Socioeconomic Differences and Family Clustering of Infant and Child Mortality: A Multilevel Analysis of Rural Southern Sweden, 1766-1895

Tommy Bengtsson and Martin Dribe
Centre for Economic Demography and Department of Economic History
Lund University, Sweden
Tommy.Bengtsson@ekh.lu.se

Abstract

This paper focuses on how differences by socio-economic status, sex, and family unit in infant and child mortality developed during the first stage of the demographic transition. It uses multilevel Cox regression controlling for shared unobserved factors at the family level included to examine this issue. The problem of comparing the impact of unobserved factors at family level with the effects of observed factors is solved by employing a new method for converting the variation stemming from unobserved factors at family level into Median Hazard Ratios (MHR), directly comparable with relative risks. The data are for a rural area in Southern Sweden and comes from the Scanian Demographic Database. The principal findings are that while socioeconomic differences in child mortality widened and became much larger than sex differences by the end of the nineteenth century, differences between families belonging to the same socioeconomic group were even larger.

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Introduction

While it is widely recognized that the socioeconomic differences in mortality today are substantial (Valkonen 1993), it remains an open question how large they were in the past. The fact that public health measures, as well as subsidized medical care, have reached an increasingly larger share of the population during the course of the twentieth century is an argument in favor of the *convergence* view. Economic resources are also more evenly spread today than in the past, partly by transfers across individuals. Empirical support for the divergence view can be found from several investigations mainly of the urban situation (see Antonovsky 1967 for an overview).

The convergence view has been challenged by Link and Phelan (1995), who argue that socioeconomic inequalities in mortality basically have remained more or less *constant* over the last 200 years. They argue that while the specific mechanisms varied over time, the upper classes were always able to avoid premature deaths since they had larger access to resources (Link and Phelan 1995). The empirical evidence supporting this view is rather weak since Lind and Phelan mainly cited anecdotic evidence from nineteenth century observers, not investigations covering long time periods (van Poppel, Jennissen, and Mandemakers 2006).

The convergence view has also been challenged by historical demographers, who argue that socioeconomic differences instead have *diverged* during the last 150 years or so (Smith 1983). Before then socioeconomic differences in mortality were minor or possible even reversed. The argument is that mortality in the past was mainly due to communicable, often highly virulent, diseases. Since upper classes were at least as exposed to diseases, they suffered as much or even more than the rest of the population. The English upper classes, for example, experienced about the same mortality as ordinary people up until the mid-eighteenth century (Hollingsworth 1957; Livi Bacci 1991; Wrigley and Schofield 1981). Evidence from other parts of Europe and North America suggest that it was primarily during the course of the nineteenth century that the social gradient in mortality emerged and widened (Riley 2001; Woods 2000). This is, in fact, to some extent in line with Antonovsky, who argues that the convergence stage starting around 1850 have been preceded by a period of divergence starting around 1650 (Antonovsky 1967). Thus both advocators of the convergence and the divergence view believe that socioeconomic differences in mortality were minor far back in time. The difference is the dating of the start of the divergence and what happened afterwards.

Historical demographers have also pointed to the fact that regional differences in mortality were often large in the past, much larger than socioeconomic differences, whether due to population density, communication networks, sanitation and access to safe water, organization of poor relief and health care, breast-feeding practice or differences in agricultural productivity (Smith 1983; Reid 1997; Woods, Williams, and Galley 1993). First of all, mortality was much higher in urban areas; the expression *urban penalty* has often been used to describe it. Second, differences were often large also between rural areas. Geographic differences seem to have declined during the late nineteenth and early twentieth century; the difference between rural and urban areas, as well as within urban areas, becoming smaller (Fogel 2004; Woods, Williams, and Galley 1993), which was likely an outcome of public investments in sanitation systems and health care.

From the mid-eighteenth century onwards female life expectancy at birth improves more rapidly than for males enlarging the gap between the two sexes. More specifically, life expectancy in best-practice countries from the 1840s onwards has improved with almost three month per year; the corresponding figure for males is 8.6 percent less, which makes a considerable difference over a 150 year period (Oeppen and Vaupel 2002). As an example, the difference in life expectancy increased from a few years to five years or more in favor of females in Sweden from the mid-nineteenth century until today (Statistics Sweden 1999, Tables 5.4-5.5). While the enlargement of this gap is indisputable, it does not mean that females had lower mortality in all ages in the nineteenth century. In nineteenth century Europe excess female mortality, especially from late childhood through childbearing ages, has frequently been observed, which has been connected to adverse conditions for women primarily due to childbearing, work load, and intra-household resource allocation (e.g. Alter, Manfredini and Nystedt 2004; Humphries 1991; Johansson 1984; Kennedy 1973: chapter 3; Klasen 1998; Stolnitz 1956).

Finally, the differences in mortality between families were large. Certain families seem to have experienced much higher mortality than others, especially with respect to mortality in the first year of life (Edvinsson et al. 2005; Lynch and Greenhouse 1994). Whether this clustering of mortality was more prominent among certain socio-economic groups than others we do not know, neither if it diminished as life expectancy at birth improved.

As life expectancy increased, disease patterns have changed, from high to low virulent infectious diseases, and later to chronic diseases like coronary heart diseases and cancer (Omran 1971; Preston 1976; Rotberg and Rabb 1983). The age pattern in mortality has also changed. Improvements in life expectancy in the past—up until the mid-20^{th} century—primarily stem from reductions in infant and child mortality, although adult mortality started to decline in the mid-nineteenth century.

