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THE EFFECT OF FERTILITY LIMITATION ON INTERGENERATIONAL SOCIAL MOBILITY: THE QUALITY–QUANTITY TRADE-OFF DURING THE DEMOGRAPHIC TRANSITION

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Summary. The hypothesis that family size limitation by parents enhances the upward mobility chances of their children in (post)industrial populations has a long-standing record in many disciplines, including sociology and economics, as well as evolutionary anthropology and social biology. Yet the empirical record supporting or contradicting the theory is surprisingly limited. The aim of this contribution is to develop a test of the effect of family size limitation on children's intergenerational mobility. This test is applied to an urban population in Belgium that was in the process of experiencing its demographic transition, including the decline of fertility, at the end of the 19th century. The results indicate that the effect of family size was strong, even after controlling for parental social status as well as birth order. Surprisingly, the effects of birth order and family size appear to be largely independent.

Introduction

Alfonso-Sánchez *et al.* (2003) have pointed out that a lot of progress has been made in recent decades in the study of natural fertility in pre-industrial populations, but that 'much less thought and study have been given to the development of the mechanisms whereby human beings have adapted their reproductive capacity to match their environment' (p. 482). This contribution aims to concentrate on one mechanism that has a long-standing record in the theoretical literature of several disciplines, but that has hardly been put to the test. This mechanism involves the effect of family size limitation by parents on the social mobility of their children in modernizing societies. Although the data set used has several limitations, the approach and method proposed should stimulate future tests with more data.

Family size and intergenerational mobility

In his 1890 classic *Dépopulation et civilisation*, the French sociologist and demographer Arsène Dumont argued that adults with ambition tend to limit their

family size because numerous offspring is an obstacle to success and achievement. 'For people who want to go up,' he wrote, 'many children make inconvenient luggage' (Dumont, 1890 (1990), p. 77, author's translation). The same holds for those who project their social status ambitions onto their children: a large seed dilutes parental resources and therefore complicates or aggravates the social situation in the next generation (Dumont, 1890 (1990), pp. 73–91).

The hypothesis that parents limit their fertility in order to further the life chances of their children is a classic one (Lesthaeghe, 1977; Kasarda & Billy, 1985). For example, Ariès (1980), referring to Dumont, argues in an article amply cited by demographers, that the decline of fertility in the West is the consequence of the emergence of a child-oriented society. In such a society, parents' main investment consists of helping their children to get ahead. 'The fewer the children, the more time and care could be devoted to each and the better the results. Parents came to view their family as a small elite whose members were selected via birth control' (Ariès, 1980, p. 647). Hence, the spread of fertility limitation is linked to intergenerational social mobility: restricting offspring was one of the strategies to ensure that children's social status would be superior to that of their parents.

In the English-speaking world, the classic reference is Joseph A. Banks' *Prosperity and Parenthood* (1954). Banks was familiar with and explicitly referring to the work of Arsène Dumont when arguing that social ambition was one of the motivating forces of family size limitation in the English middle classes. Banks' work on the decline of fertility is amply cited in English historical demography, for example in Szreter (1996).

In economics, the negative effect of family size on the future social status of children is known as the 'quality–quantity trade-off'. Becker (1991) calls proper consideration of the interaction between child quantity and quality 'probably the major contribution of the economic analysis of fertility' (p. 135). Becker's economic theory implies that a reduction in the number of children raises investments in child quality, where quality is measured by the current as well as the future well-being of children, including their income when they become adults (Becker, 1991).

The sociological idea that fertility limitation may be instrumental for success in the social world has an analogue in social biology and in evolutionary anthropology and psychology. Humans are on the slow extreme of the fast–slow reproduction continuum (r versus K selection, respectively), but this leaves a great deal of flexibility for slowing down or speeding up their fertility, depending on the environmental conditions of their life histories. Therefore, humans may produce more offspring, investing little in each, or produce just a few and invest a great deal in each child in order to enhance its survival chance (MacDonald, 1999; Livi-Bacci, 2001; Morgan & King, 2001; Kaplan & Lancaster, 2003). Life History Theory considers this quantity–quality balance to be one of the most fundamental trade-offs affecting natural selection on fertility and, hence, fitness (MacDonald, 1997; Kaplan & Lancaster, 2003).

In evolutionary biology, reproductive success is not measured by the number of births but by the number of children that survive and produce offspring in turn (Mayr, 2001). In this perspective, reproductive success or fitness can be defined as the product of quantity and quality of offspring. In this context, quality refers merely to

the probability that reproduction occurs in the next generation, a variable that is thought to depend on parental investment, i.e. the amount of resources allocated by the parents to their progeny (Beauchamp, 1994).

However, evolutionary theorists now extend their models to include success in the social world as well. Among evolutionary psychologists, it is common to argue that social status seeking is an evolved motive disposition, i.e. a goal that tends to be common to most people all over the world: people in all human societies tend to monitor their position relative to others in the society and are highly motivated to increase or maintain their social status, if they think they have the possibility to do so (MacDonald, 1999). From a bio-evolutionary perspective, status seeking may indeed have been naturally selected because for mammals like humans high social status was probably not only beneficial to the survival of offspring but it also enhanced success in mating, hence triggering a sexual selection effect as well (Hrdy, 1999). However, according to some evolutionists, the cultural environment in modern society evolved in such a way that the evolved motive to increase or maintain social status came into conflict with the motive to maximize the number of offspring. Therefore, status-seeking people in (post)industrial societies who perceive themselves as being able to take advantage of opportunities for upward social mobility by restricting fertility are strongly inclined to do so: they tend to follow a low fertility–high parental investment strategy (MacDonald, 1997, 1999).

