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Social Mobility over Three Generations in Finland, 1950–2000

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We modelled social mobility over three generations in Finland from 1950 to 2000. From the 1950 population census sample, and consequent censuses, we constructed 57,585 three-generation lineages. A three-dimensional mobility table, containing eight layers—one for each grandmother and -father, son and daughter, and grandson and -daughter lineage—was built using the Erikson–Goldthorpe class schema. The social inheritance process was found to be very similar across all the eight lineages. After controlling for parents' social class, the grandchildren's social class is almost conditionally independent from the grandparents' social class. No additive effect was found from grandparents to grandchildren, but weak lagged effects were found. The lagged *inheritance* leads to a higher probability that the grandchildren of the service class and self-employed farmers remain in the same class. The lagged *barrier* of mobility leads to grandchildren who have particular disadvantaged grandparent origins having a lower chance of gaining more advantageous positions themselves. However, taking into account more than two consecutive generations adds very little explanatory power to the analysis of social mobility.

Introduction

Social mobility is usually studied as an association between the parents' and children's social class. If it is assumed that the connection between parents and children's class positions increases social stratification, it should equally be assumed that the connection between the positions of grandparents and grandchildren does the same, even when controlling the parent–child effects. However, much less empirical studies have been published on social mobility over more than two generations. The reason for this is most likely the shortage of data as opposed to a lack of interest.

Extending the analysis of social mobility to three generations can produce new and valuable knowledge on how social positions are transmitted over generations. If controlling the connection between the status positions of two consecutive generations does not fully cancel the effect of grandparents' status on the status of the grandchildren, we can hopefully argue something more about the persistence of class inequality between generations.

In this article social mobility over three generations in Finland will be analysed empirically using register-based longitudinal census panel data running from a 1950 census sample to 2000. Children's class position from 2000 is combined with the parents' class positions in 1975 and to the grandparents' class position in 1950, thus including over 57,000 different grandparent–parent–child lineages. The analysis will mainly utilize categorical Erikson–Goldthorpe class schema.

The structure of the article is as follows. First we take a look at the few empirical examples of analysing social mobility between more than two generations. After that we describe our data set and overall changes in social mobility in Finland and finally test the hypotheses concerning the possible effects of the grandparents' class on grandchildren's class.

Previous Empirical Studies on Mobility over Various Generations

There are relatively few studies that analyse social mobility over more than two generations. For example, Biblarz *et al.* (1996) applied a *Longitudinal Study of Generations* in the USA, but analysed different cohorts as if they had been different cross-sectional snap-shots. This is how age and cohort differences are often analysed in studies of social mobility in order to distinguish them from the periodical changes in social fluidity (Breen and Jonsson, 1997; Breen, 2004, 6).

There is a body of mainly theoretical work on the topic of how to model social mobility over several generations that was published in the 1950s and 1960s, which concentrates on how to model intra- and intergenerational mobility with Markovian-type models. The idea of a Markovian model is to simplify a complex process into a single step between two time points, in this case between consecutive generations.[1] Social mobility is said to follow a Markovian process if knowing only the parents' class allows us to predict their children's class. Or in other words, social mobility is following a Markovian process if grandparent's and grandchildren's classes are conditionally independent after controlling for parent's class. However, very little empirical testing of those models were done then or later (Glass, 1954; Mukherjee, 1954; Prais, 1955; Duncan, 1966).

Of the modern empirical analyses of social mobility, one study that is comparable to the current research setting is that of Warren and Hauser (1997). They analysed social mobility over three generations using panel data constructed from the Wisconsin Longitudinal Study (WLS). The WLS is based on three surveys collected in 1957, 1975, and 1992 of people who graduated from Wisconsin high schools in 1957. Information both on 1957 graduates and their spouses' parents was collected as well as information on one child. Warren and Hauser used the Duncan Socioeconomic Index (SEI) as a proxy of social status in their study. Using regression and structural equation models, they found that after controlling for parents' characteristics, the educational level or the occupational status of grandparents had few significant effects on their grandchildren's education or occupational status. The finding is in line with an older British study by Ridge (1974) in which no significant direct grandfather effects were found in regression-based re-analysis of the men's mobility tables originally reported by Glass (1954).

The fact that there are no significant direct grandparent–grandchildren effects after controlling for parent's status is not surprising. In a classic study of income mobility, Becker and Tomes (1986) point out that because of the regression to the mean, '. . . *almost all the earnings advantages or disadvantages of ancestors are wiped out in three generations*'. For example, if the regression coefficient of earnings correlation between two generations G1 and G2 is 0.4 and the coefficient between the generations G2 and G3 is the same, the correlation between G1 and G3 is already hypothetically $0.4 \times 0.4 = 0.16$. Although a more recent body of research on income mobility establishes that eradication is likely to take more than three generations, the phenomenon is an important factor, even when categorical measures are used.

Finland has been observed as being a fairly 'open' European society, in which the association of classes as well as income levels of consequent generations are fairly weak, much like in other Nordic countries (Pöntinen, 1983; Erikson and Goldthorpe, 1992; Erola and Moisio, 2002; Jäntti *et al.*, 2006). The effects from grandparents to grandchildren may be easier to discover when the association between consecutive generations is weaker. So we might find different results than Warren and Hauser (1997). Also the differences in the period are likely to play a role; Finland in 2000 may be considered as a more equal society than the United States of America in the 1970s (and Britain in the 1950s).

To our knowledge, no previous three (or more) generations' mobility studies applying a version of Erikson-Goldthorpe classification have been done. It can be expected that using a categorical measure of social status may lead to somewhat different results than those of Warren and Hauser (1997), who used a continuous status index (Hauser, 1978). For example, the regression method of applying continuous status measures may leave unnoticed the persistence of class differences in for example 'lower' and 'upper' ends of the class schema.

Research Hypotheses

Taking into account the study of Warren and Hauser (1997) as well as the results of Becker and Tomes (1986), we can expect that the effect of grandparent's status on the status of grandchildren may be mediated, mainly or entirely, through the parent's status. Hence, we can consider modelling the panel with a first-order single chain Markovian model that assumes we only need to know the parent's social class to be able to predict the children's class.

