Family Networks versus Genetics in Social Outcomes, England 1750-2019

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Abstract

In any society individuals are embedded in family networks: parents, grandparents, uncles, aunts, and cousins. Most social science disciplines - anthropology, economics, sociology and psychology - assume these family networks play an important role in the outcomes for children. It is certainly the case that even controlling for parent characteristics, the characteristics of other relatives help predict child outcomes. Here we show, however, using an extensive multigenerational lineage of English families 1750-2019 that there is good evidence that family networks played no causal role in child outcomes. In this lineage we know which relatives were alive or dead when children are born, which were geographically proximate at birth, and which distant. We find dead and distant relatives were just as strongly predictive of social outcomes as living and proximate ones. Relatives seemingly provide only information about the underlying characteristics of parents. Parents alone determined child social outcomes. We further show that the size of the relative effects, at least in the case of grandparents, is of the magnitude a simple first order Markov model of status transmission would predict, where the outcomes of parents derive from their underlying transmittable status only with noise. Genetic transmission of social outcomes is one such model.

1 Introduction

It is clear that in predicting the social outcomes for children, the status of relatives other than the parents is informative, even when we control for the characteristics of the parent.[1] This is true for the lineage data used in this study. The outcomes we have for children include occupational status, wealth at death, two measures of educational status, survival to age 21, and adult age at death. Tables 1 and 2 show, controlling for father characteristics, the coefficients on each of these variables for grandfathers and uncles, and for grandfathers and cousins. Column 2 of table 1 shows, for example, the predictive effect of grandfather wealth on child wealth, controlling for the characteristics of the father, and for the wealth of an uncle. It similarly shows the predictive value of uncle wealth controllng for father and grandfather. In each case we have included just one uncle or one cousin in the regression estimate. If a child had a high status grandfather, then

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[1]See, for example Chan and Boliver (2013); Dribe and Helgertz (2016); Ferrie et al. (2016); Knigge (2016); Møllegaard and Jæger (2015); Zeng and Xie (2014)

controlling for the father's status, this predicted higher status for that child. The same holds for uncles and cousins. Controlling for fathers and also grandfathers, the higher their status the higher the predicted status for a child. The magnitudes of the coefficients in tables 1 and 2 suggest that if all collateral relatives were included their combined contribution to predicting outcomes for children would typically be greater than that for the father alone.

Table 1: The Influence of Relatives on Outcomes, Controlling for Fathers, Grandfathers and Uncles

	Outcome:				
	Ln Wealth	Occupational Rank	Education	At School 14-20	Adult Age at Death
	(1)	(2)	(3)	(4)	(5)
Father	.269***	.371***	.186***	.351***	.131***
	(.005)	(.005)	(.003)	(.017)	(.005)
Grandfather	.129***	.158***	.078***	.157***	.107***
	(.004)	(.005)	(.003)	(.018)	(.006)
Uncle	.081***	.159***	.109***	.151***	.058***
	(.005)	(.005)	(.003)	(.017)	(.004)
Observations	36,034	51,991	68,976	39,920	75,198
R^2	.311	.487	.173	.274	.052

Note: *p<0.1; **p<0.05; ***p<0.01
Errors clustered at the grandfather level.
For schooling the independent variable is occupational rank.
Age at death is normalized (Z-score)
Female indicator Included but not reported

Why does the status of relatives other than parents predict outcomes in this way? One prominent school of thought across social sciences - anthropology, economics, education, psychology and sociology - is that relatives other than parents play a causal role in the outcomes for children. In evolutionary anthropology, for example, part of the reasoning behind this is the puzzle as to why women typically enter menopause long before the end of their life. A proposed solution to this puzzle is the "grandmother hypothesis." Grandmothers forego reproduction at later ages in order to improve the reproductive success of their children (Williams (1957); Lahdenperä et al. (2004)). Sarah Hrdy argued more generally that humans evolved as cooperative breeders — relatives other than the parents, such as grandparents, uncles, aunts and older siblings – all contribute to the rearing of children (Hrdy (1999); Mace and Sear (2005)). Such arguments have been made for the contribution of childless uncles and aunts, for example, to their nieces and nephews in the inclusive fitness literature of evolutionary anthropology (Pollet and Dunbar, 2008, Tanskanen, 2013). Sociologists have also argued that there is evidence of transfers and influence from collateral relatives in child rearing. As we saw above, controlling for parent characteristics grandparents' characteristics are associated with those of their grandchildren (Chan and Boliver, 2013, Prix and Pfeffer, 2017, Zeng and Zie, 2014).

Table 2: The Influence of Relatives on Outcomes, Controlling for Fathers, Grandfathers and Cousins

	Outcome:				
	Ln Wealth	Occupational Rank	Education	At School 14-20	Adult Age at Death
	(1)	(2)	(3)	(4)	(5)
Father	.269***	.401***	.229***	.367***	.141***
	(.005)	(.005)	(.003)	(.019)	(.005)
Grandfather	.161***	.166***	.090***	.141***	.082***
	(.004)	(.005)	(.004)	(.019)	(.005)
Cousin	.104***	.162***	.133***	.202***	.032***
	(.006)	(.004)	(.004)	(.017)	(.004)
Observations	31,835	44,476	62,760	37,006	78,908
R^2	.351	.482	.188	.279	.039

Note: *p<0.1; **p<0.05; ***p<0.01
Errors clustered at the grandfather level.
For schooling the independent variable is occupational rank.
Age at death is normalized (Z-score)
Female indicator Included but not reported

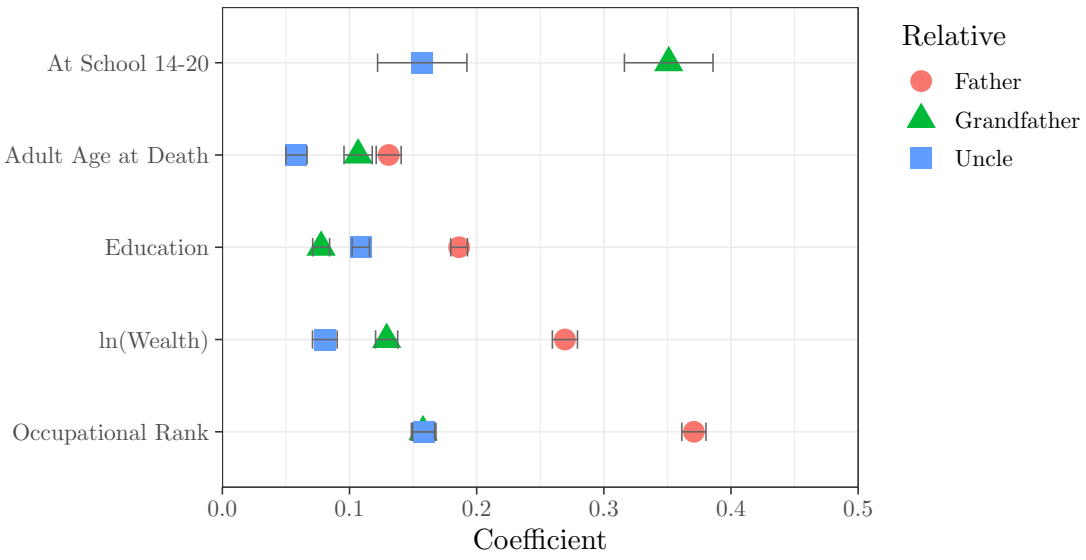

Figure 1: Male Correlations in Status

However, as Song and Mare (2019) note of these association studies

> their capacity to establish the importance of grandparent effects is incomplete. The importance of grandparents is, broadly speaking, proportional to the mutual availability or exposure of grandparents and grandchildren.....many of the most important mechanisms through which grandparents may influence grandchildren, especially when grandparents assist parents in raising children, require mutual exposure of grandparent and grandchild generations.....Even when grandparents live apart from their adult offspring and their grandchildren, they are likely to exert a much stronger influence while alive than after they die. This suggests that estimated effects of grandparents' resources on the well-being of their grandchildren may vary depending on the degree to which grandchildren are exposed to their grandchildren (and vice versa), whether through coresidence or shared lifetimes (Song and Mare, 2019).