The aim of this paper is to study the socioeconomic differences in infant and child (1-15 years) mortality, to compare with differences by sex, location and other factors including unobserved factors at family level, and to look at the development over time. As regards the variation at family level due to unobserved factors, we employ a new measure to make it comparable to other factors. We study the period 1766-1895; a period during which mortality started to decline secularly. This period also saw a thorough transformation of agriculture, the beginning of industrialization, and an increasing proletarization of the population. We focus on infants and children because their mortality development contributed most to overall changes in life expectancy in this period. We begin by providing an overview of the study area and data used, and then turn to the statistical models and how to compare the family level variation to observed socioeconomic differences. Next we present the empirical results and discuss their implications.

Area and data

The data used are based on local population registers for five rural parishes in western Scania in southern Sweden: Hög, Kävlinge, Halmstad, Sireköpinge, and Kågeröd.[1] They are all about 10 kilometers from the coast in the Western part of Scania, which is the southernmost province of Sweden. In 1766, the five parishes had 2,509 inhabitants. By 1895 that figure had increased to 5,539: an average annual increase of 0.6 percent during this 129-year period, a

[1] The data is maintained by the Scanian Demographic Database, which is a collaborative project between the Regional Archives in Lund and the Centre for Economic Demography, Lund University. The source material is described in Reuterswärd and Olsson (1993), and the quality of data is analysed in Bengtsson and Lundh (1991).

somewhat slower rate of growth than for rural Sweden as a whole during the same period, which was 0.7 percent per year (Statistics Sweden 1999).

Family reconstitutions, accomplished using data for births, marriages and deaths for the period from the late seventeenth century until 1894, have been combined with register data. The reconstitutions were carried out automatically using a computer program (see Bengtsson and Lundh 1991). They have been checked manually too and linked to other register data; chiefly poll-tax registers (*mantalslängder*), which provide yearly information on landholding, and the catechetical examination registers (*husförhörslängder*), with information on migration and household context. The database contains all individuals born in the different parishes, or migrating into them. Instead of sampling any particular group (a birth cohort for example) each individual is followed from birth, or time of arrival in the parish, to death, or migration out again.

The sample used here is children aged 0-15 years. Out-migrants are censored at time of departure. For the period after about 1815 we have individual level information on migration, while before this date we only have migration information at the family level. Thus before 1815 we cannot identify when individual family members moved, but only when the family as a whole left. However, since very few children left home before 15 (less than five percent, see Dribe 2000:115) the lack of individual level information on migration has very limited practical relevance. The quality of the information of births and infants deaths has been controlled for by estimating the proportions of infant deaths taking place in the first months of life for different social groups and by estimating the sex-ratio at birth (Bengtsson and Lundh 1994; Bengtsson and Dribe forthcoming).

We employ a four-category social structure based on access to land. The upper classes (clergymen, nobles, etc) are left out of the analysis, since they constituted no more than about one percent of the population (see Bengtsson and Dribe 2005:353). The first group consists of freeholders and tenants on crown land who had sufficient land at their disposal for them to be able to provide for their family and pay land rents or taxes.2 Freeholders owned their land and paid land taxes, while crown tenants farmed land that belonged to the Crown and paid land rent. Although important differences between these groups existed, for example when it came

[2] We have used 1/16 *mantal* (a rough measure of the productive potential of the farm) as the limit of subsistence, which is also they way the contemporary society defined it (see Dribe 2000: chap. 2 for a discussion).

to inheritance and subdivision of land (see, e.g., Dribe and Lundh 2005; Gadd 2000:76, 198–202), their situations were in many respect highly similar, especially compared to other social groups. Both groups had non-family members employed and both groups typically produced a surplus for the market. They are merged into a single group, hereafter called freeholders.

The second group is manorial tenants with land above subsistence level (hereafter called tenants). They were part of a manorial system and their conditions differed in important respects, both socially and politically, from that of freeholders and crown tenants (e.g. Gadd 2000:76–78, 86). While they too employed non-family labor, they leased their farms only for a certain number of years at the time. At least until the 1860s, they paid most of their rent in labor, working on the demesne (Olsson 2002).

The third group—the semi-landless—consists of smallholders with land below subsistence level, crofters (*torpare*) and cottars (*gatehusmän*), who sometimes had landholdings equal to that of smallholders, but other times lacked land altogether. Unfortunately it is impossible from the sources to distinguish between crofters with and without land. This makes the semi-landless group somewhat heterogeneous, containing smallholders and crofters with land below subsistence level as well as some crofters lacking land altogether.

Finally, the fourth social group—the landless—contains various occupational groups without access to land, i.e. artisans, soldiers, married servants and agricultural workers. During most of the period under study the landless groups mainly consisted of rural people, but in the final decades of the nineteenth century one of the parishes (Kävlinge) grew from a rural village to a small town following the building of the railroad, and the establishment of several factories. This also changed the composition of the landless group somewhat, which now included groups without land, but that was not necessarily poor. In order to capture this new stratification a more refined social classification should be used, allowing further differentiation of the landless groups. But since it is only relevant for a 10-15 year period out of the 130 year period under study, we have not pursued this issue further here.