Summing up, the fertility limitation–intergenerational mobility hypothesis is long-standing in many disciplines. Therefore, one would expect that there is abundant empirical support for it. The connection between fertility control and intergenerational mobility is so cogently described in the literature that one tends to believe that this is an established, well-tested fact. Yet, the empirical record supporting the case is surprisingly meagre. Becker, for example, only cites some aggregate statistics to show that at times when the birth rate was falling, the educational level of children was rising (see Becker, 1991, pp. 148–151). There is much more published research on other types of connections between fertility and social mobility. For example, many studies have been published about the effects of social mobility on the fertility of the mobile generation (for example: Bean & Swicegood, 1979; Zimmer, 1981; Westoff, 1981; Sobel, 1985; Kaplan *et al.*, 1998), but not on the effects of fertility limitation by parents on the social mobility of their children.

Hypothesis

The aim of this paper is to test the hypothetic effect of family size limitation by parents on the intergenerational mobility of their children. This test will be carried out in an urban European population that was in the process of experiencing its demographic transition, including the decline of fertility, at the end of the 19th century. The full causal rationale for the specific hypothesis to be tested is as follows.

If there exists (1) an evolved motive disposition among humans to strive for (intergenerational) upward mobility and if (2) society would evolve in such a way that a smaller number of siblings enhances the probability that parents or their children, or both, maintain or enhance their social status, then fertility can be expected to

decline as a result of diffusion effects. This can indeed be expected because under these two conditions, even people who do not limit their family size but naturally have a smaller family will tend to rise on the social ladder. Other people may observe this and may therefore try to limit their family sizes intentionally in order to advance their mobility chances as well. Hence, if conditions (1) and (2) are true, then fertility decline would be a predictable result.

A critical proposition in this hypothesis is that, under modern societal conditions, family size has a negative effect on social status, or, conversely, that fertility limitation is advantageous for the position on the social ladder. This proposition will be tested here with respect to intergenerational social mobility.

Methods

If parents were motivated to let their children climb the social ladder, was fertility limitation an effective strategy to achieve that goal? Did children with fewer siblings end up with a higher social standing than children with more siblings, other things being equal? Reflecting these two questions, there are two perspectives to the link between family size and intergenerational mobility. From the perspective of the parents, the distributions of children's social statuses can be compared according to family size. From the perspective of the child, the exogenous variables are sibsize (i.e. the number of siblings, Blake, 1989) and parents' social standing while the variable to be explained is own occupational status. This section first discusses the pros and cons of both perspectives. It is assumed that the empirical analysis will use historical family reconstitutions because these are the kind of data typically available for historical fertility research (see Alfonso-Sánchez *et al.*, 2003).

Perspective of the parents

Technically, the job from the parental perspective can be done, for example, by logistic regression analysis, counting the number of surviving children as trials and the number of upwardly mobile children as binomially distributed successes. Let T_j be the total number of surviving children of a married couple j and U_j the number of children who are upwardly mobile. To be modelled is the unobserved probability P_j that determines how many children are expected to be upwardly mobile given the number of children born. The hypothesis at issue implies that this probability P_j depends, among other things, on the number of children T_j. Taking U_j/T_j as the empirical outcome of the process guided by the unobserved P_j enables estimation of the unknown regression parameters of the following logistic model:

$$\log\left(\frac{\hat{P}_j}{1-\hat{P}_j}\right) = \log\left(\frac{{}^{U_j}\!/_{T_j}}{1-{}^{U_j}\!/_{T_j}}\right) = \beta_0 + \beta_1 T_j + \sum \beta_k X_{kj} + \varepsilon_j. \qquad (1)$$

A major disadvantage of this approach is the great loss of information. Model (1) is on the aggregated level of families. As a consequence, it is impossible to take into

account properly how the individual characteristics of children influence P_j. Suppose, for example, that birth order is one of the determinants of the likelihood of upward mobility. Because Model (1) is on the family level, it is not possible to include individual birth order in the list of covariates.

A second disadvantage, following from the first, is that modelling on the parental level would possibly also introduce a substantially important bias in the estimate of the effect of family size. Indeed, even though birth order and family size are clearly not independent, they may have a separate impact on intergenerational mobility (Blake, 1989). Suppose that, indeed, birth order influences social mobility so that higher birth orders are less likely to be mobile. Then failing to control for birth order would imply that its negative effect is unjustly attributed to family size T_j in Model (1), because higher birth orders are over-represented among larger families and not represented in small families.

Data limitations also pose a problem. In the majority of cases, the distribution of children's achieved statuses is not completely known in historical demographic data sets due to censoring. Because the observation period is limited, information about the occupational status is available only for a few children (for example only for the first one or two surviving children at the time of their marriage). If the data are gathered at a local level, emigration also implies censoring. For example, in the sample used in this paper, the occupation remains unknown for children who migrated out of the community under study. As a result, for parents as units of analysis, the analysis will have to be limited to the known part of the distribution.