Zeng and Xie (2014), for example, have evidence for rural China that the educational level of grandparents influences that of grandchildren, but only where they are co-resident with the grandchildren. Dead or living non co-resident grandparents educational attainment has no influence. This is the kind of evidence needed to establish a causal connection.[2] The results from Knigge (2016), however, do not indicate a substantial role for causal grandfather effects. Thus the causal role of grandparents and other relatives is an unresolved issue.[3]

If grandparents and other relatives have a causal role in child outomes by supplying resources, or being models for children, then three things should potentially matter to the size of that effect. First, is the relative alive at the time of the birth of the child? Dead relatives will play no direct causal role.[4] . Second, does the relative live close enough to the family to interact with the child? Distant relatives may be able to send money to support a child, but they will not be able to supply childcare, education, or cooked meals. Nor will they be able to shape a child by social interaction. Third, how much attention and resources would different relatives be expected to supply? In particular the input of care and resources to a child from grandparents would be expected to be greater than from uncles/aunts. Uncles and aunts will mainly have their own dependent children that need care and attention, while grandparents will generally be without dependent children by the time their own children are producing grandchildren. Further among uncles and aunts, some will be childless and some not. Those that are childless will be expected to supply much more aid to their nephews and nieces.

Another possibility, though, is that relatives other than parents play no causal role in child outcomes, whether or not they interact with children. Parents are able to provide all the material support necessary for the full development of children. Instead the status of collateral relatives merely provide information as to the true underlying status of the parents, which is what alone determines the outcomes for the children. This "parents only" transmission could stem from purely social and cultural mechanisms of transmission. However, it would also be the pattern of transmission were the main mechanism of transmission to be additive genetics. In the additive genetics case social status is determined by a first order Markov process where the only thing that matters

[2]The empirical evidence for this effect in Zeng and Xie is rather weak, however, given the very large sample size.

[3]See Knigge (2016) table 3. The coefficient on the interaction terms for the grandfather effects by space and time are less than the standard errors for the main grandfather effect estimate.

[4]In the case of wealth relatives can leave assets to as yet unborn children in the English legal system. But if the will specifies "£x to each of my grandchildren" then only grandchildren alive at the time of death qualify. Only if the will specifies such conditions as "£x to each of my grandchildren at age 18" will all children born after the testator's death, but before the oldest child reaches age 18, inherit.

is the genetic value of the parents. Grandparents serve only to give information on the underlying genotype of parents. In this interpretation dead grandparents are just as informative about outcomes as living ones. Also geographically distant relatives are just as informative as geographically proximate ones in predicting outcomes. Uncles and aunts with children of their own provide just as much information as those who are childless.

For example, in the simple model of status transmission posited in Clark et al. (2014), observed social status y is derived from a slow changing underlying status x, where

$$y_t = x_t + u_t \tag{1}$$

$$x_t = bx_{t-1} + e_t \tag{2}$$

This model of transmission is first order Markov. Only the parents matter. But grandparent characteristics with such a structure will correlate with those of grandchildren, even controlling for parents. If the grandfather has high status relative to the father, then on average the inheritable x component of the observed father status y will be high relative to the transitory component (u), so the predicted status of the child will be higher. Thus grandfather, or uncle, or cousin, status provides information for a given father y on the likely value of the underlying x. The status of relatives predicts child outcomes, even with complete controls for father status. But there is no causal association.

Equations (1) and (2) also serve to describe social outcomes in the case where there is additive genetic determination of social outcomes. In this case y is the phenotype value, and x the genotype value. x regresses towards the mean because of imperfect assortative mating, with the value of b depending on the correlation of parents genotype values. Again the status of relatives provides a predictor of the relative contribution of the genotype versus the random component u to the phenotype. But other relatives play no causal role.

The additive genetic model also suggests a weighting for how significant the information content of different relatives will be. That information will be proportionate to the genetic distance between relatives. That distance for relatives up to second cousins is shown in table 3. Note in the table that the genetic distance will be the same for an individual grandparent as for uncles/aunts. So each uncle/aunt should be as informative about child outcomes as each grandparent if status derives mostly from genetic transmission of characteristics. Similarly the status information from great grandfathers, who will almost all have no direct interaction with their great grandchild, should be the same as for cousins, who will be contemporaneous.

Relative to Child	Matching on Genotype	Matching on Phenotype
Parent-Parent	$h^2 m$	r
Mid-parent	h^2	h^2
Single parent	$h^2 \frac{1+m}{2}$	$h^2 \frac{1+r}{2}$
Siblings	$h^2 \frac{1+m}{2}$	$h^2 \frac{1+m}{2}$
Avuncular	$h^2(\frac{1+m}{2})^2$	$h^2(\frac{1+m}{2})\frac{1+r}{2}$
Grandparent	$h^2(\frac{1+m}{2})^2$	$h^2(\frac{1+m}{2})\frac{1+r}{2}$
Cousins	$h^2(\frac{1+m}{2})^3$	$h^2(\frac{1+m}{2})^2\frac{1+r}{2}$
Gt Grandparent	$h^2(\frac{1+m}{2})^3$	$h^2(\frac{1+m}{2})^2\frac{1+r}{2}$
Second Cousins	$h^2(\frac{1+m}{2})^5$	$h^2(\frac{1+m}{2})^4\frac{1+r}{2}$

Table 3: Phenotype Correlations for a Genetically Inherited Trait
Note: m is the correlation of parents in genotype, r the correlation in phenotype.

2 Testing for the Causal Influence of Relatives

2.1 Living versus Dead

In this paper we use an extended lineage of English families 1750-2019, the Families of England (FOE) database, to test these various accounts of the role of relatives in social outcomes. The FOE database has in total 367,000 individuals, but only around 52,000 for which there are measures of social status. For this lineage we have birth and death dates for family members, as well as their geographic location at birth, marriage and death. We also have various social outcomes: wealth at death, occupational status, attainment of higher education, length of education, child survival rates, and adult longevity. Typically we have social outcomes only for people born 1750-1930, an era where women did not have social status independent of their husbands. In terms of transfers of resources across generations it could be argued that women matter more: grandmothers rather than grandfathers. However, below we can also proxy for the influence of grandmothers through the status of their husbands.

We can thus first estimate for each child outcome, y_i, the parameters in the expressions

$$y_i = a + \sum b_{jF} y_{ijF} + b_Z y_{iZ} + d_{iZL}(a_{ZL} + b_{ZL} y_{iZ}) + \epsilon \tag{3}$$

where y_{ijF} is the father's social outcomes y_{iZ} is the social outcome of other relative (grandfather, grandmother, uncle, cousin) and d_{iZL} = indicator for other relative being alive at time of birth of child. The coefficients of interest here are b_Z and b_{ZL}. If $b_{ZL} = 0$ then the status of living relatives is no more predictive of child outcomes than that of dead relatives. Since dead relatives cannot interact with children, this implies there can be no causal connection between the social status of relatives and the subsequent social status of the child. Thus if $b_{ZL} = 0$, then the relatives other than parents are playing no causal role. Only if $b_{ZL} > 0$ do we have an indication that relatives other than parents are playing a causal role in child outcomes. The relative size of b_Z and b_{ZL}indicates how much the status fof relatives just signals the underlying status of parents, b_Z, and how much relatives might matter through interactions with children, b_{ZL}.

