The intergenerational transmission of first birth timing in Norway

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Introduction

The intergenerational transmission of family size and fertility timing between generations can play a role for fertility patterns, but has got little attention from demographers and other social scientists. The strong data requirements, i.e. detailed fertility histories of both the parents and their children, represent the main reason for this. It is not unlikely that parents' behaviour is transmitted to its children, but the evidence for such transmission is still weak. Solid knowledge about any such effects may be of importance for development of policies, as the implications for future fertility are obvious. In fact, the importance of intergenerational transmission processes might be accentuated in the current climate of low (and lowest-low) fertility in contemporary societies.

Literature review and theoretical contributions linking parents' and children's fertility behaviour

In a review on the topic, Murphy (1999) argues not only that there is a consistent correlation in the family size of parents and their children, but also that this relationship has tended to become more substantial over time. Later studies on the intergenerational transmission of fertility size seem to confirm this finding (Murphy & Knudsen 2002). Besides studies of family size, also the intergenerational transmission of first birth timing has been studied (e.g. Barber 2001, Rieken & Liefbroer 2009), where results show a significant interdependence between the parents timing of first birth and the children transition to their own parenthood. In general, the mother-daughters associations seem to be stronger then the father-son associations (Murphy 1999).

Two main ideas emerge when outlining the potential mechanisms behind an intergenerational transmission of fertility behaviours. The first comprises a broad socialisation, or social learning, theory. These approaches state that the children either learn from the behaviour of their parents or adopt their norms. This can happen in various ways; parents can function as role models or having their own agenda (including a wish to become grandparents) and on their children (Axinn, Clarkberg & Thornton 1994, Barber 2000). The second main idea focuses more on the general intergenerational transmission of socioeconomic characteristics, as income, occupation and status. At the same time, these socioeconomic factors can affect fertility outcomes themselves (see for example Hoem, Neyer & Andersson 2006). Studies on the transmission of completed fertility size use usually different regression methods, while the analysis of the timing of the birth requires event history models.

A common downside of both these ideas and the empirical evidence obtained from their application is that they are generally unclear about the status of causality. There are numerous other factors linked with both parents' and children's fertility behaviour that are not controlled, and which may in whole or in part generate the observed association and bias regression coefficients of the transmission effect. One obvious possibility in the case of biological relatives is heritable genetic factors. Such genetic factors could either be linked directly to fecundity or other characteristics that are associated with fertility (e.g. health and appearance). Besides genetic factors, also other stable family characteristics (e.g. parents' divorce) that affect fertility may play a role.

In our study we address this problem in three steps and give new insight into the intergenerational transmission of first birth timing. Firstly, we run ordinary Cox proportional hazard regressions to test for the existence of a transmission effect of timing of birth between mothers and their daughters. In a second step, we include family fixed-effects to make within-family comparisons (comparing daughters with the same mother) of how mother's age at birth of daughter *A* affects "daughter *A*'s age at first birth. This allows us to control for all non-measured stable characteristics at the level of the family in a model of the transmission of timing of birth (Allison 2005). In a third step we examine how censoring and unequal censoring times within the family affect results in family fixed-effects models. In such models, a fairly large proportion of observations are not used due to censoring. As all comparisons in the model are done within families, there are many comparisons that may not be made due to the fact that one of the sibling's birth intervals is censored. This means that all those mother–daughter dyads are excluded where the daughters remains childless. If one interval is censored there is nothing with which to compare the birth and these siblings are eliminated form the partial likelihood function (Allison 2005: 116). We address this problem by doing a Monte Carlo experiment which assesses the accuracy of estimates obtained under a set of typical censoring conditions.

Data and methods

There are rather strong requirements put on our data for an analysis of intergenerational transmission of fertility timing. One first problem is that the transition to parenthood can happen in a broad time window, especially for men. If one chooses an early age cut (e.g. 30 years), one treats many persons as childless even though they at a later stage in life still will get children. To minimize this problem, we have chosen to focus on women, aged at least 45 years. This is an age where most women have completed their fertility and only few childless women still will become mother at a later point in life. We use data gathered from different Norwegian person registers, updated the 31.12.2009. The Norwegian person register includes all persons that ever have received a person-number and through this person-number the information from different register can be linked together. We select those women born in 1954 to 1964, aged between 45 to 55 years at the end of 2009 (405.579). In analyses of intergenerational transmission, we can only include those registered alive and as residents in Norway at the end of 2009 (n = 349.198; leaving out those died earlier and emigrated; the latter do not always report their births to the Norwegian register). As we need also information on the mothers, we have to exclude those where register information on the mother is missing (mostly immigrants). In addition we sorted out where the age of first birth was below 15 year, this is the case among 116 women and among 143 mothers. This gives us a data set for the analysis with 314.989 women (born 1954-64) and their mothers. Data from the Norwegian person register do not only offer the possibility to do such analysis with an exceptional high number of cases. In addition the data are not biased by any non-response bias and the provided information are reliable.

The daughter's age at first birth of is our main dependent variable. Table 1 gives a descriptive overview and displays both the percentage of childless and the median age at first birth. The results show that both median age at first birth and the proportion of childless women increase by birth cohorts. Compared to other western countries, these changes are rather small in Norway.