Perspective of individual children

Instead of analysing the distribution of children's occupations from the perspective of parents, it is also possible to take an individual child i as the unit of analysis. A simple way to proceed is to see whether or not a child is climbing the social ladder during adulthood compared with its parents. The observed binary variable U_i can be seen as the observed outcome of a Bernouilli experiment with an unobserved probability of success P_i. Subsequently, the likelihood of occupational mobility P_i can be analysed by means of a logistic regression model, including individual sibsize T_i in the list of covariates:

$$\log\left(\frac{\hat{P}_i}{1-\hat{P}_i}\right) = \beta_0 + \beta_1 T_i + \sum \beta_k X_{ki} + \varepsilon_i. \tag{2}$$

Of course, this presupposes that individual sibsizes are known. Yet, the sample of people for whom this information is available is not a random sub-sample of the population in most historical demographic data sets. If that selectivity is related to the process under study, the analysis will be biased to some extent. Suppose that a sample is taken of individuals living in a municipality or district and that information about the size and social status of their parental families is searched for in the same local sources. This will be harder for individuals in the population who moved away from their native towns and villages than for those who were not geographically mobile.

Without access to the full story, there is no way to determine the strength of the bias. Theoretically, if children in large families are more likely to migrate out of their birthplace, and if migrants are more likely to be also mobile in social space, the (indirect) effect of family size on social mobility will be underestimated when the data about migrants are unavailable. If this is true, estimates of the effect of family size can be considered to be conservative ones.

Multilevel approach

Not all characteristics included in the list of predictors of Model (2) are measured at the same level. The model includes both individual characteristics X_{ki}, for example sex and birth order, and characteristics that are common to all children from the same family of orientation, for example the occupational status of the father and family size.

If the study sample includes more than one child per family, it cannot be considered to be a sample of independent observations because children are nested within families. Children who grow up in the same family share common genes as well as experiences, involving similar living standards and parental rearing and raising habits. Therefore, children from the same family may to a certain extent resemble each other quite well.

This intra-family correlation is ignored in Model (2), even if it includes both family- and individual-level covariates. Even though some were born and bred in the same nest, individual observations are treated as if they were unrelated. This can be seen from the strictly individual error term ε_i. As usual in regression analysis, it is assumed that the error terms are unrelated between observations. Yet with nested data, this assumption may be unrealistic, in this case as a consequence of intra-family correlation (Kreft & de Leeuw, 1998).

Even after controlling for the family characteristics that feature in the list of covariates, some families may be more likely to let their children climb the social ladder than others. The reasons for this heterogeneity on the family level remain unobserved, but this unobserved heterogeneity makes the disturbance term correlate among children from the same family. Ignoring this intra-family correlation, as in Model (2), amounts to overrating the number of independent observations and this makes tests of significance too liberal (Kreft & de Leeuw, 1998).

To solve the problem, a random component should be added to Model (2) to capture the effects of unobserved heterogeneity on the family level. If families differ in the odds that their children are intergenerationally mobile, the fixed intercept β_0 of Model (2) should be replaced by an intercept that varies from family to family. This intercept-with-a-variance β_j can be written as the sum of one overall, fixed baseline intercept plus a family-specific deviance term:

$$\beta_j = \gamma_{00} + u_{0j}, \tag{3}$$

where γ_{00} is the fixed mean intercept and u_{0j} is the family error term that measures the deviation of each family from the mean intercept. Substitution of the fixed intercept β_0 in Model (2) with the intercept-with-a-variance β_j, defined in equation (3), yields Model (4):

$$\log\left(\frac{\hat{P}_i}{1-\hat{P}_i}\right) = \gamma_{00} + \beta_1 T_j + \sum \beta_k X_{ki} + (\varepsilon_i + u_{0j}). \quad (4)$$

Note that the subscript of T has been changed from i into j in order to indicate that this is a family-level covariate. After controlling for the measured family and individual characteristics (T_j and X_i) the overall propensity of intergenerational mobility differs between families, as indicated by the u_{0j} term.

Context and data

The models described above will be applied to the population of the Belgian city of Leuven while it was experiencing its demographic transition. Leuven is situated in the Dutch-speaking part of Belgium but is very close to the language border. The city did not undergo a rapid and large-scale industrialization in the 19th century. Instead, its economy drifted with the industrializing and rapidly expanding national economy. The provincial town played a supportive role in the industrialization of Belgium, primarily through its functions as a centre of education, trade and transport. The small-scale local industry expanded and modernized gradually, and included mainly food industry, craft textile manufacturing, tanneries, wood and construction. Leuven became an important educational centre, offering primary and secondary education to the provincial environment, and higher education to the whole country. Activities in the tertiary sector included transit, wholesale and retail trade, and an important military settlement. The size of the population grew from about 30,000 in 1850 to about 42,000 inhabitants in 1910, mainly due to natural growth rather than immigration, even though fertility started to decline from the 1870s (Matthijs *et al.*, 1997).

The sample used has been constructed in two steps. First, the population registers were searched for all people born in 1850 who had lived in the study community of Leuven, Belgium, at any point in time between the years 1866 and 1900. For the people from this 1850 generation who married, complete family reconstructions were carried out (see Van Bavel, 2002, 2004a). These reconstructions represent the parental generation. In the second step, both the population registers and the marriage records of the city of Leuven were searched in order to find the occupations of the children found in the first step. Hence, the sample of children consists of those born within wedlock with at least one of the parents born in 1850.

Unfortunately, as indicated before, a high percentage of the occupations of the children remains unknown for two reasons. First, the study period extends only to the year 1910. At that time, many children of parents from the 1850 generation were as yet recorded without occupations because of their young age. Second, children who migrated out of the municipality and started to work elsewhere, did not record their occupation in Leuven. Therefore, if there is a connection between social and geographical mobility, then it may introduce some selection bias: if children who move on the social ladder are more likely to migrate out of their native town, then socially immobile children will be over-represented in the sample. Again, this would imply conservative estimates for the mobility effect.