Thus the null-hypothesis for the current analysis is:

After controlling for the association between the class positions of grandparents (G) and parents (P) as well as between parents (P) and children (C), there will not be any significant association between class positions G and C.

Markovian models do not often fit because assuming a process follows a Markovian chain is a strong assumption. Often the preceding situation in times *t*-2, *t*-3, etc. have—in addition to time *t*-1—an association with the situation in time *t*. In other words, situation in time *t*-2 can have an additive (cumulative) effect along with situation in time *t*-1 on the situation in time *t* (Langeheine and van de Pol, 1990). For example, if both the grandfather and father are farmers, this may more strongly predict that the grandchild will also become a farmer compared to a case where only the father is a farmer. The situation in time *t*-2 can also have a direct effect on the situation in time *t*. For example, if the grandfather is a farmer, the grandchild may have a bigger probability of also being a farmer, regardless of whether the father is a farmer or not. This kind of direct effect is sometimes also referred to as a lagged effect. Therefore, we have plausible reasons for expecting social mobility to not follow a Markovian process. In this case, we need to consider how the status of grandparents could have an additional and/or direct effect on the occupational status of their grandchildren. Erikson and Goldthorpe list three important mechanisms affecting mobility: the desirability, the advantages and the barriers (Erikson and Goldthorpe, 1992, 122–123). We also consider similar mechanisms in this study.

The first and the most obvious one is the promotion of certain kinds of advantages through material inheritance. Wealth tends to accumulate in the family, so also having wealthy grandparents alongside wealthy parents may give an additive material advantage to the grandchild. Also, rather than having their own children inherit all the material assets, inheritance can partially or wholly 'jump' over one generation, with grandparents able to give financial support directly to their grandchildren. These assets can be used to start a business or to take over a family business or a farm; or to help finance further education.

We would expect these effects to be observable as a higher probability of immobility between grandparents' and grandchildren's classes in three cases: among the service class I+II, among the class of the self-employed IVa+b and among the self-employed farmers IVc. The service class I+II has the highest income level and also the highest amount of material wealth that the grandchildren can inherit and use for their own good. In the class of self-employed there might be a family business that grandchildren may continue, and in the case of the self-employed farmers there might be a farm and land to be inherited such that the grandchildren continue farming themselves. The effect is similar to the one assumed by the inheritance effect INH2 in the Core Model of Social Fluidity (Erikson and Goldthorpe, 1992, 125–7).

Thus we may propose the immobility due to inheritance hypothesis:

Inheritance leads to a higher probability that the grandchildren of the service class, self-employed and self-employed farmers remain in the same class.

We may consider the desirability effects next. The immobility in general can be strengthened by the inheritance of social capital. This would require us to make the hypothesis more general, assuming higher odds of immobility in all the diagonal cells of the grandparent–grandchildren mobility table. The class of the grandparents may have an impact on what kind of level of education grandchildren achieve and what kind of job they obtain. The social connections of the grandparents may help grandchildren to get certain kinds of jobs similar to their own. The grandparents may teach the grandchildren to value certain kinds of work. The effect is very similar to that of the parental impact on children's class (Ganzeboom *et al.*, 1991; Goldthorpe, 2000, 172–178). Thus in principle the social capital may be at work in all the classes by increasing immobility, as is assumed with the INH1-effect in the Core Model of Social Fluidity (Erikson and Goldthorpe, 1992).

It also may be argued that in the case of the most 'advantageous' classes I+II the tendency to immobility is less affected by the ascription towards other classes. In the class of self-employed farmers the inheritance effect may be strengthened by the difficulty in getting into farming unless one already lives in the countryside, which would make immobility stronger in the case of this class. It may be that we observe stronger inheritance in these two diagonal cells of the mobility table than in others, or even no effect in other cells altogether.

Further, there can also be additive or lagged barriers to social mobility. This means that there are obstacles for people with particular grandparent class origins to access certain class positions themselves. Although Erikson's and Goldthorpe's classes should not be considered as a status ranking, it can be argued that certain occupations are more advantageous than others because of the higher permanent incomes and lower risk of unemployment as well as because of the more positive career prospects. According to previous research these kinds of advantageous classes are typically the service and self-employed classes (Erikson and Goldthorpe, 1992, 34; Goldthorpe, 2000, 239–241; Erola, 2004, 202). Given that a great part of the overall change in class structure between grandparents and grandchildren has been from manual classes to service classes, it is reasonable to assume that if there is a significant barrier, especially, one that should be considered as a problem for the equality of opportunity, it exists between service and self-employed classes and other classes. It would be the lack of resources, whether material or immaterial, which makes it harder for the grandchildren of other classes to reach these two classes.

The existence of the barrier may not be fully explained by the disadvantages alone; it may also be a product of social-capital-related issues that increase the likelihood of immobility. For example, it may be argued that having a working-class grandfather lowers the odds of a grandchild being in a service class because the relative distance to the service class would appear to be longer. Or that having a working class grandparent rather increases the likelihood that you prefer manual occupations rather than trying to achieve a service-class position. Whether the barrier is created by disadvantages or not, it should be observed as a lower mobility to service classes for those whose grandparents were neither in a service- nor in a self-employed class. Thus another hypothesis, called the *barrier of mobility*, may be proposed:

The barrier of mobility leads to grandchildren with disadvantaged grandparent origins having a lower chance of attaining more advantaged positions themselves.

This barrier effect may be observed as either a lagged or as an additive effect (or both). The barrier effect is additive, for example, if a working class grandfather and father lowers the grandchild's probability to be in service classes more than just a working class father alone. The barrier is lagged in nature, if the working class grandfather reduces grandchild's probability of being in service classes even after the father's class is controlled for.

As shown by the example of Warren and Hauser (1997), these hypotheses should not be considered as gender-blind. Everybody has a mother and father and two grandfathers and two grandmothers. We can expect that the social inheritance process is different in different grandfather and -mother, father and mother, grandson and -daughter lineages. It may also be anticipated that the 'female' lineages involving the mother and grandmothers will show lower additive and lagged inheritance than the 'male' lineages with grandfathers and the father. We expect this because a farm estate and family business are more likely to pass to sons than to daughters. However, if social capital is more important in additive and lagged inheritance than wealth, then there are perhaps no differences between male and female lineages. A gender difference in the additive and lagged barrier effect is harder to foresee. It might be argued that in the all male and all female lineages, an additive or lagged barrier effect is perhaps stronger than in other lineages.

