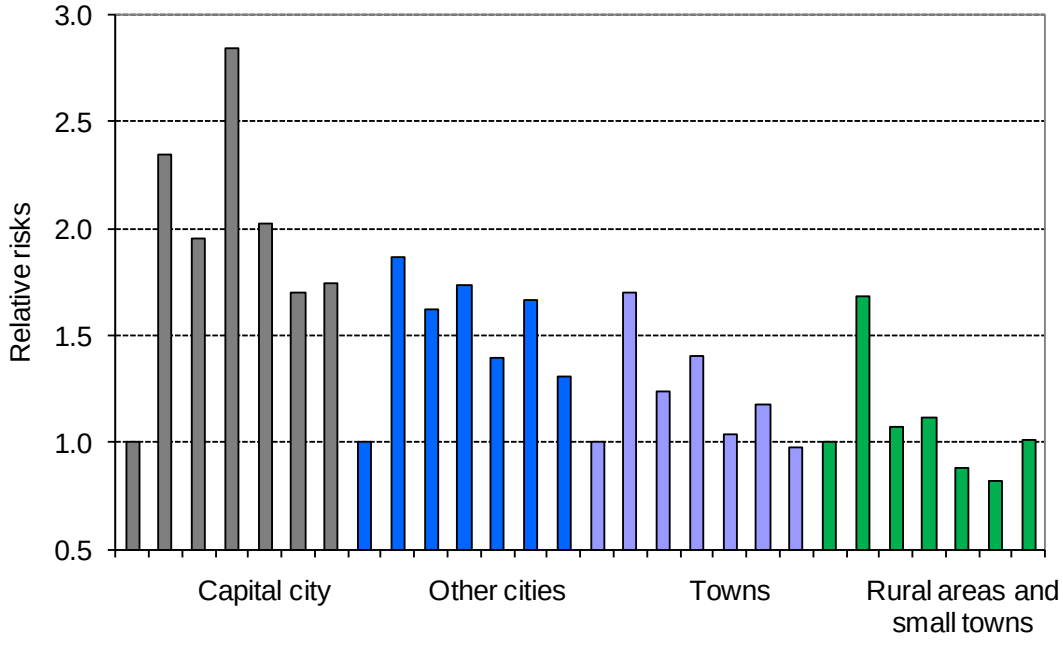
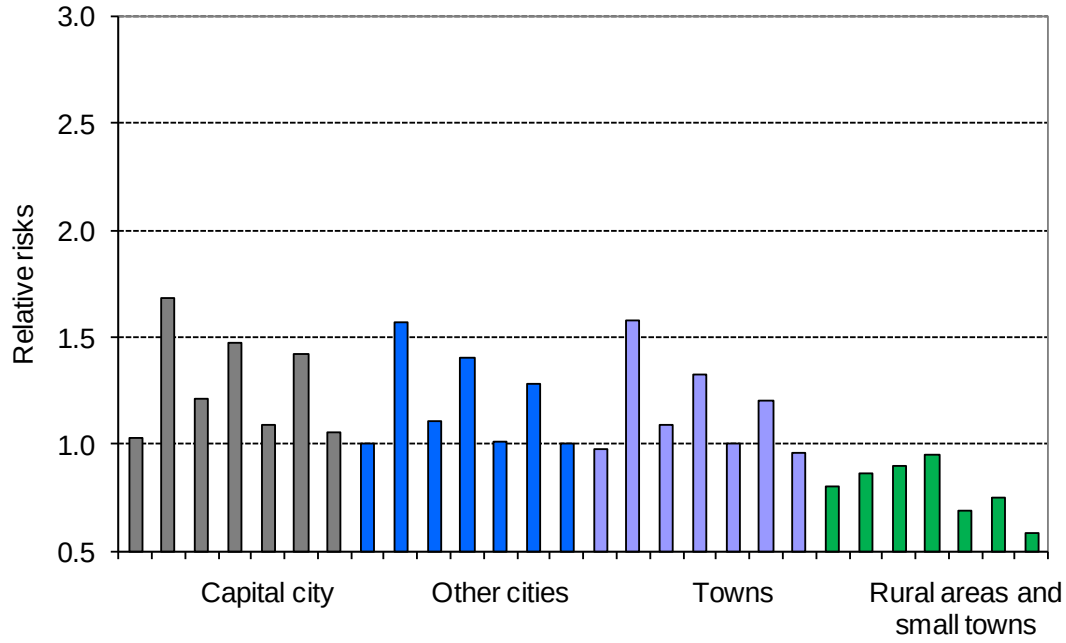
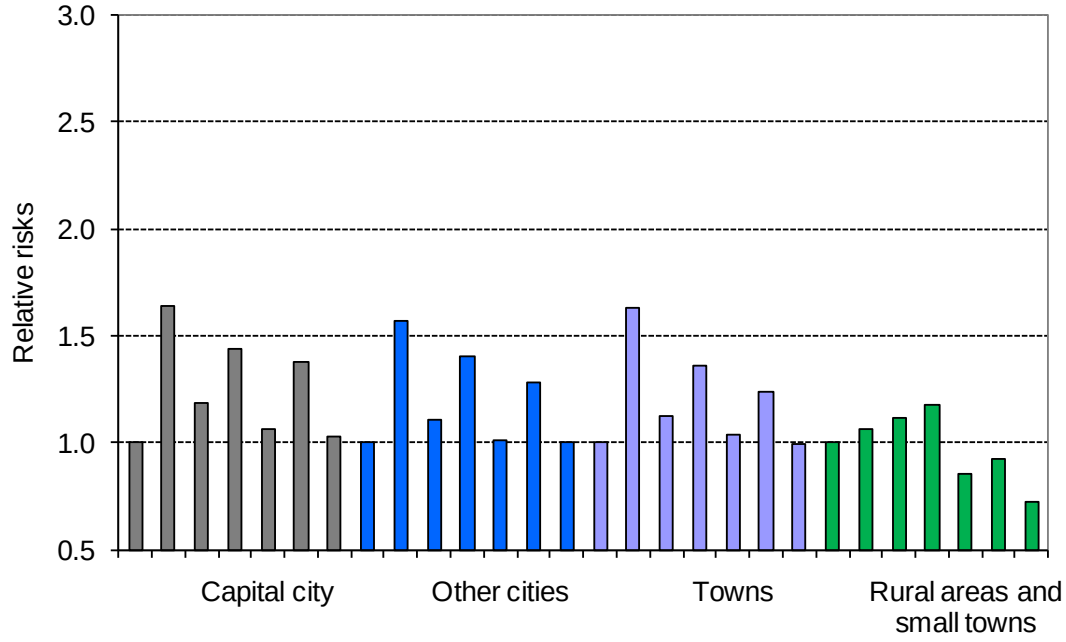


Figure 9a: Relative Risks of Moving to Apartments by Place of Residence. (The Reference Category is 'Childless in Other Cities'.)



Note: The bars represent the (relative) risk levels for the following categories:
First bar – childless; second bar – first pregnancy; third bar – first child; fourth bar – second pregnancy; fifth bar – second child; sixth bar – third pregnancy; seventh bar – third child

Figure 9b: Relative Risks of Moving to Apartments by Place of Residence. (The Reference Category is 'Childless'.)



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