After searching the population registers and the marriage records, occupational titles were identified for 488 children: 275 (56%) sons and 213 (44%) daughters. It is common in historical research to use only men's occupations as indicators of social status. Women's occupations were not validly and reliably recorded in the 19th century, perhaps because their social standing was determined much more by the title stated by their fathers and husbands than by their own occupations (Haller, 1981; Herr, 1995). In fact, many women who did not 'have to' work were probably economically privileged so that failing to mention an occupation can to some extent be considered as a status symbol (Matthijs, 2001). If the family rather than the individual is the unit of social stratification (Haller, 1981), men's occupational titles are much better indicators of social standing than women's are (Van Bavel *et al.*, 1998).

Restricting the analysis of intergenerational mobility to men's occupational titles further reduces the sample size. Here, the loss of observations will be kept to a minimum by including sons-in-law. That is: the occupations recorded for fathers will be compared with the occupations recorded by their sons as well as by their sons-in-law. The latter's occupations are only known if the daughters married in Leuven during the study period.

Table 1 gives simple descriptive statistics for the final sample selected for the empirical analysis. First, the parental sample includes 212 observations. This means that for 212 marriages from the 1850 generation the occupation of at least one of their children has been identified. In half of the cases, just one child occupation was found. For a quarter of the marriages, there are two occupations available for analysis, and for another quarter more than two.

Second, the total number of children observed with an occupation is 381. This is the number of cases available for analysis from the perspective of the child generation. This sample includes 272 sons and 109 sons-in-law. Sibsize, i.e. the number of siblings alive, is measured at the age of 20 years. In this sample, the variable is approximately normally distributed with a mean of 4·44 and mode of 5. In contrast, the birth order variable is highly skewed, reflecting the limited period of observation.

The occupational classification scheme is derived from Van Bavel *et al.* (1998). Nominal occupational categories were ordered on a scale of social standing after estimating association measures, using Goodman's row and column effects model II (Goodman, 1979). The number of occupational categories had to be reduced to three for the present analysis because of the limited number of observations. These categories are: working class occupations, representing a relatively low social standing, middle class occupations, and upper class occupations.

Although the distinction between structural and relative mobility (Simkus, 1984; van Leeuwen & Maas, 1996) is not at issue here, comparison of the marginal distributions of social standing between fathers and sons (-in-law) suggests that there was some structural mobility going on during the study period from the lower to the upper classes. The bottom panel of Table 1 indicates that 67·72% of the parents were working class and only 5·77% upper class, whereas in the child generation, the percentages were 59·32% and 15·75%, respectively. Perhaps family size limitation was used by parents as a strategy to be able to invest more in children, for example by

Table 1. Descriptive statistics of the variables used in the mobility models, Leuven (Belgium), 1866–1910, children of parents born in 1850

			n	%
Parental sample			212	100·00
Number of children with identified occupation per parental couple:				
1			107	50·47
2			58	27·36
3			34	16·04
3			9	4·25
4			4	1·89
Sample of children			381	100·00
Sons			272	71·43
Daughters			109	28·57
Sibsize at age 20:		%	Birth order	%
0		4·46	1	37·80
1		8·66	2	27·56
2		11·81	3	15·49
3		13·12	4	9·71
4		12·34	5	5·51
5		15·49	6	1·57
6		11·29	7	1·05
7		10·76	8	0·52
8		7·61	>8	0·78
>8		4·46	(*n*=381)	100·00
(*n*=381)		100·00		
Social status of the father	**Social status of the son(-in-law)**			
Row percentages	(1)	(2)	(3)	Total
(1) Upper class	40·91	22·73	36·36	100% (*n*=22)
(2) Middle class	22·77	32·67	44·55	100% (*n*=101)
(3) Working class	10·85	22·09	67·05	100% (*n*=258)
All	15·75	24·93	59·32	100% (*n*=381)
	(*n*=60)	(*n*=95)	(*n*=226)	
Column percentages	(1)	(2)	(3)	All
(1) Upper class	15·00	5·26	3·54	5·77
(2) Middle class	38·33	34·74	19·91	26·51
(3) Working class	46·67	60·00	76·55	67·72
Total	%100·00	%100·00	%100·00	%100·00

Source: Population Registers and Civil Registration records (Van Bavel, 2002).

allowing them to go to school, in order to make sure that they would be ready to occupy a position in the growing administrative occupations with a high social standing. The following analysis should make clear whether or not sibsize made a critical difference for the likelihood that a son or son-in-law would climb from a

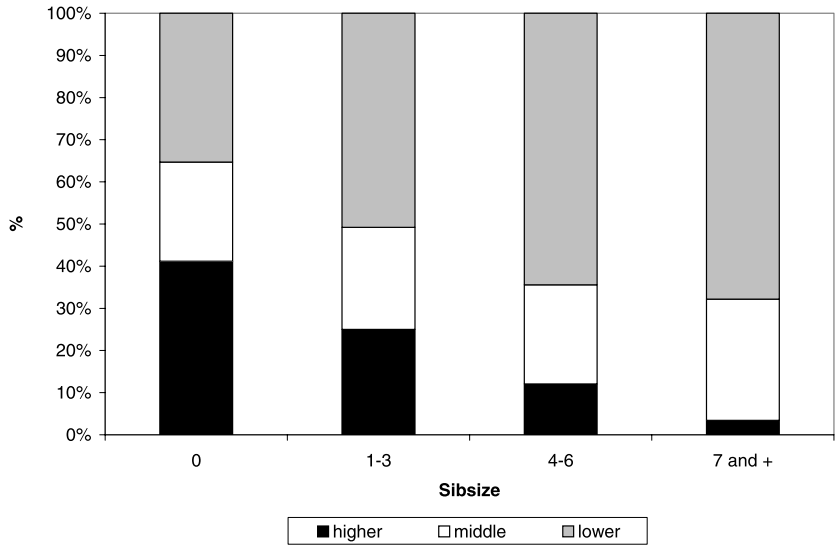

Fig. 1. Distribution of children's social status by number of siblings, Leuven 1866–1910. Source: as for Table 1 (n=381).

family background with lower social standing to the higher classes. To this end, the next paragraphs first provide bi- and trivariate descriptive statistics from the perspective of the children before turning to multivariate hypothesis testing from both the parental and the child perspective.