Description of the Data Set

The data comes from the Longitudinal Census Panel (LCP) Data 1950–2000 from Statistics Finland, which is a census- and population-register-based data set. The latter part of the LCP, covering every fifth year from 1970 to 2000, is constructed from the population register. A simple random sample of 58,205 individuals was drawn from the 1970 population register and all individuals who lived in the same household as the initial sample person were included, resulting altogether in a sample of 242,469 individuals. The total sample contained 5 per cent of the Finnish population in 1970. Every individual in the 1970 sample was then followed to 2000, even if he or she moved to another household. New household members after 1970 were included into the data and followed the same way (Statistics Finland, 1996; Österbacka, 2004).

The older part of the LCP is the 1950 population census that is linked to the 1970–2000 panel data. The 1950 census is a stratified sample, covering every tenth household in Finland. Those households in the 1950 census who have a child (under 18 years) living in their household were selected. If this child was found

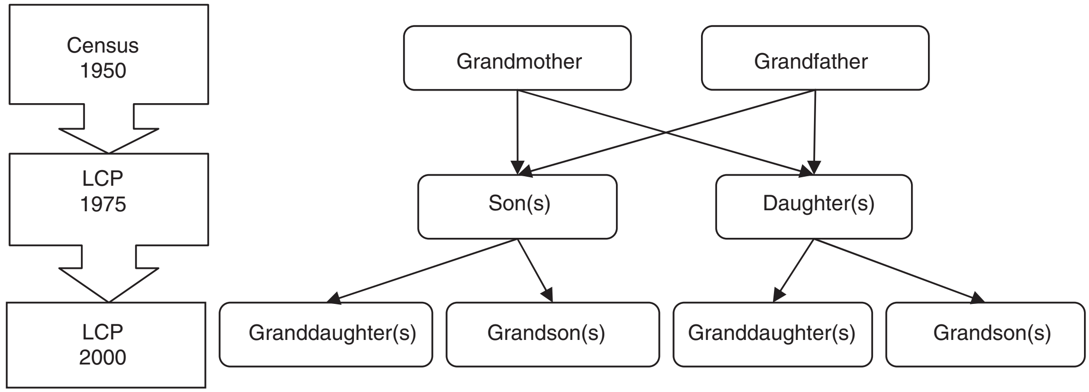

Figure 1 Construction of the grandparent–parent–grandchild lineages

also in the 1970–2000 panel data, then his or her childhood household information from 1950 was linked to the 1970–2000 panel data. It was possible to identify 23,894 persons in the 1975 grouping, who have been child members of a household in the 1950 census and who had children of their own living in their household.

Because both the census and population register contain occupational information, we were able to connect the occupation of parents in 1950 to their children's occupation in 1975 and to their grandchildren's occupation in 2000. If information is available only from one grandparent in 1950, only this grandparent's lineage is included in the data. Women have a lower labour force participation rate, especially in 1950 data. Subsequently, noticeably more grandfathers and slightly more fathers and grandsons are present in our data set. This construction of lineages is presented in Figure 1. Since grandmother and -father lineages are followed separately, each grandchild is represented approximately twice in our data set. Grandmother and -father lineages are also separated from father's and mother's lineages, depending on whether it is the mother or father whose 1975 information is linked to the 1950 census.This result altogether in 57,585 lineages:

- 9,075 father to grandfather lineages for sons and 8,140 for daughters,
- 6,285 father to grandmother lineages for sons and 5,707 for daughters,
- 8,649 mother to grandfather lineages for sons and 8,131 for daughters,
- 5,971 mother to grandmother lineages for son and 5,627 for daughters.

The social class schema used to code occupation labels is the seven-class CASMIN version of the Erikson–Goldthorpe classification (e.g. Breen, 2004, 12)[2].

The classes are:

I+II	Service class
III	Routine non-manual class and lower salary service
IVa+b	Self-employed (non-farming)
IVc	Self-employed farmers
V+VI	Manual supervisors and skilled manual workers
VIIa	Semi- or unskilled manual workers
VIIb	Semi- and unskilled manual workers in agriculture

The $8 \times 7 \times 7 \times 7$ balanced panel constructed in this way means that there are unequal marginal distributions between the panel and the cross-sectional data sets from 1950, 1975, and 2000. As pointed out by Duncan (1966), social mobility transfers the parents' social class structure via transition probabilities to the children's social class structure and for this, children's social class structure is not the same as the general social class structure in that time. In other words, some of the grandparent's and many of the parents are still in the population that determines the current class structure. Also some of those of the same generation as the (grand)parent did not have children and they are not represented in the mobility table. Moreover, some (grand)parents had several children and are therefore represented more than once in the mobility table.

Table 1 shows the class structure for men and women in census data 1950, 1970, and 2000 compared with those in the mobility table. The self-employed

Table 1 The class structure in the census data samples in 1950, 1975, and 2000 compared with grandparents, parents, and children in the three generation mobility table

Population in census	Men			Women		
Year	1950	1975	2000	1950	1975	2000
I+II	8.9	18.0	26.7	11.6	10.6	22.9
IIIa+b	2.1	4.9	7.0	17.4	40.7	38.2
IVa+b	7.8	4.9	7.8	5.2	2.8	4.8
IVc	16.5	13.0	7.3	3.4	11.5	6.2
V+VI	22.3	29.3	24.1	8.4	6.6	6.5
VIIa	14.4	25.7	24.6	11.2	23.4	18.8
VIIb	28.0	4.2	2.5	42.9	4.4	2.6
Total	100.0	100.0	100.0	100.0	100.0	100.0
Mobility table	**Grandfathers**	**Fathers**	**Sons**	**Grandmothers**	**Mothers**	**Daughters**
Year	**1950**	**1975**	**2000**	**1950**	**1975**	**2000**
I+II	9.3	26.6	29.8	5.6	11.7	28.5
IIIa+b	1.1	4.7	10.1	7.1	42.8	45.0
IVa+b	10.3	7.2	5.5	4.1	2.6	3.5
IVc	32.2	10.8	3.3	4.7	11.9	1.9
V+VI	20.6	26.9	23.9	4.4	5.8	4.9
VIIa	12.8	20.4	26.0	7.1	23.5	15.3
VIIb	13.9	3.4	1.5	67.1	1.6	1.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

Note: I+II, service class; IIIa+b, routine non-manual and lower salary service; IVa+b, self-employed; IVc, self-employed farmers; V+VI, manual supervisors and skilled manual workers; VIIa, unskilled workers; VIIb, farm labour.

classes, especially those of farmers, seem to be somewhat overrepresented among the grandparents of our mobility table. In the case of grandmothers the bias is clear among the farm workers—this is due to fact that many housewives in the countryside report themselves as an 'emäntä', the wife of a farmer, for their occupation, even if their husband's main occupation would not be in farming. Also the larger family sizes of farmers may have an impact on the figures.