Table 1 displays the distribution of parental social status for the children (0-15 years) included in the sample. First it is evident that the proportion of landless families increased a great deal, from 25 percent in the first period to 57 percent in the last period. This is connected to a larger process of proletarization following the agricultural transformation and early industrialization of the nineteenth century. At the same time the proportion of tenants declined profoundly from 36 percent in the first period to only 8 percent in the last, while the proportion freeholders increased somewhat. The diverging trends of freeholders and tenants are explained by a thorough structural change in the estate sector, where land formerly owned by the estates were subdivided and sold – sometimes to the former tenants but more often to a few large landowners or people coming in from other parishes (see Dribe and Olsson 2006). The proportion of semi-landless first increased as crofters were used increasingly instead of tenants on the manors, and then declined in the last period when the estates started to base their labor force on married servants on yearly contracts, so called *statare,* belonging to the landless groups.

- Table 1 here

Statistical model

To estimate the influence of various factors on infant and child mortality, and how this changed over time, we use a Cox proportional hazards model with frailty (see Therneau and Grambsch 2000:232–233):

$$ln\ h_{ij}(a) = ln\ h_0(a) + \beta x_{ij} + \omega_j$$

where: $h_{ij}(a)$ is the hazard of death for an individual i of family j at duration (age) a, $h_0(a)$ is the baseline hazard, i.e. the hazard function for an individual having the value zero on all covariates, β is the vector of parameters for the individual covariates (x_{ij}) in the model, and ω_j is a vector of the random effects (frailties) at family level, assumed to be normally distributed (Gaussian).[3]

Usually when using frailty models, or multilevel modeling more generally, one is only interested in "controlling for" unobserved variation in the data (unobserved heterogeneity). More recently, however, methods to assess the actual importance of this unobserved variation have been presented. Larsen and Merlo (2005) devise a method for calculating Median Odds

[3] The estimations were made using the eha package in R, developed by Göran Broström at Umeå University in Sweden.

Ratios (MOR) in multilevel logistic regression, which can be generalized to "Median Hazard Ratio" (MHR) in the Cox frailty model. The MHR quantifies the importance of the variation at the secondary level (family in our case). The idea is to estimate the difference in risk between randomly chosen individuals with the same value on the covariates in the model. The MHR is the median difference in risk between individuals from a high risk family and low risk family. Provided that the random effects are normally distributed (Gaussian frailty) the MHR is defined as:

$$MHR = \exp[\sqrt{(2*\sigma^2)}*\Phi^{-1}(0.75)]$$

where: σ^2 is the frailty variance, and $\Phi^{-1}(0.75)$ is the 75 percent percentile of the normal distribution (see Larsen and Merlo 2005 for a derivation of this formula). The MHR is always greater than one and indicates the median increase in risk for a given individual from a high risk environment compared to an individual from a low risk environment. It is directly comparable to the hazard ratios (relative risks) of ordinary covariates in the Cox model. Hence, it is a very simple, but yet informative, measure of the importance of unobserved variation between families. In the analysis below we will compare the MHR of family level variation to hazard ratios of belonging to different social groups, and see how it evolves over time, which will give us an idea of the importance of unobserved family factors for infant and child mortality over time.

We begin with a basic model that contains sex, socioeconomic status, birth date, and family level frailty, and which serves to capture the basic differences between social groups and between families. In the next step an extended model is estimated that includes more covariates at the individual and family level: parish of residence, presence of parents, food prices, and season of birth. Finally, in order to assess the importance of the family level variation in different social groups, separate models are estimated for each socioeconomic group. All models are estimated separately for infants (0-1) and children (1-15) since much research suggest that the mechanisms behind mortality differ greatly between infants and children.

Results

Figures 1-3 displays the Kaplan-Meier estimates of the survival functions by sex, socioeconomic status and parish for the entire period under study. They show the basic age pattern of mortality without controlling for any variables. From Figure 1 it is quite clear that boys had somewhat higher mortality than girls, and that this difference emerged already in the first year of life. The difference was not very large: 81 percent of the boys survived their first year, and the corresponding figure for girls is 82 percent. If we instead look at the proportion of newborns surviving to their tenth birthday the figure for males is 70 percent and for females 71 percent. Turning to the socioeconomic pattern in Figure 2, there seems to have been some differences, but they changed with age. Tenants had among the highest mortality in the entire age span, while landless had relatively low mortality in infancy and early childhood, but high mortality in later childhood. Parish of residence also mattered for survival as is evident from Figure 3. Children in Hög consistently experienced lower mortality than children in the other parishes. The differences between the other parishes varied by age.

- Figures 1-3 here

Thus far we have only been looking at the basic differences according to sex, socioeconomic group and parish of residence before estimating any models, but said nothing about changes over time, or the impact of other potentially important variables. Since the social structure differed considerably between the parishes it is also impossible to determine whether the low mortality in Hög was accounted for by its lack of tenants, or if there were differences between the parishes also when controlling for the socioeconomic structure. To do this we now turn to the multivariate model estimations.

Table 2 displays the estimates of the basic model for infants. It shows that girls had 10-12 percent lower mortality risks than boys in the first year of life and that the socioeconomic differences is doubling over time, starting at a 20 percent difference between highest and lowest strata. These differences are, however, at best only statistically significant at 10 percent level. The only statistically significant estimations for any observed covariate is for date of birth, during the second period; children born one year later has a 1 percent lower mortality, thus the difference being born in the beginning and the end of the period is roughly 45 percent, quite a rapid decline.