On the causal account of the effects of collateral relatives the predicted value of the intercept parameter a_{ZL} could be positive or negative. If interaction with grandparents and uncles and aunts

always improves social outcomes for children then a_{ZL}would be positive. Having living relatives, whatever their social status would improve your outcome compared to having a dead relative. However, it is possible that interaction with lower status grandparents or uncles/aunts could reduce outcomes for children. If these relatives model or convey low expectations on education, occupation and other social outcomes, then interacting with them could hurt the prospects of children. Thus on the causal account of the effects of relatives there is no simple prediction about the value of a_{ZL}. However, on the hypothesis that relatives play no causal role in outcomes, a_{ZL} will be unambiguously 0.

As is shown in table 4 children with living rather than dead grandfathers and uncles have fathers who are on average 5 years younger at their birth. Such children fall further down the birth order within their family. This all predictable. But interestingly those with living relatives also have fathers with lower measured social status than those with dead grandfathers or dead uncles. Thus higher status families were having children when fathers were older, making it more likely that grandfathers or uncles were dead at the child's birth.[5] Will this nullify the test proposed in equation (3) on the effects of dead versus living relatives?

Table 4: Characteristics of Children with Alive/Dead Relatives

Outcome	Mean	SD	Mean	SD	t	N
	Alive		*Dead*			
Grandfather						
Birth Order	3.15	2.38	3.83	2.75	45.12	23,902
ln(Wealth)	-1.58	2.53	-1.20	2.70	11.40	27,033
Occ. Rank	0.29	0.18	0.31	0.20	10.92	32,594
Educated	0.07	0.26	0.09	0.29	6.43	51,501
ln(Wealth), Father	-1.87	2.69	-1.61	3.02	10.38	73,240
Occ. Rank, Father	0.29	0.19	0.32	0.21	17.92	69,828
Educated, Father	0.09	0.28	0.12	0.32	14.57	102,009
Father Age at Child Birth	30.75	6.16	36.00	8.24	122.52	111,152
Uncles						
Birth Order	3.39	2.50	4.00	2.81	67.44	74,730
ln(Wealth	-1.69	2.45	-1.26	2.67	22.82	85,493
Occ. Rank	0.28	0.17	0.31	0.20	25.94	97,197
Educated	0.06	0.24	0.09	0.29	18.24	156,068
ln(Wealth), Father	-2.06	2.58	-1.73	2.94	23.90	222,650
Occ. Rank, Father	0.28	0.18	0.31	0.21	44.62	208,090
Educated, Father	0.07	0.25	0.11	0.31	33.04	299,630
Father Age at Child Birth	30.83	6.24	36.37	8.34	218.90	329,629

t is the t-statistic for difference in means (2 tailed)

The selectivity towards higher status fathers in the case of dead relatives should, however, not

[5]For fathers born 1830-1880 the average age at childbirth was nearly 4 years older for those at the top of the occupational status ranking than those at the bottom.

influence the estimated slope coefficients b_Z and b_{ZL}in equation (3). As long as the measured status of dead versus living relatives is equally indicative of their true social status, then on a causal account of the effects of relatives, we should expect $b_{ZL} > 0$. The only measure of grandfather or uncle social status that will be directly influenced by whether the grandfather or uncle is dead is wealth at death, since there is a significant positive effect of death age on wealth. Thus grandfathers or uncles dead when the child is born will have a downward biased report on wealth at death compared to living relatives. Otherwise the status measures should be equally indicative of true status for both living and dead relatives.

Equation (3) assumes that the relatives are either alive or dead for the whole childhood of children. In practice some grandfathers or uncles alive at the time the child is born are dead before the child reaches age 21. Thus in the estimations below we also use measures of years of exposure to relatives as the variables of interest. We also discuss below how to implement equation (3) when children have partial exposure to relatives in terms of only a partial period in childhood where both child and relative are alive.

2.2 Close versus Distant

To test whether geographically close relatives have more influence on child outcomes than distant ones we estimate similarly to (3) for the subset of relatives alive at time of child birth,

$$y_i = a + \sum b_{jF} y_{ijF} + b_Z y_{iZ} + d_{iZC}(a_{ZC} + b_{ZC} y_{iZ}) + \epsilon \tag{4}$$

where d_{iZC} is an indicator for the living relative being located closer than 20 km to the child place of birth.[6] The distance of 20km is used since the bulk of the data concerns children born 1800-1920 before automobile travel became common. At a distance of more than 20 km daily interactions with relatives would be highly unlikely. Here $b_{ZC} > 0$ indicates that close relatives have more influence on child outcomes that distant relatives. This would support a causal role for other relatives. $b_{ZC} = 0$ would indicate again that other relatives are playing no causal role, since for those who can interact with children their status is no more predictive of outcomes than those with no such interaction possible.

Again on the causal account of the effects of collateral relatives the predicted value of the intercept parameter for relatives living close by, a_{ZL}, could be positive or negative. Again, however, on the hypothesis that relatives play no causal role in outcomes, a_{ZL} will be unambiguously 0.

The way in which a child would typically be born more than 20 km from their grandparents would be if the father had moved. As table 5 shows movers, those whose place of death is more than 20 km from their place of birth, are of higher status than stayers.[7] Thus close grandparents will tend to be in lower status families than distant ones. For uncles a distant uncle would equally be the product of the child's father having moved, or the uncle having moved, or both. Since movement is more for higher status individuals we would again expect distant uncles to be more common in higher status families.

As noted we have location for individuals at birth, marriage and death. We match children at birth to their relatives (other than father who is assumed to be at the same location) at their

[6]We use the geodesic distance (calculated using the disGeo function in the Geosphere package in R) between the birth location of the child and the death location of selected relatives.

[7]Distance is estimated as before as the geodesic distance (calculated using the disGeo function in the Geosphere package in R) between the birth and death location.

Table 5: Characteristics of Movers versus Stayers

	Stayers	se	N	Movers	se	N	Diff. T-Stat
Distance, Birth to Death	4.14	0.08	10,560	117.31	1.27	6,239	1,417.35
Higher Education (indicator)	0.06	0.00	4,103	0.13	0.01	3,824	17.23
Occupational Rank	0.26	0.00	3,001	0.34	0.00	2,939	24.08
ln(Wealth)	-2.07	0.04	4,279	-1.17	0.04	4,742	24.52
Age at Death (>20)	64.59	0.24	10,488	69.59	0.22	6,218	20.81

Source: FOE Database

location at death. There is thus a potential mismatch. A distant uncle may have lived in the same locality as the child during their childhood, but moved away later in life. A child may have moved away from relatives in the course of their childhood. This means that there will be some bias in that stayers will typically have been present for the whole childhood of children, while movers will have been absent for less than the entire childhood. But on average children will have more exposure to stayers than to movers.

2.3 Childless Uncles

Uncles without children of their own should provide more support for their nieces and nephews than those with their own dependent children. This claim is made both on the practical grounds that uncles with their own children have less time to interact with and support nieces and nephews, and are also less likely to co-reside with them. Some recent studies report empirically observing such effects, with childless uncles, for example, more likely to co-reside with nieces and nephews (Pollet and Dunbar, 2008, Tanskanen, 2013).