Results

Descriptive analysis

Clearly, there is some connection between the family size of orientation and children's own occupational status of destination. Figure 1 gives the two-way distribution of the occupational statuses of destination by sibsize. The figure shows a consistent tendency of decreasing proportions reaching the higher social statuses by increasing size of the parental family.

Of course, this tendency may be the result of intergenerational immobility rather than sibsize, because there is a strong relation between social background and the size of the family of procreation. That is: parents from the higher, white collar professional and business classes were the first to limit their fertility by means of parity-dependent stopping behaviour (Van Bavel, 2004b). Accordingly, their children's sibsizes were smaller as well. The effect of sibsize on children's own occupational status suggested by Fig. 1 may therefore be spurious.

Yet, Fig. 2 shows that the negative association between sibsize and achieved occupational position does not disappear after controlling for the ascribed social standing as measured by the occupation of the father. For example, the proportion of children with a working class background climbing up the social ladder was as high

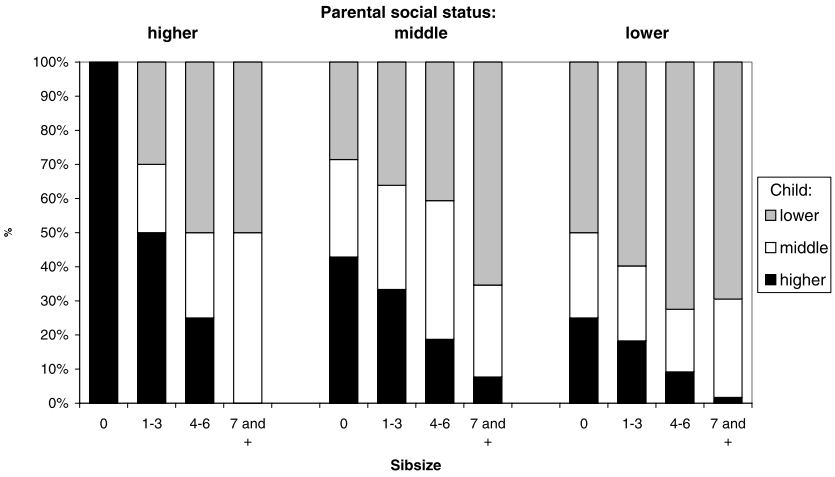

Fig. 2. Distribution of children's social status by parental social status and number of siblings, Leuven 1866–1910. Source: as for Table 1 (n=381).

as 25% for children who had no siblings at all and 18% for children with one, two or three siblings. The corresponding proportion was only 9% for children with four, five or six siblings, and only 2% for children with seven or more siblings.

Still, there is another reason why the effect of sibsize, suggested by both Figs 1 and 2, may be spurious. Indeed, the number of siblings is correlated with birth order: people with one or two siblings cannot have birth order six or seven, and first-born children are more likely to be found among families with one or two children than among bigger families. As a consequence, if birth order has an effect on social status, it may be captured by sibsize.

Figure 3 shows that there is indeed a connection between birth order and occupational position of destination, even after controlling for the parental social background. Due to small sample sizes at higher birth orders, the overall relation is somewhat more erratic than the one shown in Fig. 2. Nevertheless, the proportion reaching the higher social strata is consistently higher among first-, second- or third-born children than among children with a higher birth order.

To conclude, there are many inter-correlations between potentially important predictors of the occupational status of destination. Therefore, these covariates should be analysed within a multivariate framework. The next section does this by means of logistic regression analysis.

Multivariate analysis

Table 2 shows the results of a number of logistic regressions of the occupational statuses recorded for children. The top panel displays the results for the analysis from the parental perspective (Model (1)), the middle panel shows the results for the analysis from the child perspective, including only fixed parameters (Model (2)), and at the bottom are the results of the multilevel approach (Model (4)). In all cases, the

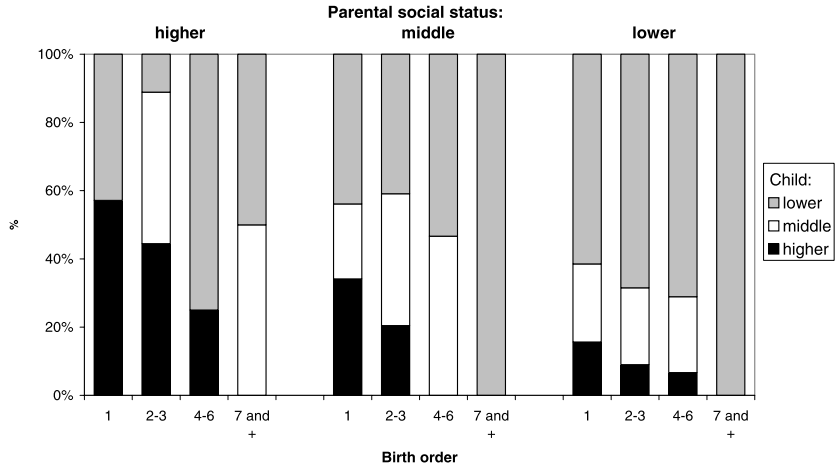

Fig. 3. Distribution of children's social status by parental social status and birth order, Leuven 1866–1910. Source: as for Table 1 (n=381).

dependent variable is the probability that children record the occupational status that is indicated in the three column headings of Table 2.