Turning to the effects of unobserved factors at the family level, the MHR shows that the median increase in mortality for a given individual from a high risk family compared to an individual from a low risk family was 60 to 105 percent, statistically significant in all periods. Thus the family effect, net of other factors included in the model, is twice as strong as the effects of socioeconomic status and five times stronger than the gender effects until 1815, and from then on even stronger relatively speaking. This is not very surprising since our previous analyses have shown that family levels factors, other than socioeconomic ones, are important in the first year of life (Bengtsson 2004). Such factors include both observed factors at family level, like whether both parents are alive and not, and unobserved factors, like length of intensity of breast-feeding and caring habits.

- Table 2 here

Table 3 shows the results of the same model for children aged 1-15 years. This is a group that is more sensitive to the socioeconomic conditions of the family as well as external factors, such as food price changes, according to our previous findings (Bengtsson 1993, 2004; Johansson 2004). Thus it is in this age group that we expect a social gradient to emerge, and this is also what we find. Also here the gap in socioeconomic differences is widening over time. In fact, mortality is somewhat higher among the wealthiest group, the freeholders, than in any other group in the first period, while considerably low in the final period. Girls, likewise, have higher mortality than boys in the first period, but lower later on. The socioeconomic gap is larger than for infants; children of tenants, semi-landless and landless families had 43 to 71 percent higher mortality than children of freeholders, the wealthiest group, in the period after 1860. The difference between the two sexes varied between plus 18 to minus 11 percent. The ‘un-modeled’ family effect (MHR) varies between 48 and 71 percent, less than for infants. Still the inter-familial differences were larger than, or at least as large as, the socioeconomic gap and much larger the sex gap, which was only significant for the first period. It is also clear that while socioeconomic differences emerged and got stronger over time, the importance of family level variation did not decline but widened as well.

- Table 3 here

When expanding the model to include more observables, we find that whether both parents were alive and present had a great impact on survival in infancy, and a bit less later in childhood (Tables 4 and 5). Food prices had no effect on infants, only on children, a result generally attributed to breast feeding practices (Livi Bacci 1991) and only children of lower social strata were affected (Bengtsson 2000; 2004; Johansson 2004). Season of birth and area of residence were important too, but to a much lower degree. Interestingly, the importance of family level variation did not decline when adding presence of parents, parish of residence, food prices, and season of birth. Thus belonging to the “right” family was at least as important as any observed factor included in the models.

- Tables 4 and 5 here

The question is whether the importance of family level variation differed according to socioeconomic status. To deal with this issue, we have estimated one model for each socioeconomic group (parish of residence has been excluded because some socioeconomic groups – freeholders and tenants – are not present in all parishes and we wanted the same models for all groups). The reason for including presence of parents and season of birth is to be able to compare the effects of unobserved variables at family level with some other important covariates. The model is estimated for the entire period to keep the number of observations reasonable high.

- Tables 6 and 7 here

Tables 6 and 7 show that the importance of family level variation was high in all social groups, though less for freeholders. Thus the inter-family differences due to unobserved factors are not likely to be related to wealth but to other factors. Another interesting finding is that while the wealthiest group could compensate for lack of a parent as regards children in ages 1 to 15 years, this was not true for infants indicating that socioeconomic factors were of greater importance for children than for infants.

Conclusion

In this paper we have used a newly developed indicator to quantify the impact of family level heterogeneity in infant and child mortality, which are the most important age-groups for the long-term improvements in life expectancy up until the mid-twentieth century. Instead of only controlling for this kind of heterogeneity, as has been common in previous research, we have actually been able to show the degree of its importance and compare it with observed differences between the sexes, socioeconomic groups, parish of residence, as well as some other variables at the individual or family level. We study a period when socioeconomic differences in mortality can be expected to have emerged, and we could demonstrate an increased socioeconomic differentiation in child mortality (1-15 years), during a period of improvements in living standards in the latter part of the nineteenth century. The seemingly paradoxical result is likely to be due to the general reduction of mortality in highly virulent diseases, which no or only a small social gradient, due to their low or non existent nutrition dependency. For infants we found no similar increase in socioeconomic differences, which stresses the different patterns of mortality for infants and children. The general patters during this period is that while socio-economic status mattered more than sex for child mortality, spatial differences (parish of residence) mattered even more. We could, however, also show that the family level heterogeneity was of similar or greater importance than socioeconomic status. For both infants and children these family effects were of considerable importance, which corroborates previous research on the family clustering of mortality in infancy. It is also interesting to note that the importance of the family level did not decline over time as socioeconomic differences became more pronounced. If anything the trend was towards an even greater importance of the family level over time. The family level was also important in all socioeconomic groups, even though it seems to have been of greatest importance among the landless.

Taken together, our results stress familial aspects of mortality. Even when we control for observed variables measuring wealth, season of birth, parish of residence, presence of parents and sex, there were differences between families of the same socioeconomic group in terms of both infant and child mortality. The family level heterogeneity might have been due to differences in caring practices, housing and residential conditions, breastfeeding, or inherited factors. Which of these that were most important is impossible to assess at this stage.

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Table 1. Distribution of parental social status (%) for children 0-15 in the Scanian sample 1766-1895.