We thus estimate for each child outcome, y_i, each the parameters in the expressions

$$y_i = a + \sum b_{jF} y_{ijF} + b_U y_{iU} + d_{iCU}(a_{CU} + b_{CU} y_{iU}) + \epsilon \tag{5}$$

where y_{iF} is the father's social outcome y_{iU} is the social outcome of an uncle, and d_{iCU} = indicator for uncle having children of their own. The coefficient of interest here is b_{CU}. Did the status of uncles without children matter more in predicting child social outcomes than their uncles who were childless? If $b_{CU} = 0$, then uncles with children of their own are equivalent in providing information about child outcomes as uncles without their own children. That would be consistent with uncles in fact playing no causal role in child outcomes. If in contrast $b_{CU} > 0$ we have an indication that uncles are playing a causal role in child outcomes.

Again the expected value of a_{CU} is ambiguous under the causal interpretation. Childless uncles might always provide benefits to children, through resource transfers, or through childcare, or through social interactions. But it could also be that low status childless uncles disadvantage their nieces and nephews by requiring support from their parents, or by increasing crowding in the home, or by disrupting the home. On the hypothesis that relatives play no causal role in outcomes, a_{CU} will be unambiguously 0.

As above, childless uncles and those with children are not equivalent in terms of social status. As table 6 shows uncles with children (defined as uncles with at least ibe child born) are of lower status than childless uncles. As before this should not influence the estimates of $b_U$or b_{CU}.

Table 6: Characteristics of Children with Childless/Non Childless Uncles

Outcome	Mean	SD	Mean	SD	t	N
	Childless		*Has Children*			
Female	0.48	0.50	0.48	0.50	0.37	101,991
Birth Order	3.53	2.63	3.63	2.63	7.95	29,286
ln(Wealth	-1.14	2.74	-1.64	2.47	-20.52	25,485
Occ. Rank	0.32	0.21	0.28	0.18	-26.31	34,647
Educated	0.11	0.31	0.07	0.25	-16.81	56,211
ln(Wealth), Father	-1.44	3.03	-2.06	2.63	-33.78	68,094
Occ. Rank, Father	0.33	0.22	0.28	0.18	-42.91	65,891
Educated, Father	0.13	0.34	0.07	0.26	-34.45	97,718
Father Age at Child Birth	33.95	8.00	33.26	7.77	-18.36	101,991

t is the t-statistic for difference in means (2 tailed)

2.4 Grandfathers versus Uncles

If status is transmitted through additive genetics, then based on table 3, the correlation between child status on any aspect of social status and grandfather status should be the same as that between child and uncle, whether or not the grandfather lives and the uncle is childless. With relatives correlating with children on status because of a causal connection it is ambiguous in general whether the grandfather or uncle correlations would be greater. Both can provide support for children. But often the grandparents will be dead. However, if uncles have their own children this will be the first claim on their time and resources. On balance because there are more living grandfathers than childless uncles, the grandfather effect would be expected to be stronger.

Thus looking at these correlations we will have a strong test of whether genetic transmission could explain most relative correlations, but a weak test of the causal effects of relatives.

2.5 Great-grandfathers versus Cousins

If status is transmitted through additive genetics, then based on table 3, the correlation between child status on any aspect of social status and great grandfather status should be the same as that between child and cousin, even though children would rarely interact with great grandparents. Here there is a complete contrast with theories which attribute a causal role to relatives, since great-grandparents would rarely interact with a child, and so have no effect on child outcomes. Cousins in contrast would be contemporaneous.

3 Data

The data used in this study comes from a genealogical database of 367,000 English and Welsh people who had rarer surnames, born 1750-2019, that is under construction to test various theories of social mobility. Since the data was collected to study social mobility in England from 1750 to 2019, the initial surnames used were deliberately oversampled from the top and bottom of the wealth distribution for those dying 1858-1887.[8] However, a later set of lineages which had much

[8]See, for example, Clark and Cummins (2015).

more average status 1858-1887 was contributed by members of the Guild of One-Name Studies, a society devoted to studying the history of individual surnames all across the world. There are 49,584 individuals from the rich lineages, 25,841 from the poor, and 291,587 from lineages of average wealth.

Throughout the period 1750-2019 England has been characterized by a nucleated family structure. Parents mainly resided with their children without the presence of grandparents or siblings. But there was no social taboo against co-residence. So the census records of 1841-1911 and population register of 1939 show modest numbers of co-resident three generation families, or families where siblings of parents co-resided. The family structure throughout this period is thus characteristic of that of modern western Europe.

All births, deaths and marriages were registered in England from 1837 on. After 1865 the death register includes age at death. So for rare surname individuals we can link their births, deaths and marriages (though less easily for births before 1865). The censuses of 1841-1911, and a 1939 population register provide information on parentage (see the list of data sources below). For marriages before 1880 there is considerable information available from parish records of baptisms, which recorded parents' names, and from parish records of marriages, which recorded the names and ages of those marrying as well as their fathers' names. There are many ancillary records which show, particularly for higher status families, family relationships: accounts, for example, of all men matriculating at Oxford and Cambridge universities prior to 1893, their fathers and their marriages, and also probate records.

By focusing on rare surnames, and by employing the whole set of records available for England we achieve much higher matching rates than is typical for linking parents and children in 19th century censuses.[9] But the nature of the sources means we cannot identify parentage for all the people in our sample. Thus for 4,562 recorded rare surname births 1860-1879, we identify a father or mother for 86%.[10] The reasons for failing to find at least one parent in the other 14% of cases are various. In some cases the name likely was misspelled in the birth record, and the person does not belong in the surname lineages used to form the sample. Of those not linked 60% show no further appearance in any record after their birth under the birth name. Likely in most of these cases the name is just misspelled on the birth register. In others the child dies before appearing in a census, or their father dies, or they are living with grandparents in the census, or the family emigrates.[11] Thus one third of those born not linked to a parent died before age 10. However, for children identified as living to at least 21, 3,485 births 1860-79, the match rate is much better, with only 2.1% without at least one parent identified.

The birth, death and marriage registers give geographic location at the level of the registration district (originally a Poor Law Union) which encompassed a number of parishes. Throughout the period of study, 1837-19, there were around 600 registration districts in England and Wales. Figure 2 shows the geographic coverage of the data in our lineage database.

The information we have for social outcomes is:

[9] Long and Ferrie (2018)for example, link only 20% of adult sons to their fathers in England between 1851 and 1881.

[10] In some cases, where the child is illegitimate, only the mother is listed on birth records.

[11] We could identify the father by getting the birth certificate, but this is prohibitively costly.

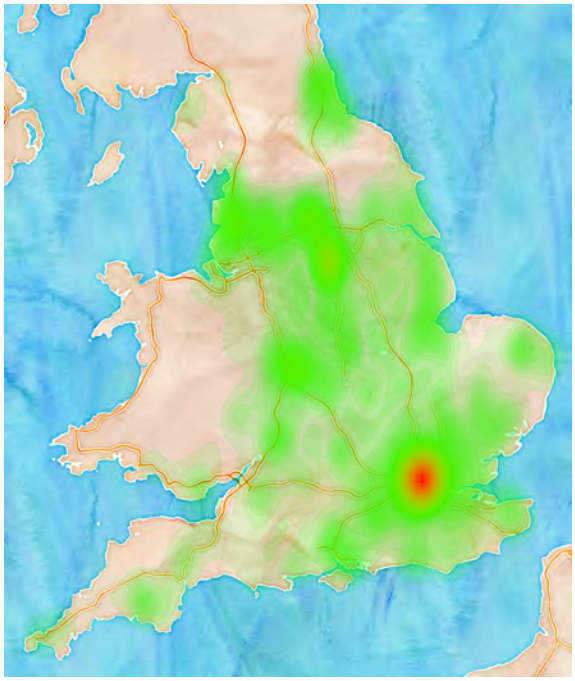

Figure 2: The Geography of the Lineage Data, Births 1780-2016

Schooling 14-20

For a subset of all children we observe whether they were explicitly in school or in an apprenticeship aged 11-20 then they appear in a census 1851-1911 at these ages.[12] We also have a measure of whether they were explicitly in employment (exclusive of apprenticeships) ages 11-20 for these cases. Since most children were still in school we make this variable more informative of educational status by looking at schooling ages 14-20.