Observing the class structure of the parents in 1975, the overrepresentation in the balanced panel seems to be focused in class I+II, and the proportion of the unskilled workers seems to be underestimated. In the children's case in 2000, the difference between the marginal distributions in the balanced panel and in the cross-sectional data seems to be smaller.[3] Other effects may also be involved; for example, different classes enter into the labour market at different ages, and especially the class structure of 2000 in the balanced panel may be affected by this.

The outflows (in the balance panel) from grandparents to parents, parents to grandchildren and grandparents to grandchildren, without separating eight different types of lineages, are shown in Table 2. In the first part of the table describing the outflow from grandparents to parents, the growth of service classes and the diminishing of farm-labour occupations seem to dominate. In the second part of the table (parents to grandchildren) the structural change in the occupational structure has somewhat slowed down compared to the outflow table of the grandparents and parents. However, the slow down in structural change did not lower the high level of relative mobility in Finland. The third part of the table presents the outflow from grandparents to grandchildren. The first impression is that the immobility (in the diagonal cells) is lower than in the outflow tables between consecutive generations. The classes I+II and III are somewhat exceptions: immobility in the two upper left-hand diagonal cells is as high in the grandparents to grandchildren table (41.8 and 30.4) as it is in the parents to grandchildren table (44.6 and 29.0). This probably reflects a structural change (in the marginal distributions) where the share of service and non-manual occupations has grown in Finland between 1950 and 2000.

Table 2 Outflow tables from grandfathers to fathers, fathers to sons, grandmothers to mothers, and mothers to daughters

Class of grandparents	Class of parents							
	I+II	III	IVa+b	IVc	V+VI	VIIa	VIIb	
I+II	51.3	28.3	4.0	1.4	6.7	7.4	0.7	100%
III	30.0	31.0	6.4	2.1	13.6	15.8	1.2	100%
IVa+b	20.3	22.4	7.3	10.7	15.1	21.6	2.7	100%
IVc	13.5	18.1	4.6	22.0	16.8	21.0	3.9	100%
V+VI	20.4	28.2	4.2	1.6	21.0	23.6	0.9	100%
VIIa	21.9	29.0	4.5	1.6	18.7	23.6	0.7	100%
VIIb	11.7	20.2	4.6	17.5	18.0	23.8	4.2	100%

Class of parents	Class of grandchildren							
	I+II	III	IVa+b	IVc	V+VI	VIIa	VIIb	
I+II	44.6	25.8	3.8	0.9	9.3	15.0	0.6	100%
III	31.4	29.0	4.4	1.1	13.1	20.0	0.8	100%
IVa+b	29.7	25.6	11.1	1.3	12.8	18.2	1.2	100%
IVc	24.8	21.9	5.2	15.3	14.7	14.4	3.7	100%
V+VI	23.7	26.6	4.0	1.0	20.1	23.7	0.9	100%
VIIa	22.4	27.7	4.3	1.1	17.6	26.0	0.8	100%
VIIb	21.0	27.2	5.6	3.3	15.8	23.7	3.4	100%

Class of grandparents	Class of grandchildren							
	I+II	III	IVa+b	IVc	V+VI	VIIa	VIIb	
I+II	41.8	27.7	3.2	0.7	8.9	16.9	0.7	100%
III	28.6	30.4	3.4	0.9	11.2	24.4	1.1	100%
IVa+b	32.4	25.8	5.2	2.6	14.1	18.5	1.4	100%
IVc	30.4	25.3	5.5	5.0	14.9	17.3	1.4	100%
V+VI	27.3	28.3	4.0	0.7	15.5	23.4	0.8	100%
VIIa	29.5	27.0	4.5	0.8	14.5	22.9	0.8	100%
VIIb	26.5	26.3	4.8	3.7	16.4	20.8	1.5	100%

Note: I+II, service class; IIIa+b, routine non-manual and lower salary service; IVa+b, self-employed; IVc, self-employed farmers; V+VI, manual supervisors and skilled manual workers; VIIa, unskilled workers; VIIb, farm labour.

Additive and Lagged Effects in Three-Generation Mobility

In order to test the hypotheses we analyse the produced mobility tables with log-linear and log-multiplicative layer effect models (Xie, 1992). By comparing the fit of different models as well as by interpreting the parameter estimates, we should be able to argue how well the hypotheses apply to our data. This begins by studying the three way table of grandparents (G), parents (P), and children (C), without separating the effect of different types of lineages.

Cross-tabulating the social class of grandparents (G), parents (P), and children (C) produces a $7 \times 7 \times 7$ mobility table with 343 cells. We carried out analyses using the LEM program (Vermunt, 1997). The model fit is estimated with chi-squared values (G^2) in relation to the degrees of freedom (df), the estimate for the reduction of the likelihood-ratio value (rG^2), dissimilarity index (Δ), and Bayes Information Criterion (BIC) (Vermunt, 1997, 74). A well-fitting model will have rG^2 as close to 100 as possible, Δ close to zero and a negative BIC as low as possible. A model with negative BIC is preferred to a saturated model. Also the usual statistical significance of chi-squared values in relation to degrees of freedom in each model is provided, although the usual limit of a well-fitting model (P>0.05) is not sensible with the number of cases we have.

The independence model (I) in Table 3 gives us a baseline for studying the associations in the GPC table.