	1766-1815	1815-1860	1860-1895
Freeholders	10	10	12
Tenants	36	19	8
Semi-landless	30	37	23
Landless	25	33	57
Total	100	100	100
Person years at risk	49187	65302	62588

Source: The Scanian Demographic Database.

Table 2. Cox regression estimates (relative risks) of infant mortality, 1766-1895 in the Scanian sample. Basic model.

	1766-1815			1815-1860			1860-1895		
	Mean	RR	p	Mean	RR	p	Mean	RR	p
Sex									
Males	0.50	1.00	ref.cat	0.51	1.00	ref.cat	0.52	1.00	ref.cat
Females	0.50	0.90	0.09	0.49	0.89	0.06	0.49	0.88	0.12
Social status									
Freeholders	0.10	1.00	ref.cat	0.10	1.00	ref.cat	0.11	1.00	ref.cat
Tenants	0.40	1.12	0.36	0.19	1.20	0.15	0.08	1.31	0.22
Semi-landless	0.31	1.05	0.72	0.34	1.07	0.55	0.21	0.92	0.65
Landless	0.19	1.22	0.11	0.37	0.99	0.94	0.61	1.29	0.11
Birthdate	1790.91	1.00	0.51	1838.47	0.99	0.00	1876.68	0.99	0.17
Var(random effect)		0.24	0.00		0.27	0.01		0.56	0.00
MHR		1.60			1.64			2.05	
Events		1186			1117			606	
Person years at risk		4013			5599			4916	
Overall p (χ^2)		0.00			0.00			0.00	

Source: The Scanian Demographic Database.

Table 3. Cox regression estimates (relative risks) of child mortality (1-15), 1766-1895 in the Scanian sample. Basic model.

	1766-1815			1815-1860			1860-1895		
	Mean	RR	p	Mean	RR	p	Mean	RR	p
Sex									
Males	0.51	1.00	ref.cat	0.50	1.00	ref.cat	0.52	1.00	ref.cat
Females	0.49	1.18	0.05	0.50	0.89	0.14	0.48	0.99	0.89
Social status									
Freeholders	0.10	1.00	ref.cat	0.11	1.00	ref.cat	0.12	1.00	ref.cat
Tenants	0.26	0.76	0.05	0.19	1.05	0.76	0.08	1.50	0.05
Semi-landless	0.30	0.92	0.55	0.38	1.06	0.70	0.23	1.43	0.04
Landless	0.26	0.87	0.36	0.33	1.20	0.20	0.57	1.71	0.00
Birthdate	1783.45	1.00	0.27	1831.38	1.00	0.25	1869.42	1.00	0.96
Var(random effect)		0.17	0.23		0.26	0.07		0.35	0.01
MHR		1.48			1.63			1.76	
Events		617			736			712	
Person years at risk		45174			59703			57672	
Overall p (χ^2)		0.00			0.00			0.00	

Source: The Scanian Demographic Database.

Table 4. Cox regression estimates (relative risks) of infant mortality, 1766-1895 in the Scanian sample. Extended model.

	1766-1815			1815-1860			1860-1895		
	Mean	RR	P	Mean	RR	p	Mean	RR	p
Sex									
Males	0.50	1.00	ref.cat	0.51	1.00	ref.cat	0.52	1.00	ref.cat
Females	0.50	0.91	0.10	0.49	0.89	0.06	0.49	0.89	0.18
Social status									
Freeholders	0.10	1.00	ref.cat	0.10	1.00	ref.cat	0.11	1.00	ref.cat
Tenants	0.40	0.96	0.77	0.19	1.04	0.81	0.08	1.35	0.20
Semi-landless	0.31	0.91	0.55	0.34	0.97	0.80	0.21	0.92	0.65
Landless	0.19	1.07	0.64	0.37	0.88	0.34	0.61	1.30	0.12
Birthdate	1791.91	1.00	0.70	1838.47	0.99	0.00	1876.68	0.99	0.16
Parish									
Hög	0.09	1.00	ref.cat	0.11	1.00	ref.cat	0.09	1.00	ref.cat
Kävlinge	0.10	0.88	0.42	0.14	1.04	0.80	0.13	0.94	0.77
Halmstad	0.17	1.15	0.38	0.18	1.20	0.20	0.19	0.93	0.71
Sireköpinge	0.19	1.15	0.38	0.20	1.11	0.46	0.28	1.11	0.55
Kågeröd	0.46	1.14	0.38	0.37	1.31	0.04	0.32	0.97	0.87
Presence of parents									
Both present	0.97	1.00	ref.cat	0.97	1.00	ref.cat	0.98	1.00	ref.cat
Both not present	0.03	1.75	0.00	0.03	1.82	0.00	0.02	1.75	0.02
Season of birth									
Dec-Feb	0.27	1.00	ref.cat	0.27	1.00	ref.cat	0.25	1.00	ref.cat
Mar-May	0.24	1.11	0.19	0.25	1.06	0.50	0.26	1.26	0.05
Jun-Aug	0.22	0.85	0.06	0.22	0.93	0.43	0.24	1.06	0.61
Sep-Nov	0.27	0.98	0.77	0.26	0.87	0.11	0.25	1.11	0.38
Rye price	-0.01	1.20	0.73	0.00	1.92	0.20	0.00	1.33	0.76
Rye × Tenants		1.10	0.86		0.77	0.67		2.27	0.53
Rye × Semi-landless		0.60	0.38		0.56	0.31		0.79	0.85
Rye × Landless		0.79	0.70		0.50	0.22		0.96	0.97
Var(random effect)		0.25	0.00		0.27	0.01		0.57	0.00
MHR		1.61			1.64			2.05	

Events	1186	1117	606
Person years at risk	4013	5599	4916
Overall p (χ^2)	0.00	0.00	0.00

Source: The Scanian Demographic Database.