The results from the parental model clearly confirm that the status of the family of orientation was a major determinant of the social status of destination, as measured by the occupation of the father or father-in-law. According to the model, the proportion of children recording an upper class occupation rather than middle or working class, is estimated to be four and a half times higher for parents who were upper class themselves as compared with parents who were working class. For middle class parents, this odds ratio is estimated at 2·214, always comparing with working class parents.

Family size is measured as the number of children alive when the oldest child reaches age 20. After controlling for parental social status, the effect of family size on the proportion of children recording an upper rather than a middle or lower class occupation was clearly negative: according to the model estimate, per extra child in the family the odds decreased with factor 0·731. The effect of family size on the proportion of children with a working class destination was in the opposite direction but smaller in magnitude. There was no significant effect on the odds for middle class occupations.

As mentioned before, a major drawback of the parental model is that it cannot control for birth order because this is an individual characteristic. The fixed effect model from the child perspective (the second panel in Table 2) includes both individual birth order and family size. Family size is called sibsize there, i.e. the number of siblings alive at age 20 of the analysed child. The results confirm the effects of family size estimated from the parental perspective, both with respect to direction and order of magnitude. Birth order appears to have had an independent effect on the odds of ending up in the upper classes, apart from the sibsize effect, in the same direction and with a highly comparable order of magnitude. So, high sibsize was a drawback for everyone if the intention was to reach an upper class occupation. Being born at the back of the row only added to this effect.

Table 2. Logistic regression of the occupational statuses of children of parents born in 1850, Leuven 1866–1910 ($n=381$)

	Social status of destination								
	Upper			Middle			Lower		
	$e^{coeff.}$	SE^{coeff}	p	$e^{coeff.}$	SE^{coeff}	p	$e^{coeff.}$	SE^{coeff}	p
Parental perspective									
Intercept	0·577	0·359	0·126	0·235	0·309	<0·001	0·999	0·271	0·997
Family size	0·731	0·068	<0·001	1·033	0·047	0·486	1·138	0·044	0·003
Parental social status									
Lower (Ref.)	1·000	—	—	1·000	—	—	1·000	—	—
Upper	4·585	0·494	0·002	1·082	0·534	0·883	0·323	0·467	0·016
Middle	2·214	0·325	0·014	1·729	0·260	0·036	0·401	0·244	<0·001
Child perspective									
Fixed effects model									
Intercept	0·587	0·383	0·163	0·209	0·317	<·001	1·104	0·278	0·721
Sibsize	0·759	0·072	<0·001	1·033	0·051	0·519	1·126	0·048	0·013
Parental social status									
Lower (Ref.)	1·000	—	—	1·000	—	—	1·000	—	—
Upper	5·169	0·524	<0·002	0·978	0·542	0·968	0·319	0·488	0·019
Middle	2·143	0·328	0·020	1·700	0·262	0·043	0·409	0·247	<0·001
Birth order	0·756	0·141	0·047	1·002	0·083	0·983	1·120	0·079	0·150
Ego=daughter (Ref.=son)	1·349	0·323	0·354	1·664	0·258	0·048	0·530	0·243	0·009
Fixed and random effects (multilevel model)									
Overall intercept	0·408	0·557	0·110	0·194	0·362	<0·001	1·244	0·386	0·572
Sibsize	0·695	0·110	0·001	1·035	0·055	0·526	1·168	0·070	0·028
Parental social status									
Lower (Ref.)	1·000	—	—	1·000	—	—	1·000	—	—
Upper	10·577	0·870	0·007	0·959	0·575	0·942	0·192	0·744	0·028
Middle	2·702	0·486	0·042	1·745	0·287	0·054	0·301	0·387	0·002
Birth order	0·721	0·173	0·060	1·002	0·087	0·986	1·131	0·100	0·222
Ego=daughter (Ref.=son)	1·599	0·432	0·278	1·689	0·271	0·055	0·436	0·317	0·009
Family variance	2·315*	1·408	0·102	0·238*	0·442	0·590	1·733*	0·883	0·051

*The family variance is the only parameter estimate that is not reported in exponentiated form.
Source: as for Table 1.

Birth order and sibsize did not influence the probability of ending up in the middle classes, while the effects on the probability of recording a working class occupation were in the expected, positive direction: the more brothers and sisters, the higher the odds that children of parents born in 1850 were to be found in the working classes, even after controlling for paternal social status. As in the parental model, the magnitude of the estimated effect is smaller than the one for the upper class destination. The birth order effect is statistically significant neither for the working class nor for the middle class destination. Also this individual-level model confirms that paternal occupation was a major determinant of the occupational status of sons and sons-in-law.

Finally, controlling for all variables already mentioned, there seems to have been an interesting difference between the social fate of sons and daughters. That is: daughters were more likely to marry a man with a middle class occupation than sons were likely to end up with a middle class occupation themselves. The opposite holds for the working classes: holding the other covariates constant, daughters were less likely to end up in the working classes, as measured by their husband's occupations, than sons were, as measured by their own occupations. The reasons for this gender difference fall beyond the scope of this study.