Table 3 Loglinear models fitted to the grandparents, parents, and grandchildren GPC mobility table

Model	Parameters in the model	df	G²	rG²	*P*-value	Δ	BIC
I	(G,P,C)	324	15425.7	0.00	<0.0001	17.1	11874.3
II	(GP,GC)	252	4853.4	0.60	<0.0001	9.5	2091.3
III	(PC,GC)	252	8434.5	0.30	<0.0001	12.4	5672.3
IV	(GP,PC)	252	750.7	0.94	<0.0001	3.8	−2011.4
V	(GP,PC) (stationary)	294	2450.3	0.82	<0.0001	6.7	−772.2
VI	(GP,PC)+QPM	245	641.2	0.95	<0.0001	3.4	−2044.2
VII	(GP,PC)+ILI	251	667.0	0.94	<0.0001	3.5	−2084.2
VIII	(GP,PC)+ILI+LBM	250	546.8	0.95	<0.0001	3.0	−2193.4
IX	(GP,PC,GC)	216	296.4	0.97	0.0002	2.0	−2071.0

Note: *G, class of grandparent; P, class of parent; C, class of children, QPM, quasi-perfect mobility for GC-association; ILI, immobility due lacked inheritance for G; LBM, lacked barriers of mobility for GC.*

The independence model assumes that there is no association between G, P, and C, hence the statuses of grandparents, parents, and children are not associated in any way, which is understandably not a very plausible assumption. As expected, the independence assumption does not hold: the model has 324 degrees of freedom with a likelihood-ratio value of 15,425.7 (G^2) and a dissimilarity index of 17.1 per cent (Δ).

In the next three models (II–IV) two pair-wise associations are released at a time, in order to study how much explanatory power the excluded pair-wise associations have. Model II has parameters describing the associations between grandparents and parents (GP) and grandparents and grandchildren (GC), thus assuming that there is no association between the statuses of parents and grandchildren. Model III releases associations between parent and grandchildren (PC) and grandparents and children (GC), assuming that there is no connection between the statuses of grandparents and parents. Both of the models take 72 degrees of freedom compared to Model I, and improve the fit of the model in all respects. Neither of the models would be preferred to the saturated model, because the BIC is positive in both of them.

Model IV releases associations between grandparents and parents (GP) and parents and grandchildren (PC). The model assumes that there is no additive or lagged effects; all the associations in the GPC table can be described as a first-order single-chain Markovian process, where the grandchildren's social class is conditionally independent from that of the grandparents, after controlling for the parents' social class. The model reduces the likelihood-ratio value by 94 per cent if compared to the independence model (rG^2), decreases the misclassification index to 3.8 per cent and the BIC is negative, at −2,011. Thus, the model already achieves a good fit, meaning that it is enough to know the parent's social class in order to predict quite accurately the children's social class: the grandparents' effect on their grandchildren's social class is channelled mostly through the parents' social class. Model V tests the hypothesis that GP and GC are identical, i.e. that the Markovian process is stationary. The model has a much poorer fit than model IV, indicating that mobility is different between grandparents and parent and parents and grandchildren.

It seems that we can reject the hypothesis about strong additive or lagged effects between grandparent and grandchildren. However, some room for additive and lagged effects in the GPC table still exists: the model fit is not perfect. As the models with lagged effects are simpler than models with additive effects, we can look for a better model fit by allowing lagged effects in the GC sub-table. So the next model (VI) assumes that lagged effects in the GC sub-table are explainable by the so-called quasi-perfect mobility hypothesis. Quasi-perfect mobility assumption controls the effects of the diagonal cells of a mobility table (Appendix 1). Here the model can be used to estimate the broadest version of the lagged effects hypothesis: assuming that lagged effects increase the odds of all persons who are in the same class position as their grandparents, although the strength of this effect can vary according to class.[4] The improvement of the fit of the model is modest compared to Model IV, although statistically significant; the likelihood ratio is improved by one per cent, the dissimilarity index is improved by 0.4 and the BIC is practically the same. However, the quasi-perfect parameter estimates of the GC sub-table supports the lagged inheritance hypothesis made earlier. The strongest (lagged) immobility is found in service (I+II) and farmers' classes (IVc). But contradictory to our hypothesis, (lagged) immobility in the self-employed class is not evident.

Model VII simplifies Model VI by taking into account only the higher likelihoods of immobility in classes I+II and IVc in the form of an ILI-parameter (Appendix 1). If compared to Model IV, the statistically significant fit improvement is modest, but still clear in terms of the BIC. Thus it appears that the lagged inheritance effect seems to play a role, whether in the form of material or social inheritance in the case of the service class and self-employed farmers. However, only the weakest version of the hypothesis is accepted.

Our hypothesis about the lagged barriers of mobility assumes that those whose grandparents originate from classes IIIa+b, V+VI, VIIa, and VIIb should be expected to have a lower probability to be positioned in classes I+II, IVa+b, and IVc. This is tested with parameter LBM in model VIII (Appendix 1). Compared to model IV or VII, the BIC is improved and the chi-squared improvement by degrees of freedom is statistically significant. This means that there exists also a 'lagged barrier of mobility' that even after controlling for parent's class, leads to the grandchildren of routine non-manual and manual workers having a lower probability of moving to the service, self-employed and farmers' classes.

Releasing all parameters in the GC association (Model IX) to be estimated freely brings model fitness almost to the level where the difference between estimated and observed frequencies is statistically non-significant (df=216, G^2=296.4, P-value = 0.0002). Compared to model IV, the dissimilarity index is reduced from 3.8 to 2.0 and rG^2 from .94 to .97. This suggests that GC associations play a rather small role after controlling GP and PC. Also, no significant additive effects seem to exist, since we do not have to take into account any three-way association (GPC) to find a model that has practically speaking a perfect fit with the data.[5] The parameter estimates of model IX are presented in Appendix 2.

Gender Effect in Three-Generation Mobility

As stated earlier, it is reasonable to assume that there are gender differences in three-generation mobility. To test these possible gender effects, we introduce a new variable L in our mobility table. The eight categories of L describes the different grandfather/grandmother—father/mother—son/daughter lineages. Separating all eight possible gender-lineages in our GPC mobility table produces a layered $8 \times 7 \times 7 \times 7$ LGPC mobility table with 2,744 cells.