Table 5. Cox regression estimates (relative risks) of child mortality (1-15), 1766-1895 in the Scanian sample. Extended model.

	1766-1815			1815-1860			1860-1895		
	Mean	RR	p	Mean	RR	p	Mean	RR	p
Sex									
Males	0.51	1.00	ref.cat	0.50	1.00	ref.cat	0.52	1.00	ref.cat
Females	0.49	1.17	0.06	0.50	0.90	0.15	0.48	0.99	0.86
Social status									
Freeholders	0.10	1.00	ref.cat	0.11	1.00	ref.cat	0.12	1.00	ref.cat
Tenants	0.36	0.69	0.06	0.19	1.26	0.18	0.08	1.83	0.01
Semi-landless	0.30	0.86	0.40	0.38	1.14	0.39	0.23	1.56	0.01
Landless	0.26	0.80	0.21	0.33	1.31	0.07	0.57	1.84	0.00
Birthdate	1783.45	1.00	0.23	1831.38	1.00	0.28	1869.42	1.00	0.78
Parish									
Hög	0.09	1.00	ref.cat	0.11	1.00	ref.cat	0.09	1.00	ref.cat
Kävlinge	0.09	1.30	0.18	0.14	1.24	0.16	0.12	1.45	0.04
Halmstad	0.17	1.12	0.57	0.18	1.05	0.75	0.20	1.04	0.84
Sireköpinge	0.19	1.40	0.10	0.19	0.92	0.59	0.27	1.20	0.27
Kågeröd	0.46	1.23	0.26	0.38	0.81	0.15	0.33	0.95	0.75
Presence of parents									
Both present	0.89	1.00	ref.cat	0.91	1.00	ref.cat	0.93	1.00	ref.cat
Both not present	0.11	1.18	0.30	0.09	1.34	0.04	0.08	1.19	0.28
Season of birth									
Dec-Feb	0.27	1.00	ref.cat	0.27	1.00	ref.cat	0.25	1.00	ref.cat
Mar-May	0.24	0.81	0.08	0.24	1.04	0.72	0.26	0.90	0.33
Jun-Aug	0.22	0.94	0.59	0.22	0.92	0.44	0.24	1.01	0.96
Sep-Nov	0.28	0.93	0.52	0.27	0.96	0.72	0.25	1.08	0.48
Rye price	-0.01	1.39	0.59	0.01	0.93	0.90	0.00	0.54	0.51
Rye × Tenants		1.57	0.52		1.53	0.57		1.80	0.66
Rye × Semi-landless		0.89	0.87		3.46	0.07		4.12	0.20
Rye × Landless		2.32	0.26		1.08	0.91		2.60	0.34
Var(random effect)		0.19	0.20		0.25	0.09		0.34	0.02
MHR		1.51			1.60			1.74	

Events	617	736	712
Person years at risk	45174	59703	57672
Overall p (χ^2)	0.00	0.00	0.00

Source: The Scanian Demographic Database.

Table 6. Cox regression estimates (relative risks) of infant mortality by socio-economic status, 1766-1895 in the Scanian sample.

	Freeholders			Tenants			Semi-landless			Landless		
	Mean	RR	p	Mean	RR	p	Mean	RR	p	Mean	RR	p
Sex												
Males	0.52	1.00	ref.cat	0.50	1.00	ref.cat	0.52	1.00	ref.cat	0.51	1.00	ref.cat
Females	0.48	1.01	0.96	0.50	0.87	0.07	0.48	0.87	0.06	0.49	0.90	0.09
Birthdate	1838.26	0.99	0.00	1815.95	0.99	0.00	1833.31	0.99	0.00	1853.35	0.99	0.00
Presence of parents												
Both present	0.98	1.00	ref.cat	0.97	1.00	ref.cat	0.98	1.00	ref.cat	0.97	1.00	ref.cat
Both not present	0.02	3.20	0.00	0.03	1.34	0.23	0.02	1.72	0.01	0.03	1.78	0.00
Season of birth												
Dec-Feb	0.26	1.00	ref.cat	0.28	1.00	ref.cat	0.26	1.00	ref.cat	0.26	1.00	ref.cat
Mar-May	0.26	1.49	0.02	0.24	0.93	0.49	0.25	1.27	0.02	0.25	1.08	0.37
Jun-Aug	0.23	0.87	0.46	0.22	0.77	0.01	0.23	1.18	0.12	0.23	0.89	0.20
Sep-Nov	0.26	0.98	0.93	0.26	0.77	0.01	0.26	1.24	0.04	0.26	0.92	0.33
Rye price	-0.01	1.61	0.16	-0.01	1.46	0.05	0.00	0.92	0.67	-0.01	1.04	0.82
Var(random effect)		0.11	0.34		0.29	0.00		0.39	0.00		0.43	0.00
MHR		1.37			1.67			1.82			1.87	
Events		270			779			814			1046	
Person years at risk		1504			3030			4152			5842	
Overall p (χ^2)		0.00			0.00			0.00			0.00	