Higher Educational Attainment

For sons only we can construct an indicator variable for higher educational attainment. This is set at 1 under the following: the son enrolled at a university (Oxford, Cambridge, or London)[13]; enrollment at the Army Officer training school at Sandhurst; training as an attorney (1756-1874); enrollment as a registered doctor (1859-1956); was a member of an engineering society (Civil Engineers, 1818-1930, Mechanical Engineers, 1847-1930, Electrical Engineers, 1871-1930); was a trained cleric.

Occupational status

For sons there are measures of adult occupational status from the censuses of 1841-1911, from the population register of 1939, or from probate and other records (probate records 1858-1909 frequently give the occupation of the deceased). The occupations are translated into a status score using data from the 1911 census on average survival probabilities of children by occupation.[14] This ranges from around 0.75 to 0.94.

For all children dying 1858 and later we have whether they were probated or not, and estimated wealth at death for the probated and non-probated. We normalize for changes in wealth over time by

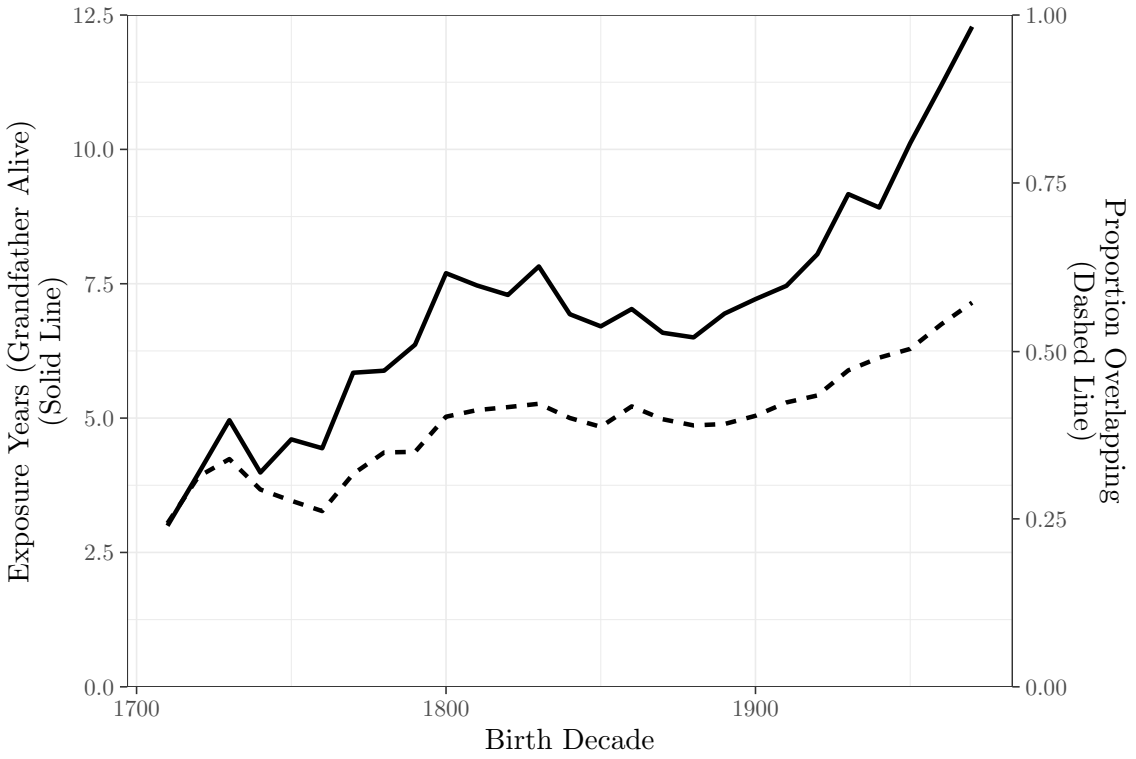

Figure 3: Grandfather Exposure

Figure 3 shows the average exposure of children to their paternal grandfathers, by decade of birth from 1820-9 on. The solid line shows the proportion of children whose paternal grandfather was alive at their birth. The dotted line shows the number of years both grandchild and grandfather were alive on average (years to age 15 by grandchildren). The proportion with paternal grandfathers alive when they were born was generally around 0.45 for the years we have data on the social outcomes for grandchildren. If we look instead at grandmothers as the ones more likely to have an influence on the outcomes for their grandchildren, we find 66% of grandchildren had a living paternal grandmother at their birth. Thus a significant fraction of children would potentially have exposure to grandparents in the period of births 1840-1930 where we have good information on child outcomes, with the average exposure being around 7 years.

Figure 4 shows the distribution of geodesic distance between grandchildren and grandfathers in our sample. 47% of grandchildren were born within 20 km of the place of death of their paternal grandfather, for grandfathers alive at the grandchild birth. Table 7, based on 35,361 unique fathers and 22,295 unique grandfathers, reports the summary statistics for our data for the grandfather-grandchild link. Thus again there is a convenient split of the data between those children with exposure to a grandparent and those not.