Table 4 shows the models fitted to the LGPC table. Model I is again an independence model that serves as a reference point for the latter models. Model II tests the hypothesis that social mobility follows a constant Markovian process in every gender lineage, only the class structures (margins) are allowed to be different across the gender lineages. With 2520 degrees of freedom, the model reduces the likelihood-ratio by 94 per cent and it misclassifies 8.2 per cent of the cases. Allowing all the lagged effects (GC) to be estimated freely does not improve the model fit much, as we can see in Model III. It seems that the social inheritance process over three generations is remarkably similar across the different gender lineages: a model that assumes that relative mobility follows the same Markovian process has a rather good fit. However, the model fit is not perfect, so there is some room for the possible gender effects, which we seek further.

Associations of Model III may have different strength in the different gender lineages. In Model IV we assume that GP, PC, and GC have the same pattern across the gender lineages, but the strength of associations can vary in different lineages. This is done by applying log-multiplicative layer effects assuming a uniform difference of GP, PC, and GC at the different levels of L (Erikson and Goldthorpe, 1992; Xie, 1992). The three Unidiff terms take 21 degrees of freedom, but they do not improve the model fit by much compared to Model III. So it seems that if there are gender differences, the differences are in the pattern of (Markovian) mobility, not in the strength of associations. The model fit does not increase substantially even if we allow all GPC association to be estimated freely, as is done in Model V, which speaks against significant additive effect.

Model VI allows the Markovian process to be different across gender lineages. The model assumes that social mobility follows the Markovian process, but this process can be different in the different gender lineages. The model fit is rather good; the likelihood ratio is reduced by 95 per cent if compared to the independence model and the model misclassifies 6.3 per cent of the cases. This suggests that social mobility follows slightly different Markovian processes in the different gender lineages.

We can try to improve the model fit by introducing the lagged effects into the model. But are the lagged effects found in the previous section constant across the gender lineages? In Model VII, we release constant

Table 4 Loglinear models fitted to the grandparents, parents, and grandchildren GPC mobility table according to lineages

Model	Parameters in the model	df	G^2	rG^2	*P*-value	Δ	BIC
I	(L,G,P,C)	2718	71829.7	0.00	<0.0001	45.2	42037.6
II	(LG,LP,LC,GP,PC)	2520	4250.0	0.94	<0.0001	8.2	−23371.7
III	(LG,LP,LC,GP,PC,GC)	2484	3717.4	0.94	<0.0001	7.3	−23509.6
IV	(LG,LP,LC)+Unidiff (GP,PC,GC)	2463	3408.9	0.95	<0.0001	6.8	−23588.0
V	(LG,LP,LC,GPC)	2268	3423.0	0.94	<0.0001	7.0	−21436.5
VI	(LGP,LPC)	2016	2870.4	0.95	<0.0001	6.3	−19226.9
VII	(LGP,LPC)+ILI+LBM	2014	2589.9	0.95	<0.0001	5.7	−19485.6
VIII	(LGP,LPC)+Unidiff (ILI+LBM)	2007	2528.9	0.95	<0.0001	5.5	−19469.7
IX	(LGP,LPC,GC)	1980	2335.4	0.96	<0.0001	5.1	−19367.3
X	(LGP,LPC)+Unidiff (GC)	1973	2293.2	0.96	<0.0001	4.9	−19332.8
XI	(LGP,LPC,LGC)	1728	1895.8	0.96	0.0027	4.2	−17044.7

Note: *G, class of grandparent; P, class of parent; C, class of children; L, lineages according to gender of grandparent, parent or child; ILI, immobility due lacked inheritance for GC; LBM, lacked barriers of mobility for GC.*

ILI and LBM effects in the GC across the lineages. This takes two degrees of freedom and improves the model fit according to the dissimilarity index and BIC. As in the previous section, this suggests that there are lagged associations between grandparent's and grandchildren's class positions. In Model VIII, we allow ILI and LBM parameters to vary across the lineages with different strengths, but with uniform pattern. This contributes very little additional explanatory power to the model. In fact the BIC is weaker than in the previous model, rG^2 is still at the same level and the dissimilarity index is lowered only by 0.2 per cent.

Model IX releases all possible GC associations to be estimated freely. This brings only a slightly better fit than Model VII according to the rG^2 and dissimilarity index. This indicates that the constant ILI and LBM effects take into account most of the GC association with only two degrees of freedom. In Model X, we allow GC association to vary across the gender lineages, but assume that the pattern of GC association is the same. This does not improve the model fit, further supporting the finding that the direct (lagged) effects from grandparent to grandchildren are similar across the gender lineages.

Finally, in Model XI, we allow lagged effects to have an association with the gender lineage, i.e. we allow LGC to be estimated freely. This brings the model fit to level, where the difference between estimated and observed frequencies is no longer statistically significant: $P = 0.003$, which is rather remarkable considering the number of cases ($N = 57{,}585$). However, the BIC suggests a worse fit for Model XI than for Models VI–X. Also, rG^2 is not improved over Models IX and X, although the dissimilarity index is somewhat smaller.

So we can conclude that we do not need to take into account any additive effects (three-way GPC associations) to be able to model a gender layered three-generation mobility table. Almost all (relative) mobility in the three-generation mobility table can be explained as a Markovian process that is constant in all gender lineages. Two small lagged effects that were found, ILI and LBM, seem to be constant across gender lineages. Also, allowing social mobility to follow different Markovian processes in different gender layers improved the fit of the model. However, both the lagged and gender effects play a rather small role in the social inheritance process, whose main feature is the Markovian process from one generation to the next.

Re-Analysis with Status Indexes

The analysis above suggests that there are some, though small class effects that cannot be explained by a Markovian model, which seems to be in slight contradiction with the results of Warren and Hauser (1997). This might follow from using a categorical status measure instead of a continuous one. So before drawing conclusions, we further tested if our results change when a continuous status measure is being used instead of a categorical one. In order to test this, occupations were coded into ISEI-scores using Ganzeboom and Treiman's conversation tools (Ganzeboom *et al.*, 1992; Ganzeboom and Treiman, 2001). The ISEI-scores are a continuous prestige scale similar to the one used by Warren and Hauser, although ISEI is expected to be more suitable for a comparative analysis (Ganzeboom *et al.*, 1992; Ganzeboom and Treiman, 1996).