Table 1: Childlessness and median age of first birth by year of birth

	Year of birth											
	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	All
Childless (in percent)	10.1	10.5	10.5	11.0	11.2	10.6	11.03	11.0	11.1	11.5	11.4	10.90
Median age at first birth	23.9	24.3	24.5	24.9	25.2	25.4	25.7	26.0	26.0	26.2	26.3	25.3
All (in percent)	*8.8*	*8.9*	*9.1*	*9.0*	*9.1*	*9.1*	*9.0*	*9.0*	*9.1*	*9.3*	*9.6*	*100.0*

In contrast to other studies on the intergenerational transmission of birth we can not use mother's age at first birth as an independent variable, but her age at the birth of the respective daughter. A precondition for estimating fixed effect models is that there must be variation in the independent variables in the model within the group defined by the fixed-effects, which in this case are the children of the mother in question. A mother's age at first birth is the same for all her children, while her age at the birth of the actual child varies (apart from for multiple births).

Preliminary results

We first present our preliminary results from the models without fixed-effects (see Table 2). In all the three models 314.989 women, born in 1954-64 are included. 280.669 of them have experienced the transition to motherhood, while 34.320 remained childless (10.9 %) and are thereby treated as censored in the proportional hazard models.

Table 2: Cox proportional hazard regressions: Age at first birth, Hazard Ratio (e^{β})

	Model I	**Model II**	**Model III**
Mother's age at birth or respective daughter	0.98***	0.97***	0.98***
Year of birth		0.97***	0.98***
Parity and siblings Ref: *First born of two*			
Single child		1.07***	0.97***
Second born of two		1.16***	1.05***
First born of three or more		1.12***	1.11***
Second born of three or more		1.24***	1.15***
Parity 3 or higher of three or more		1.43***	1.21***
Highest education at birth Ref: *univ. college & university degrees*			
Compulsory education			3.30***
Upper secondary school			1.78***
Mothers highest education Ref: *univ. college & university degrees*			
Compulsory education			1.05***
Upper secondary school			1.00

***p<0.01, **p<0.05

In the first model we only include mother's age at the birth of the selected daughter as an independent variable. The hazard ratio of 0.98 indicates that for each one-year increase of mother's age at the birth of the selected daughter, her hazard of entering parenthood is reduced by an estimated 1.8 percent.
This effect remains highly significant and on the same magnitude even when we include other independent variable (Model II and Model III). The median age at first birth has increased by cohorts (see Table 1) and the results from the Cox-regression models reflect this too. For every one year increase in the year of the birth, the hazard of entering motherhood is reduced by an estimated 1.8 percent (Model III).
In our categories for parity and siblings we combine information about the other children of the mother (siblings of the daughter). The hazard for becoming mother for those without siblings is about 97 percent of the hazard of those who were first born of two (Model III). The results indicate that those with more siblings are more likely to become a mother.
Mother's education only plays a minor role. But the own educational level at the time of the first birth is highly significant. Compared to those with a degree from a university college or university, those with compulsory education or upper secondary school have a significant higher hazard ratio.

Fixed-effects cox regression models

In the second step, we run fixed-effects cox regression models comparing sibling. Fixed effects models are often used to compare different measures of one person (for example in panel data) or different time spans of one person (for example time between births of one person). In these cases the essence of fixed effects method is captured by saying that each individual serve as his or her own control. That is accomplished by making comparisons within individuals, and then averaging those differences across all the individuals in the sample (Allison 2005). In our case, we do not make comparisons within individuals, but within families. Daughters of the same mother are compared with each other and thereby we control for all non-measured stable characteristics at the level of the family.
This means also, that all daughters that do not have a sister or half-sister to compare with in our dataset will automatically be dropped out of the fixed effect analysis. This is the case for 57% of all the persons in our dataset. The fixed-effects cox regression models are thereby initially based on 133.844 persons (75% of them have one sister in the dataset, 20% two sister and less then 5% three to five sisters). The preliminary results of this analysis are presented in Table 3.

Table 3: Cox proportional hazard regressions with fixed-effects: Age at first birth, Hazard Ratio (e^{β})

	Model I	**Model II**	**Model III**
Mother's age at birth or respective daughter	0.94***	0.99	1.02
Year of birth		0.94***	0.94***
Parity and siblings Ref: *First born of two*			
Second born of two		1.02	0.93***
First born of three or more		1.27	1.13
Second born of three or more		1.32	1.12
Parity 3 or higher of three or more		1.33	1.08
Highest education at birth Ref: *univ. college & university degrees*			
Compulsory education			5.99***
Upper secondary school			2.62***

***p<0.01, **p<0.05

Again we only included mother's age at the birth of the respective daughter in the first model. The hazard ratio of 0.94 is again highly significant. But in the fixed effect models, the effect does not remain significant if we control for year of birth (Model II). The year of birth is again significant in Model II and III and for every one year increase the hazard of entering motherhood is reduced by an estimated 5.6 percent. In contrast to this, the combination of parity and siblings has no significant effect on the timing of first birth in the fixed effect models. Only in the third model, the second born of two siblings has a significant lower hazard ratio. The effect of own education at the first birth (or end of 2009 if childless) is the same as in the ordinary proportional hazard models (see Table 2).

Summary and further steps

Our preliminary results indicate that one should be cautious in the analysis of the transmission of fertility timing between generations. Ordinary proportional hazard models lead us to the conclusion, that mother's age at birth of daughter *A* effects daughter *A's* own age at first birth even when controlling for other substantial factors. First results from fixed-effect models, that allow us to control for all non-measured stable characteristics at the level of the family, do not support this finding.

In a next step we will repeat our analysis of the fixed-effect models, but control for the status of the father. In the here presented preliminary results, the daughters compared in the fixed-effect models only have to have the same mother (including half-siblings). By including information on the father, we will be able to focus on full siblings. In addition we will address the problem of censoring and unequal censoring times within the fixed-effect models in a third step (Monte Carlo experiment).

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