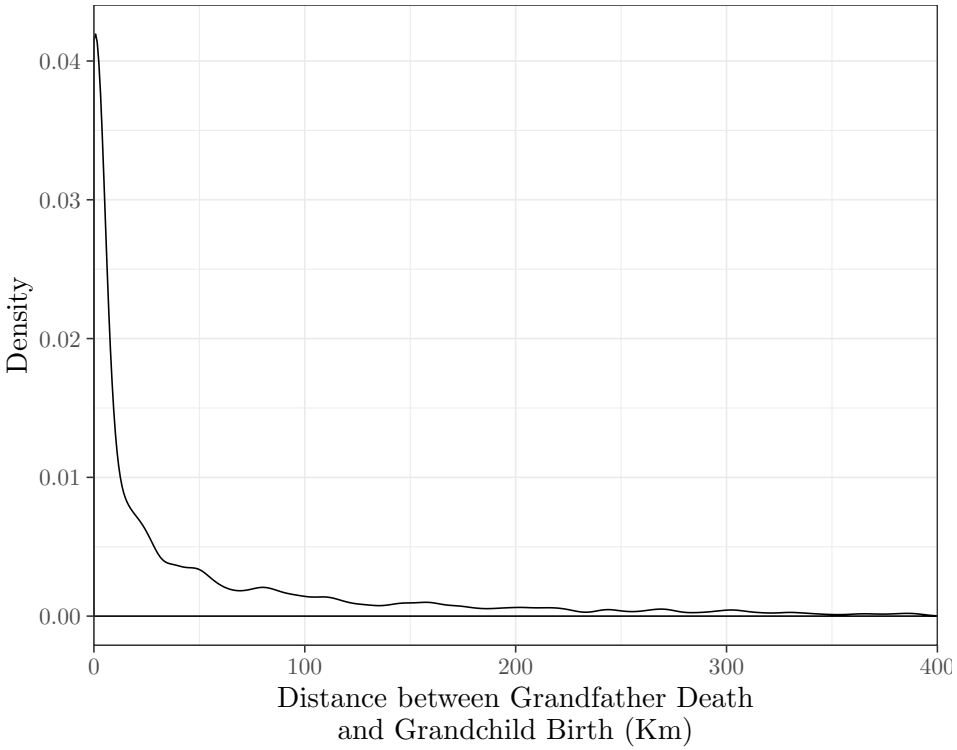

Figure 4: The Geodesic Distance between Grandfathers and Grandchildren

Table 7: Summary Statistics, Grandfather-Child Links

Statistic	N	Mean	St. Dev.	Min	Max
Birth Year	145,696	1,882.57	65.75	0.00	2,017.00
Female	154,786	.48	.50	0.00	1.00
Birth Order	154,839	3.41	2.55	1	20
Grandfather Alive at Child Birth	117,982	.53	.50	0.00	1.00
ln(Wealth) of Child	25,548	−1.46	2.61	−11.57	9.14
ln(Wealth) of Father	57,045	−1.81	2.83	−11.44	9.14
ln(Wealth) of Grandfather	57,002	−1.99	3.08	−9.21	9.14
Occ. Rank, Child	31,671	.29	.19	0.00	.93
Occ. Rank, Father	88,836	.30	.19	0.00	.93
Occ. Rank, Grandfather	89,620	.29	.19	0.00	.93
Educated, Child	37,096	.08	.27	0.00	1.00
Educated Father	84,873	.09	.29	0.00	1.00
Educated Grandfather	86,553	.08	.28	0.00	1.00
At School 14-20, Child	21,999	.33	.47	0.00	1.00
Age at Death 21+, Child	74,496	52.67	30.83	0.00	115.53
Age at Death, 21+, Father	117,210	67.95	14.57	0.00	108.47
Age at Death, 21+, Grandfather	122,019	67.59	14.47	.62	107.63
Distance Grandfather to Child	21,186	46.82	84.58	0.00	713.81
Close Grandfather	21,186	.61	.49	0.00	1.00

4 Results

4.1 Dead versus Living Relatives

We begin by looking at the potential influence of living versus dead relatives on childrens' outcomes. For paternal grandfathers this gives a nice even split of children, with 45% having their grandfather alive when they were born. For adult uncles, the fraction alive at the time of the child birth is higher, 89%. But given the variation in lifespans, and the spacing of births within families, there are plenty of observations also on dead versus living uncles.

Table 8 and figure 5 shows the comparative effect of the social status of dead versus living grandfathers on the outcomes of grandchildren, controlling for father status (wealth, education, and occupational rank). The table shows just estimates the three key parameters of equation (3), grandfather status (b_Z), grandfather alive (a_{ZL}), and grandfather alive $\times$ grandfather status (b_{ZL}).[15] The "grandfather status" estimates are effectively estimates of the predictive effect of dead grandfather's status on child outcomes. This is always significantly greater than zero. In all cases except ln wealth – occupational rank, education, normed longevity, schooling 14-20 - the grandfather being alive does not statistically significantly increase the coefficient on their status as predicting the status of the child. Thus for four of the five measures dead grandfathers have the same predictive power for child outcomes as alive ones. In the case of wealth there is a closer connection between child and grandfather wealth in the case where the grandfather was alive at the birth of the child. In this case, there is some chance that the grandchild directly inherited wealth from the grandfather. If the grandfather was already dead before the child was born there is little chance of the grandfather in his will making a bequest to the grandchild (as noted they would need to use very specific language in the will to do this). But the additional predictive effect of grandfather wealth on grandchild wealth for a living grandfather is only 20% greater than for a dead grandfather. So overwhelmingly grandfather status predicts grandchild status in a non-causal way that does not require any interaction between the two.

Table 9 (figure 6) shows the links between grandfather status and grandchild outcomes, but this time by whether the paternal grandmother was alive or dead when the child was born. The literature has been more focused on the potential transfers from grandmothers to grandchildren then on the role of grandfathers. In our data, however, grandmothers do not have independent status measures (except wealth at death), being mostly born before 1880 when married women rarely worked, and had no access to formal higher education. But even for wealth the resources of the family are likely more accurately reflected in the wealth at death of the husband than in the wealth of the wife. So we measure their status and resources by those of their husbands. As noted above, at the time of grandchild birth, many more having living grandmothers than have living grandfathers.[16] So table 9 shows the effects of grandmother status on grandchild outcomes, when the grandmother was alive at the time of the grandchild birth. As with grandfathers dead grandmothers all have significant predictive power in terms of child social outcomes. However now for 3 of the 5 social outcomes there is some additional predictive effect for a grandmother who was alive at the time of child birth, though in all cases the additional predictive effect is smaller than the main effect from dead grandmothers.

Table 10 (figure 7) shows the equivalent set of estimates for uncles dead and alive at the time of child birth. Again dead uncles always provide significant predictive information on child outcomes.

[15] A table with the full set of estimates is in the appendix.

[16] We count here only the grandmother the child is genetically related to. Since husbands would frequently remarry after the death of a wife, there were a number of step-grandmothers alive at the time of a grandchild's birth.

Table 8: The Effect of Dead/Alive Grandfather Status on Children

	Dependent variable:				
	Wealth	Occupation	Education	School, 14-20	Age, Death
	(1)	(2)	(3)	(4)	(5)
Alive at Birth?	−.123***	−.013***	−.008*	−.003	.007
	(.036)	(.004)	(.005)	(.015)	(.024)
Grandfather Status	.101***	.153***	.063***	.143***	.101***
	(.008)	(.010)	(.008)	(.036)	(.014)
Status*Alive	.020**	.023**	.030**	−.006	−.020
	(.009)	(.011)	(.012)	(.039)	(.020)
Observations	14,469	11,268	15,187	9,387	29,785
R^2	.367	.547	.243	.274	.183

Note: *p<0.1; **p<0.05; ***p<0.01
OLS Regression.Controls included but not reported:
Father's status: Wealth, Occupation, education and age, death
Female, birth year, birth order, age of death.
Age at death is Z-score, based on 100% death sample.

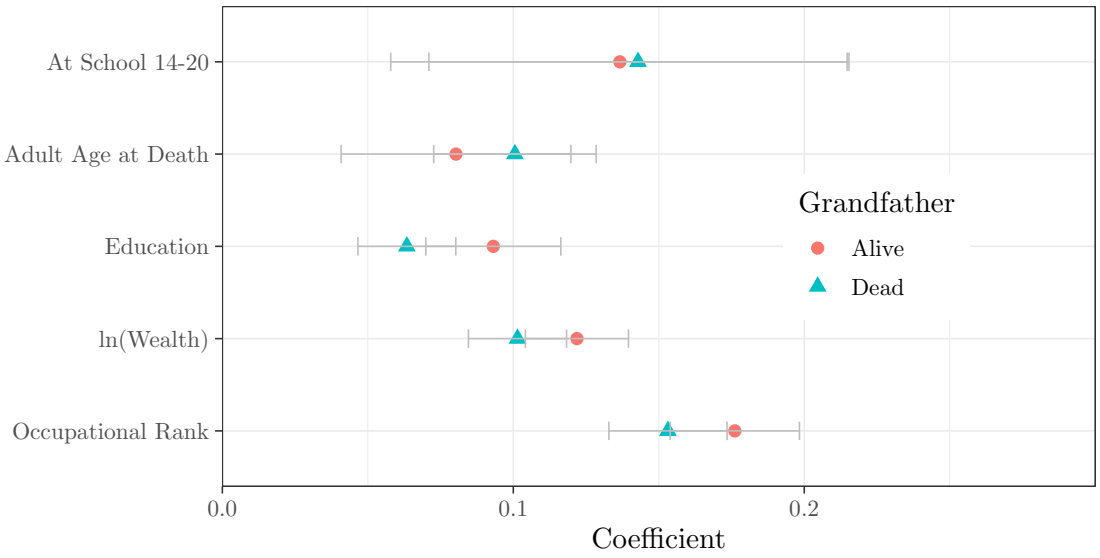

Figure 5: The Effect of Grandfathers on Child Status: Dead v Alive

Table 9: The Effect of Grandfather's Status on Children, Grandmother alive at Birth