Simple linear regression models, with the ISEI-score of the son or daughter as the dependent variable and the scores of the parents and grandparents as the independents, are shown in Table 5. A significant connection between the class status of children and that of grandfathers exists after controlling for the parents' status, even if the continuous status measures were applied. The status of the grandmother does not appear to play a role, whereas the status of the grandfather does. However, the explanatory power of the latter is at best less than one fifth of that of parent's status, and clearly less than one percent of the whole variation of ISEI score, when the effects of parental status is being controlled. Thus the effect exists, but it is very small. The result is in line with the result achieved with loglinear models.[6] If compared to the recent income mobility studies (Österbacka, 2004; Jäntti *et al.*, 2006), the ISEI correlations appear to be somewhat higher than the income correlations, especially in the case of women. For example, with the Finnish data from 1995, Österbacka reports the income correlation between sons and fathers to be .111 and between mothers and daughters .089.

Conclusions

Utilizing the Census Panel Data of Statistics Finland from 1950 to 2000 we have been able to study social mobility in Finland over three generations. We found that almost all the associations in the three-dimensional mobility table of grandparents, parents, and grandchildren can be explained by a log-linear model describing a simple (time-heterogeneous) Markovian process. This suggests that after controlling for the parents' social class, the grandchildren's social class is for the most part conditionally independent of the grandparents' social class. This was also the case when the lineages were separated according to the different gender combinations of the consequent generations and the lineages were compared.

However, all the associations in the three-generation mobility table cannot be explained by a constant Markovian process. Social and/or material inheritance seems to follow slightly different Markovian process in the different gender lineages. Also two direct grandparent–grandchildren effects were found, a finding that is not fully in line with those of Warren and Hauser (1997). These were named *as immobility due to lagged inheritance* and the *lagged barriers of mobility*. Lagged inheritance leads to a higher probability that

Table 5 Linear regression model explaining ISEI-scores of sons and daughters with the ISEI-scores of parents and grandparents

Dependent ISEI	Univariate models	Unadjusted main effects					Parent+grandfather					Parent+grandmother				
	Explanatory factors	B	SE	Beta	$p(t)$	Adj. R^2	B	SE	Beta	$p(t)$	Adj. R^2	B	SE	Beta	$p(t)$	Adj. R^2
Men	Father	0.28	0.00	0.30	***	8.9%	0.24	0.01	0.27	***	9.3%	0.25	0.01	0.28	***	8.0%
	Father's father	0.24	0.01	0.19	***	3.6%	0.11	0.01	0.09	***	0.7%					
	Father's mother	0.12	0.01	0.11	***	1.1%						0.01	0.01	0.01	n.s.	0.0%
	Mother	0.26	0.00	0.25	***	6.3%	0.18	0.01	0.18	***	4.0%	0.21	0.01	0.20	***	4.3%
	Mother's father	0.18	0.01	0.14	***	2.0%	0.11	0.01	0.08	***	0.7%					
	Mother's mother	0.08	0.01	0.08	***	0.6%						0.01	0.01	0.01	n.s.	0.0%
Women	Father	0.21	0.00	0.22	***	5.0%	0.17	0.01	0.19	***	4.5%	0.20	0.01	0.21	***	3.3%
	Father's father	0.16	0.01	0.12	***	1.4%	0.06	0.02	0.05	***	0.2%					
	Father's mother	0.07	0.01	0.07	***	0.4%						−0.01	0.02	−0.01	n.s.	0.4%
	Mother	0.22	0.00	0.21	***	4.4%	0.18	0.01	0.16	***	4.4%	0.17	0.02	0.16	***	2.4%
	Mother's father	0.17	0.01	0.12	***	1.5%	0.09	0.02	0.07	***	0.0%					
	Mother's mother	0.05	0.01	0.04	***	0.2%						−0.02	0.02	−0.01	n.s.	0.0%

****Statistically very significant effect; n.s., statistically non-significant effect.*

grandchildren of the service class and self-employed farmers remain within the same class. This can be explained by material and non-material transitions across generations, a process that apparently can in some cases jump a generation. The lagged barriers of mobility lead to the grandchildren with particular disadvantaged grandparent origins having lower chances of attaining the more advantaged class positions. Although small in size, both of these effects seem to play a role in social mobility. Both of these lagged effects were found to be constant over the gender lineages.

Applying continuous status measures in an additional analysis did not significantly change our results. When a continuous ISEI-status index was used, controlling parents' status did not completely cancel the grandfathers' effect on the status of grandchildren. This further establishes that three-generation mobility in Finland is not entirely similar to that in the USA according Warren and Hauser (1997) or in Britain in the 1950s (Ridge, 1974). We have reasons to believe that one reason for this is the better quality and the sheer size of our census data. Differences in the time period and country differences may also play a role: Finland (in 2000) has lower income inequality and higher mobility than in the USA or Britain (e.g. Österbacka, 2004, 90).

Potential reasons exist that explain the weakness of the impact of the grandparents' class on that of the grandchildren after controlling for the parent's status. For example, in a mobility table, all (random) measurement error appears as mobility and this attenuates the observed association between origin and destination (Breen and Moisio, 2004). Measurement error probably does not play a major role here, as the census data applied is of a very high-standard: a person registered as living in Finland can not be excluded from the data and the information from occupation is derived from tax records. Regression to the mean is probably a much more important factor. Further, it may be argued that in order for the grandparents' to have an effect on the grandchildren's social class, the grandparents should be alive. We did not take this into account.[7] Lagged effects could perhaps be stronger if the grandparents are still living.

To conclude, the results show that after controlling for the effect of parents' status, the direct effects of generations previous to the parents on the social status of the children can be fairly small, though they still play some role. This is the case even in a society where the inequality of opportunities is lower than in many other countries. However, it seems that taking into account more than two consecutive generations adds very little explanatory power to the analysis of social mobility.