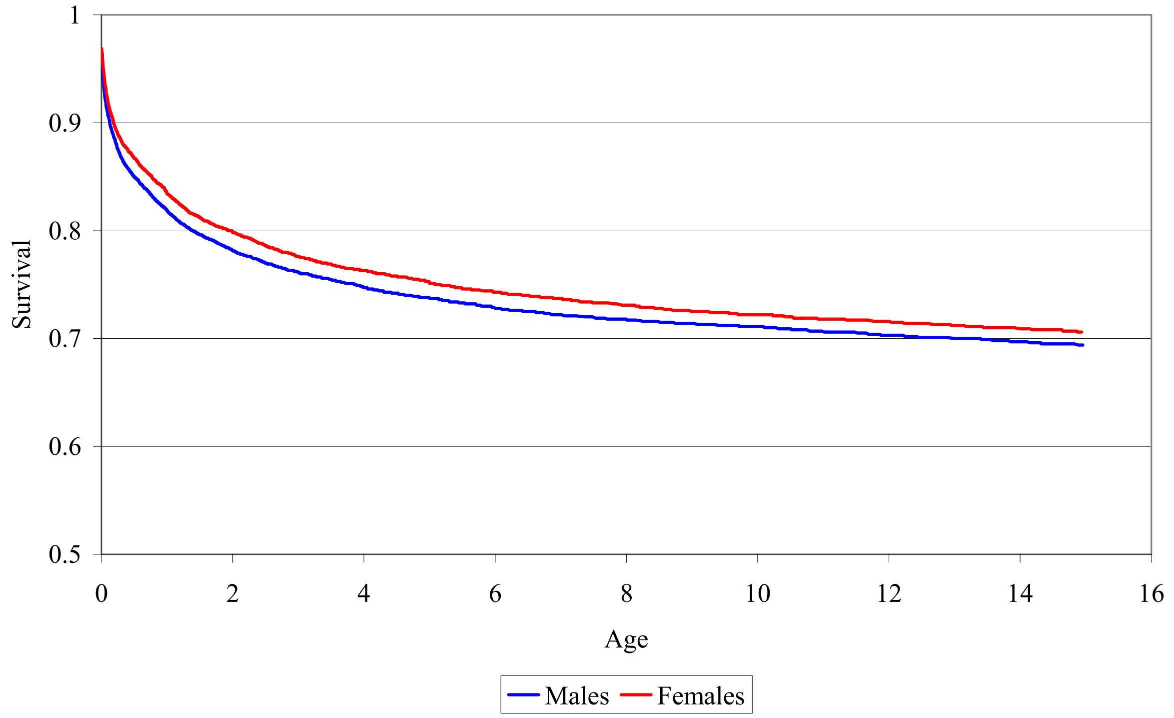
Source: The Scanian Demographic Database.

Table 7. Cox regression estimates (relative risks) of child mortality (1-15) by socio-economic status, 1766-1895 in the Scanian sample.

	Freeholders			Tenants			Semi-landless			Landless		
	Mean	RR	p	Mean	RR	p	Mean	RR	p	Mean	RR	p
Sex												
Males	0.53	1.00	ref.cat	0.51	1.00	ref.cat	0.51	1.00	ref.cat	0.51	1.00	ref.cat
Females	0.47	1.15	0.33	0.49	1.06	0.56	0.49	0.98	0.84	0.49	0.97	0.66
Birthdate	1834.96	0.99	0.00	1810.95	1.00	0.50	1828.14	1.00	0.00	1843.70	1.00	0.65
Presence of parents												
Both present	0.93	1.00	ref.cat	0.94	1.00	ref.cat	0.92	1.00	ref.cat	0.88	1.00	ref.cat
Both not present	0.07	1.39	0.29	0.06	1.10	0.69	0.08	1.19	0.31	0.12	1.25	0.07
Season of birth												
Dec-Feb	0.25	1.00	ref.cat	0.28	1.00	ref.cat	0.26	1.00	ref.cat	0.26	1.00	ref.cat
Mar-May	0.24	0.79	0.25	0.24	1.12	0.42	0.26	0.83	0.10	0.24	0.94	0.51
Jun-Aug	0.24	0.85	0.42	0.22	1.11	0.49	0.22	0.90	0.38	0.23	0.96	0.69
Sep-Nov	0.27	0.85	0.41	0.26	1.25	0.10	0.27	0.87	0.20	0.27	1.01	0.94
Rye price	0.00	1.02	0.96	0.00	1.73	0.04	0.00	2.09	0.00	0.00	1.45	0.06
Var(random effect)		0.35	0.11		0.01	0.38		0.25	0.15		0.45	0.00
MHR		1.76			1.07			1.60			1.89	
Events		196			404			606			859	
Person years at risk		17360			32318			49040			63831	
Overall p (χ^2)		0.00			0.00			0.00			0.00	