	Dependent variable:				
	Wealth	Occupation	Education	School, 14-20	Age, Death
	(1)	(2)	(3)	(4)	(5)
Alive at Birth?	.001	−.011***	.001	.012	.011
	(.037)	(.004)	(.005)	(.016)	(.022)
Grandfather Status	.094***	.134***	.051***	.143***	.092***
	(.009)	(.011)	(.010)	(.044)	(.015)
Status*Alive	.029***	.051***	.043***	.008	−.005
	(.009)	(.011)	(.012)	(.045)	(.019)
Observations	13,964	11,226	14,908	9,408	28,575
R^2	.364	.542	.245	.083	.180

Note: *p<0.1; **p<0.05; ***p<0.01
OLS Regression.Controls included but not reported:
Father's status: Wealth, Occupation, education and age, death
Female, birth year, birth order, age of death.
Age at death is Z-score, based on 100% death sample.

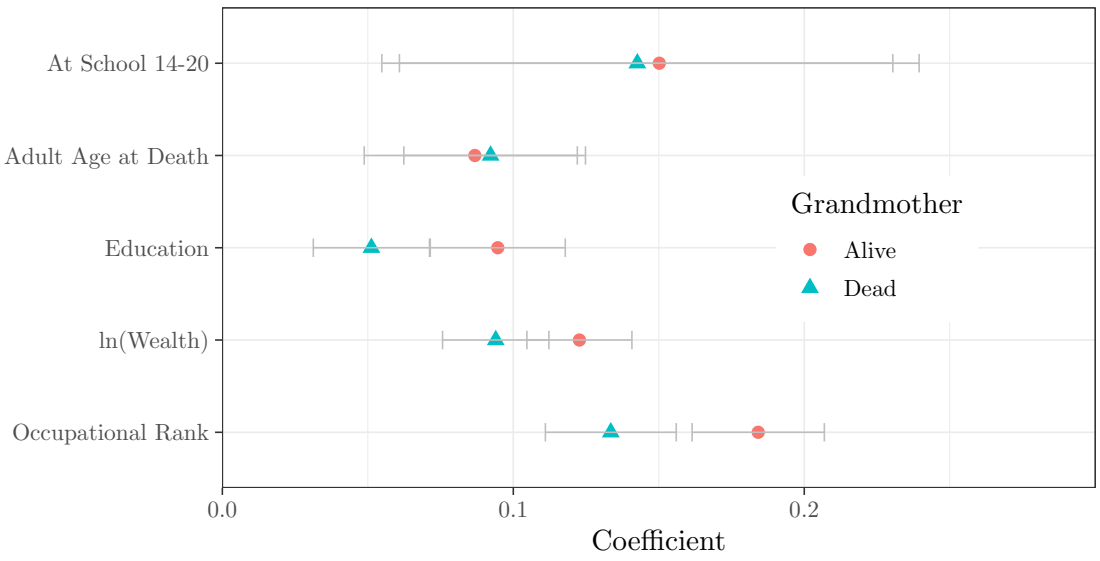

Figure 6: The Effect of Grandmothers on Child Status: Dead v Alive
Notes: Grandfather status measures used.

For living uncles there is in four out of five cases no significant additional information on child outcomes.

Table 10: The Effect of Dead/Alive Uncle Status on Children

	Dependent variable:				
	Wealth	Occupation	Education	School, 14-20	Age, Death
	(1)	(2)	(3)	(4)	(5)
Alive at Birth?	$-.076^{***}$	$-.020^{***}$	$-.017^{***}$	$-.049^{***}$	$-.011$
	(.023)	(.003)	(.004)	(.010)	(.008)
Uncle Status	$.103^{***}$	$.150^{***}$	$.077^{***}$	$.109^{***}$	$.013^{*}$
	(.005)	(.007)	(.007)	(.024)	(.007)
Status*Alive	.0003	$.036^{***}$	$.042^{***}$	$.114^{***}$	.007
	(.007)	(.008)	(.010)	(.027)	(.009)
Observations	37,013	23,744	26,455	22,260	51,731
R^2	.369	.567	.340	.278	.086

Note: *p<0.1; **p<0.05; ***p<0.01
OLS Regression.Controls included but not reported:
Father's status: Wealth, Occupation, education and age, death
Female, birth year, birth order, age of death.
Age at death is Z-score, based on 100% death sample.

The evidence in this section thus makes it clear that most of the connection in social status between grandfathers or uncles and children derives just because the status of these relatives revealing more about the underlying status of the parents, since in each case dead grandparents and dead uncles provide significant predictive information. In most cases living relatives are no more predictive than dead ones, though there is some possibility that for children with living grandmothers their status is more closely connected to their grandfathers.

But there is still the possibility that relatives play some causal role. In particular, living relatives include grandparents, for example, who are quite distant from their grandchildren and those who live in close geographic proximity. If the son moves from his fathers' farm in Lincoln several hundred miles away to London, then the influence of the grandfather in providing support to the grandchild will be much more limited than when all three generations reside in the same London parish. Thus in the next section we test whether proximate relatives have a closer association with outcomes than distant relatives.

4.2 Geographically Close versus Distant Relatives

Even relatives living at time of a child's birth might have no opportunity to interact with the child and influence their social outcomes if they live at a distance. So an even stronger test of the causal influence of relatives is to ask whether among the living, those who reside at the same location as children provide more information on child outcomes as those who reside at a disatnce.

But there is still the possibility that relatives play some causal role. In particular, living relatives include grandparents, for example, who are quite distant from their grandchildren and those who

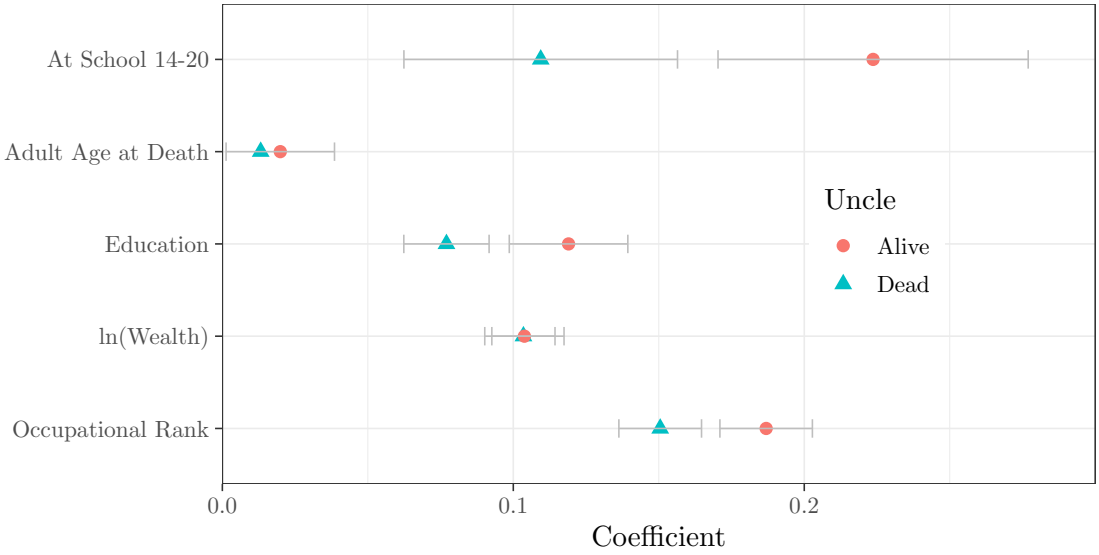

Figure 7: The Effect of Uncles on Child Status: Dead v Alive

live in close geographic proximity. If the son moves from his fathers' farm in Lincoln several hundred miles away to London, then the influence of the grandfather in providing support to the grandchild will be much more limited than when all three generations reside in the same London parish. Thus in the next section we test whether proximate relatives have a closer association with outcomes than distant relatives.