As explained in the Methods section, the standard errors of the parameters of the fixed effects model are underestimations because they do not take intra-family correlation into account. Therefore, the bottom panel of Table 3 reports the estimates from a mixed model, which includes both the same fixed effects as the ones just discussed and one random effect parameter that captures the between-family variance.

The estimated family variance indicates that there may indeed have been some unobserved heterogeneity between families with respect to the odds of leading their children to upper and working class occupational statuses. Yet, the family variance is significantly different from zero only on the confidence level of just above 10% in the case of upper class destination, and just above 5% in the case of working class destinations. The best guess is that there really was significant family variance but that it cannot be estimated reliably with the available data.

Although, as expected, the estimated standard errors of all fixed regression parameters are inflated in the multilevel model, almost all parameters discussed in the context of the fixed effects model remain statistically significant in the multilevel approach. Many estimated effects of family characteristics are even stronger in the multilevel context. For example, the negative effect of sibsize on the odds of the upper class destination is now estimated at factor 0·695 instead of factor 0·759 in the previous model. For the working class destination, the odds ratio is inflated from 1·126 in the earlier model to 1·168 in the new one. The determining effect of parental occupational status is estimated dramatically higher in the multilevel context. For example: children with an upper class background are ten times as likely to end up with an upper rather than a middle or lower class occupation themselves, as compared with children with a lower class background. The birth order effect, which is an individual characteristic, retains the same order of magnitude, although the *p* value increases due to the inflated standard error.

Discussion

The hypothesis that family size has been an important determinant of intergenerational mobility during the demographic transition is an old one. It has been reformulated in several ways in several disciplines. Yet, there is surprisingly little evidence supporting or contradicting it.

This paper has analysed 19th century sociodemographic life course data from an urban population in Belgium. It has explored three models for testing the hypothesis that children from smaller families were more likely to climb up to, or stay in, the upper classes than children from bigger families. The results from all three regression models support the hypothesis: the larger the size of the family of orientation, the

higher the odds of having a lower class destination and the lower the odds of ending up in the upper classes. This holds irrespective of the original social background. Analyses not reported in this paper show that the estimated sibsize effect retains its direction when separate regression lines are fitted for each parental occupational status group. For children with a working class background, the effects remain statistically significant in the separate analysis. For the rest, the number of observations is too low.

Of course, this is only one analysis with a rudimentary occupational status scheme applied to one small data set. It remains to be seen whether future analyses with more data from different populations confirm the patterns found in Leuven between 1866 and 1910.

The major drawback to the analysis from the parental perspective is that it is hard, if not impossible, to control for the characteristics of individual children. At least one individual characteristic was shown to have had an effect on the occupational status of destination: higher birth orders were less likely to register a higher class occupation. To the rescue of the parental model counts the unexpected finding that the birth order effect seems to have been largely independent of the sibsize effect.

The multilevel model counts one parameter more than the fixed effect model: it includes one random effect parameter that should capture the variability in status destinations among families for unobserved reasons. This mixed model is more valid but less efficient than the fixed effects model; the estimated standard errors of the fixed regression parameters are inflated but they are statistically more correct. This means that the threshold for rejecting null-hypotheses heightens but the risk of making a type I error (rejecting the null hypothesis while in fact it is true) is accordingly reduced. This suffices to prefer the multilevel approach, especially when one takes a sceptical stance towards the estimated effects.

Finally, the following questions, not dealt with here, merit more attention in future analyses. First: does sibsize matter in all social classes or are there any interactions between social class of origin and sibsize effects? Preliminary tests not shown here suggest that sibsize matters in all social classes, but the sample is too small to go into details and do robust separate estimations for all social classes.

Secondly, too little attention has gone in the present paper to gender differences. The finding that daughters were more likely than sons, all else being equal, to find themselves in the middle classes and less likely to end up in the working classes suggests that gender-specific processes were at work. In addition, the gender composition of the group of siblings remained completely untouched in this paper. It would be interesting to see whether the effects of sibsize were dependent on the proportion of brothers and sisters, and on the interaction between ego's and siblings' sexes.

Thirdly, the empirical analysis used the occupation of son-in-law as an indicator of daughter's own social standing. This implies that the dynamics of mate selection are involved in the process as well, not just intergenerational mobility. It would be interesting to analyse with more detail the relationships between sibsize, mating and intergenerational mobility, but a bigger sample is needed to this end.

Fertility can be expected to decline when society evolves in such a way that lower fertility enhances the probability that children climb the social ladder, assuming that

there would be an evolved motive disposition for upward mobility. The analysis in this paper showed, for one urban population in Belgium, that fertility limitation was indeed effective in enhancing the likelihood that children would enhance their social status. The evolutionary significance of this can be illustrated by looking at the sons of the biggest occupational group, i.e. the sons born in the working classes. Overall, 126 out of 381 (33%) of these climbed the social ladder and held a middle or higher class occupation themselves (see Table 1). Yet, the number of sibling they had made a big difference (cf. Fig. 2): among working class sons who had at most three siblings, the proportion who climbed to a middle or upper class occupation was 41%. Among sons with more siblings, this percentage was only 29%.

If the relation between family size and intergenerational mobility has a major explanatory value for the fertility transition, the kind of effects found here should *not* be found *before* the demographic transition. Maybe the number of children was less important for children's social mobility in pre-industrial Europe? Maybe this connection emerged only during the economic modernization? If that were true, the linkage between family size and intergenerational mobility may well be an important piece in the puzzle of the demographic transition.