Notes

1. This step is completely described by the distribution of states in both time points and by the transition probabilities between the two time points. Some of the literature on Markovian models also includes a second requirement for a process to be called Markovian: stationary transition matrices. Stationary transition matrices means that the transition probabilities between the state in time t and time $t+1$ are the same from one transition step to the next. However, stationary transition probabilities are rarely found in empirical studies in social sciences.
2. In order to get an EGP-classification out of the occupational data, the original classifications were first coded to ISCO-88 occupational codes. After that we applied Ganzeboom's and Treiman's conversation tools (Ganzeboom and Treiman, 2001).
3. The service classes include a relatively large part of the occupations of parents and children. It could have been worth considering separating classes I and II as well as IIIa+b from each other. However, this would have resulted in very small classes for the data for grandparents in 1950. As the currently used seven-class version of the EGP has also been used in many other important mobility studies, such as Erikson and Goldhorpe (1992) and Breen (2004), the splitting of the classes I+II and IIIa+b was not done.
4. Usually this type of model is used in order to distinguish mobility from immobility (Hout, 1983).
5. There are theories that suggest additive effects between generations. One such is a so-called 'clogs to clogs'-hypothesis (Nicholas, 1999; also, Warren and Hauser, 1997) or a 'Buddenbrook cycle', (according to the famous book by Thomas Mann). According to this hypothesis one of the key phenomena in social mobility over three or more generations is the failure in maintaining an achieved more advantageous class position. For example, persons whose grandparents have been in less advantageous positions (classes IIIa+b, V+VI, VIIa+b) and whose parents have been in more advantageous classes (I+II, IVa+b, IVc) are not able to maintain their parents position but 'return' to the class of their grandparents. When tested, the results show that the phenomenon has

some small bearing in the case of class V+VI. However, this effect is so small that it is practically irrelevant.

6. If we look at the Unidiff-parameter estimates of model X (Table 4) closer it could be seen that the Unidiff-parameter coefficients (not reported) of grandfather lineages are also slightly stronger than for grandmother lineages.
7. From the grandfathers, 33.3 per cent were already dead by the end of 2000, from the grandmothers the figure is 28.1.

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Appendix 1 Design matrices

(a) Immobility due lagged inheritance

1	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

(b) Lagged barriers of mobility

0	0	0	0	0	0	0
1	0	1	1	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
1	0	1	1	0	0	0
1	0	1	1	0	0	0
1	0	1	1	0	0	0

Appendix 2 Parameter estimates of GP, PC, and GC of model IX in Table 3 (effect coding, see Vermunt, 1997)

		GP		PC		GC	
		Beta	SE	Beta	SE	Beta	SE
I+II	I+II	1.22	0.04	0.73	0.03	0.27	0.04
	III	0.52	0.04	0.23	0.03	0.15	0.04
	IVa+b	0.19	0.07	0.01	0.05	−0.12	0.07
	IVc	−0.69	0.10	−0.32	0.09	−0.22	0.14
	V+VI	−0.38	0.05	−0.12	0.04	−0.13	0.05
	VIIa	−0.49	0.05	−0.03	0.03	0.05	0.05
	VIIb	−0.37	–	−0.50	–	0.01	–
III	I+II	0.42	0.05	0.25	0.02	−0.09	0.05
	III	0.28	0.05	0.20	0.02	0.14	0.05
	IVa+b	0.33	0.08	0.00	0.04	−0.21	0.10
	IVc	−0.64	0.12	−0.28	0.07	−0.19	0.18
	V+VI	−0.04	0.06	0.03	0.03	−0.10	0.07
	VIIa	−0.11	0.06	0.10	0.03	0.24	0.06
	VIIb	−0.25	–	−0.30	–	0.22	–
IVa+b	I+II	−0.33	0.03	0.04	0.04	0.00	0.03
	III	−0.36	0.03	−0.06	0.04	−0.13	0.03
	IVa+b	0.13	0.05	0.74	0.06	0.08	0.06
	IVc	0.60	0.05	−0.33	0.13	0.22	0.09
	V+VI	−0.23	0.04	−0.15	0.05	−0.04	0.04
	VIIa	−0.08	0.03	−0.13	0.05	−0.19	0.04
	VIIb	0.28	–	−0.11	–	0.06	–
IVc	I+II	−0.75	0.02	−0.45	0.03	0.00	0.02
	III	−0.58	0.02	−0.51	0.03	−0.14	0.02
	IVa+b	−0.35	0.04	−0.39	0.05	0.15	0.04
	IVc	1.28	0.04	1.61	0.05	0.45	0.06
	V+VI	−0.13	0.02	−0.35	0.03	−0.03	0.03
	VIIa	−0.11	0.02	−0.61	0.03	−0.26	0.03
	VIIb	0.64	–	0.69	–	−0.15	–
V+VI	I+II	0.11	0.03	−0.01	0.03	−0.04	0.03
	III	0.27	0.03	0.14	0.03	0.08	0.03
	IVa+b	−0.02	0.05	−0.13	0.05	0.00	0.05
	IVc	−0.82	0.07	−0.51	0.08	−0.32	0.11
	V+VI	0.47	0.03	0.44	0.03	0.17	0.04
	VIIa	0.38	0.03	0.29	0.03	0.15	0.03
	VIIb	−0.39	–	−0.23	–	−0.04	–
VIIa	I+II	0.20	0.03	−0.07	0.03	0.00	0.04
	III	0.33	0.03	0.17	0.03	0.01	0.04
	IVa+b	0.08	0.05	−0.06	0.04	0.10	0.06
	IVc	−0.80	0.08	−0.42	0.07	−0.24	0.12
	V+VI	0.39	0.04	0.30	0.03	0.08	0.04
	VIIa	0.41	0.03	0.38	0.03	0.11	0.04
	VIIb	−0.61	–	−0.31	–	−0.06	–
VIIb	I+II	−0.86	–	−0.49	–	−0.13	–
	III	−0.47	–	−0.17	–	−0.11	–
	IVa+b	−0.35	–	−0.17	–	0.01	–
	IVc	1.08	–	0.25	–	0.30	–
	V+VI	−0.08	–	−0.15	–	0.06	–
	VIIa	−0.01	–	−0.01	–	−0.10	–
	VIIb	0.70	–	0.75	–	−0.04	–