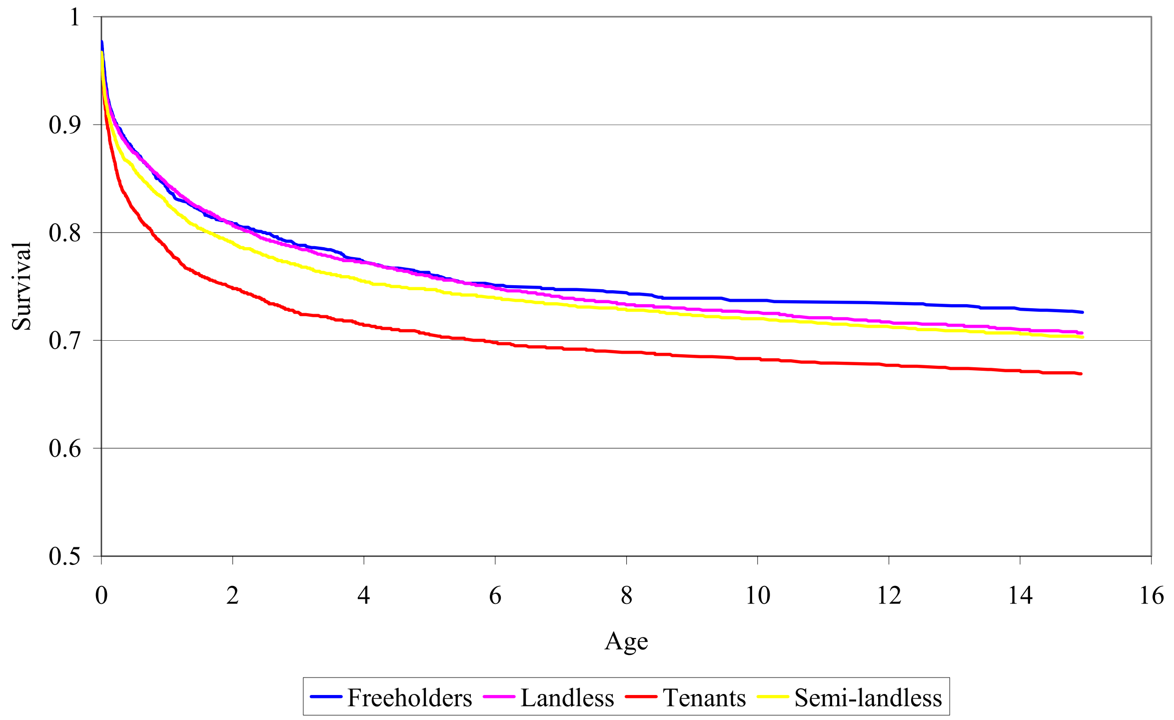
Source: The Scanian Demographic Database.

Figure 1. Survival functions 1766-1895 by sex.



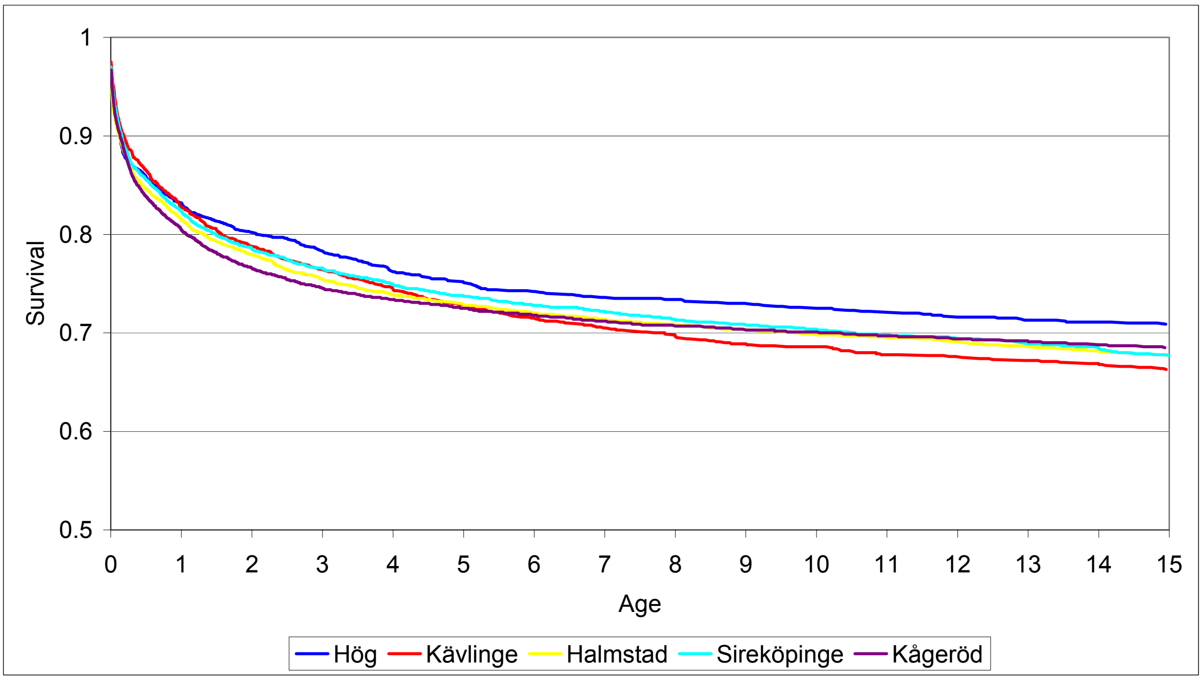
Source: The Scanian Demographic database.

Figure 2. Survival functions 1766-1895 by socioeconomic status.



Source: The Scanian Demographic database.

Figure 3. Survival functions 1766-1895 by parish of residence.



Source: The Scanian Demographic database.