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References

Alfonso-Sánchez, M. A., Peña, J. A. & Calderón, R. (2003) Time trends and determinants of completed family size in a rural community from the Basque area of Spain. *Journal of Biosocial Science* **35**, 481–497.

Ariès, Ph. (1980) Two successive motivations for the declining birth rate in the West. *Population and Development Review* **6**, 645–650.

Banks, J. A. (1954(1969)) *Prosperity and Parenthood: A Study of Family Planning among the Victorian Middle Classes*. Routledge & Kegan, London.

Bean, F. D. & Swicegood, G. (1979) Intergenerational occupational mobility and fertility: a reassessment. *American Sociological Review* **44**, 608–619.

Beauchamp, G. (1994) The functional analysis of human fertility decisions. *Ethology and Sociobiology* **15**, 31–53.

Becker, G. S. (1991) *A Treatise on the Family. Enlarged Edition.* Harvard University Press, Cambridge, MA.

Blake, J. (1989) *Family Size and Achievement*. University of California Press, Berkeley.

Dumont, A. (1890) *Dépopulation et civilisation: étude démographique*. Economica, Paris.

Goodman, L. A. (1979) Simple models for the analysis of association in cross-classifications having ordered categories. *Journal of the American Statistical Association* **74**, 537–552.

Haller, M. (1981) Marriage, women, and social stratification: a theoretical critique. *American Journal of Sociology* **86**, 766–795.

Herr, E. (1995) The census, estimation biases, and female labor-force participation rates in 1880 Colorado. *Historical Methods* **28**, 167–181.

Hrdy, S. B. (1999) *Mother Nature. A History of Mothers, Infants, and Natural Selection*. Pantheon Books, New York.

Kaplan, H. S. & Lancaster, J. B. (2003) An evolutionary and ecological analysis of human fertility, mating patterns, and parental investment. In Wachter, K. W. & Bulatao, R. A. (eds) *Offspring. Human Fertility Behavior in Biodemographic Perspective.* The National Academy Press, Washington, DC, pp. 170–223.

Kaplan, H. S., Lancaster, J. B. & Anderson, K. G. (1998) Human parental investment and fertility: the life histories of men in Albuquerque. In Booth, A. & Crouter, A. C. (eds) *Men in Families: When do They Get Involved? What Difference Does it Make?* Lawrence Erlbaum, Mahwah, NJ, pp. 55–109.

Kasarda, J. D. & Billy, J. O. G. (1985) Social mobility and fertility. *Annual Review of Sociology* **11,** 305–328.

Kreft, I. & de Leeuw, J. (1998) *Introducing Multilevel Modeling*. Sage, London.

Lesthaeghe, R. (1977) *The Decline of Belgian Fertility, 1800–1970*. Princeton University Press, Princeton, NJ.

Livi-Bacci, M. (2001) *A Concise History of World Population*. Blackwell, Cambridge, MA.

MacDonald, K. (1997) Life history theory and human reproductive behavior: environmental/ contextual influences and heritable variation. *Human Nature* **8**, 327–359.

MacDonald, K. (1999) An evolutionary perspective on human fertility. *Population and Environment* **21**, 223–246.

Matthijs, K. (2001) *De mateloze negentiende eeuw. Bevolking, huwelijk, gezin en sociale verandering*. Universitaire Pers, Leuven.

Matthijs, K., Van Bavel, J. & Van de Velde, I. (1997) *Leuven in de negentiende eeuw. De bevolking: een spiegel van het dagelijkse leven*. ACCO, Leuven.

Mayr, E. (2001) *What Evolution Is*. Basic Books, New York.

Morgan, S. Ph. & King, R. B. (2001) Why have children in the 21st century? Biological predisposition, social coercion, rational choice. *European Journal of Population* **17**, 3–20.

Simkus, A. (1984) Structural transformation and social mobility: Hungary 1938–1973. *American Sociological Review* **49**, 291–307.

Sobel, M. E. (1985) Social mobility and fertility revisited: some new models for the analysis of the mobility effects hypothesis. *American Sociological Review* **50**, 699–712.

Szreter, S. (1996) *Fertility, Class and Gender in Britain, 1860–1940*. Cambridge University Press, Cambridge.

Van Bavel, J. (2002) *Van natuurlijke naar gecontroleerde vruchtbaarheid? Geboortebeperking in Leuven, 1846–1910*. [*From Natural to Controlled Fertility? Birth Limitation in Leuven, 1846–1910.*] Leuven University Press, Leuven. (Sociology Today **6**).

Van Bavel, J. (2004a) Deliberate birth spacing before the fertility transition in Europe: evidence from 19th century Belgium. *Population Studies* **58**, 95–107.

Van Bavel, J. (2004b) Diffusion effects in the European fertility transition: historical evidence from within a Belgian town (1846–1910). *European Journal of Population* **20**, 63–85.

Van Bavel, J., Peeters, H. & Matthijs, K. (1998) Connections between intergenerational and marital mobility. A case study: Leuven, 1830–1910. *Historical Methods* **31**, 122–134.

van Leeuwen, M. H. D. & Maas, I. (1996) Long-term social mobility: research agenda and a case study (Berlin, 1825–1957). *Continuity and Change* **11**, 399–433.

Westoff, C. F. (1981) Another look at fertility and social mobility. *Population Studies* **35**, 132–135.

Zimmer, B. G. (1981) The impact of social mobility on fertility: a reconsideration. *Population Studies* **35**, 120–131.