As figure 3 shows, some grandparents lived in close geographic proximity to their grandchildren, others lived at considerable distance. In tables 12-11 we consider the effect of relatives living at the time of child birth on the status outcomes for the children, distinguishing between relatives living closer than 20 km from the child at birth, and those living far away. Did the status of geographically close relatives have more connection with the status of children than that of distant relatives? Distant relatives again have little opportunity to promote the welfare of children causally through childcare, interactions, or modelling of successful behaviors. They could, however, provide financial support even at a distance, or provide employment opportunities through their connections.

As noted above, movers tend to be of higher status than stayers. So a child being distant from their grandparents may reflect higher status. However, the status association with moving is largely a class effect. Lower status families were less geographically mobile in general. Within individual families when we compare brothers who stay where they were born versus those who move, as in table 5, we find that the higher status of movers is much more modest. Thus we can largely control for the status differences of movers versus stayers by controlling for the status of the child's father, as is done in tables 12-11 .

For most of the five social outcomes – ln wealth at death, occupational rank, higher education, schooling 14-20, or longevity – we do find positive and significant connections between the outcomes for living relatives – grandfathers, uncles, and cousins – and outcomes for children. But in no case, for any of the outcomes, is the connection stronger for relatives who are in geographic proximity to

the child. Table 11 shows, for example, the predictive effects of distant compared to proximate living grandmothers for child social outcomes. In only one case, education, is there any significant greater predictive effect for geographically close grandmothers. Figure 8 shows the relative predictive effect from close versus distant grandmothers from Table 11.

Table 11: Close versus Distant Grandmothers and Grandchild Outcomes

	Dependent variable:				
	Wealth	Occupation	Education	School, 14-20	Age, Death
	(1)	(2)	(3)	(4)	(5)
Close	$-.116^{*}$	$-.003$	.003	$-.042$	.028
	(.066)	(.008)	(.008)	(.036)	(.044)
Grandfather Status	$.103^{***}$	$.154^{***}$	$.065^{***}$	.122	.054
	(.015)	(.020)	(.015)	(.087)	(.034)
Status*Close	.008	.002	$.059^{***}$	.104	$-.050$
	(.017)	(.022)	(.022)	(.089)	(.040)
Observations	4,522	3,084	4,571	2,489	7,870
R^2	.354	.518	.201	.079	.163

Note: *p<0.1; **p<0.05; ***p<0.01
OLS Regression.Controls included but not reported:
Father's status: Wealth, Occupation, education and age, death
Female, birth year, birth order, age of death.
Age at death is Z-score, based on 100% death sample.

Table 12 shows the same estimate for distant and close uncles. The status of distant uncles is always predictive of child outcomes. Close uncles in the case of wealth show greater predictive power, though the extra effect is small relative to that of distant uncles. But counterbalancing this the age of death of close uncles is less predictive of child adult longevity than the age of death of distant uncles. Figure 9 shows the predictive effects of close versus distant uncles.

Finally Table **??** shows the predictive effects of distant cousins compared to close cousins. For all outcomes distant cousins are significantly predictive of child outcomes. In no case is a close cousin more predictive than a distant one. Figure 10 shows the predictive effects of close versus distant cousins.

For most of the five social outcomes – ln wealth at death, occupational rank, higher education, schooling 14-20, or longevity – we do find positive and significant connections between the outcomes for living relatives – grandfathers, uncles, and cousins – and outcomes for children. But in almost all cases this effect is as strong or stronger for distant as for close relatives.

4.3 Childless Uncles

The alloparenting literature in biological anthropology argues that relatives such as uncles and aunts will provide more child care and support when they themselves do not have offspring. Using the FOE database we can classify living uncles into those who are childless (taken here as having no child births associated with them), versus those who have children.

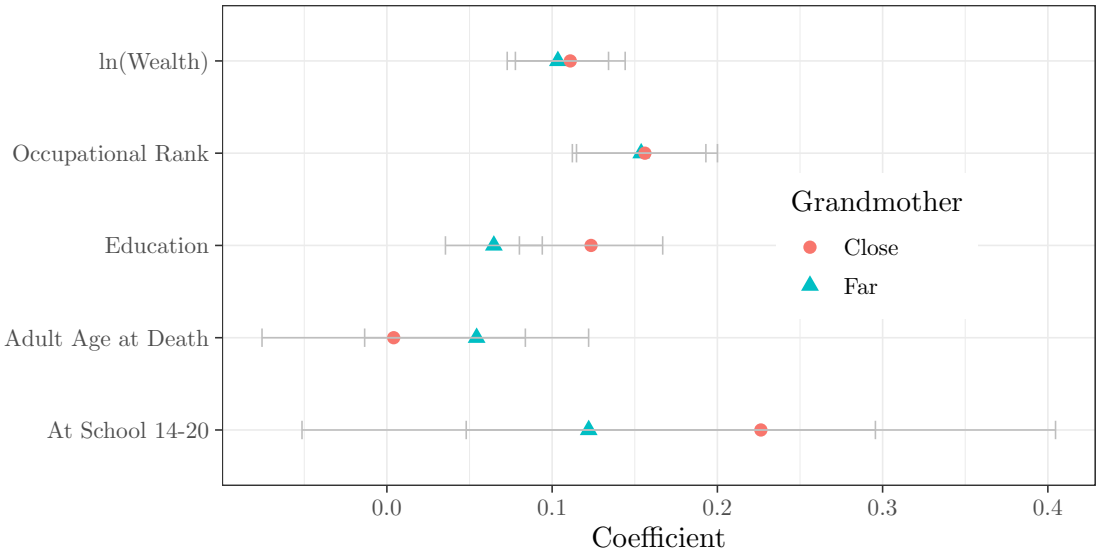

Figure 8: The Effect of Grandmothers: Far v Close

Table 12: Close versus Distant Uncles and Nephew Outcomes

	Dependent variable:				
	Wealth	Occupation	Education	School, 14-20	Age, Death
	(1)	(2)	(3)	(4)	(5)
Close	−.017	−.003	−.006	−.024	−.011
	(.045)	(.005)	(.005)	(.021)	(.011)
Uncle Status	.093***	.154***	.069***	.122***	.044***
	(.009)	(.011)	(.008)	(.046)	(.010)
Status*Close	.030**	−.001	.008	.032	−.040***
	(.013)	(.016)	(.015)	(.067)	(.013)
Observations	12,836	8,280	12,393	6,596	25,091
R^2	.355	.531	.214	.083	.187

Note: *p<0.1; **p<0.05; ***p<0.01
OLS Regression.Controls included but not reported:
Father's status: Wealth, Occupation, education and age, death
Female, birth year, birth order, age of death.
Age at death is Z-score, based on 100% death sample.

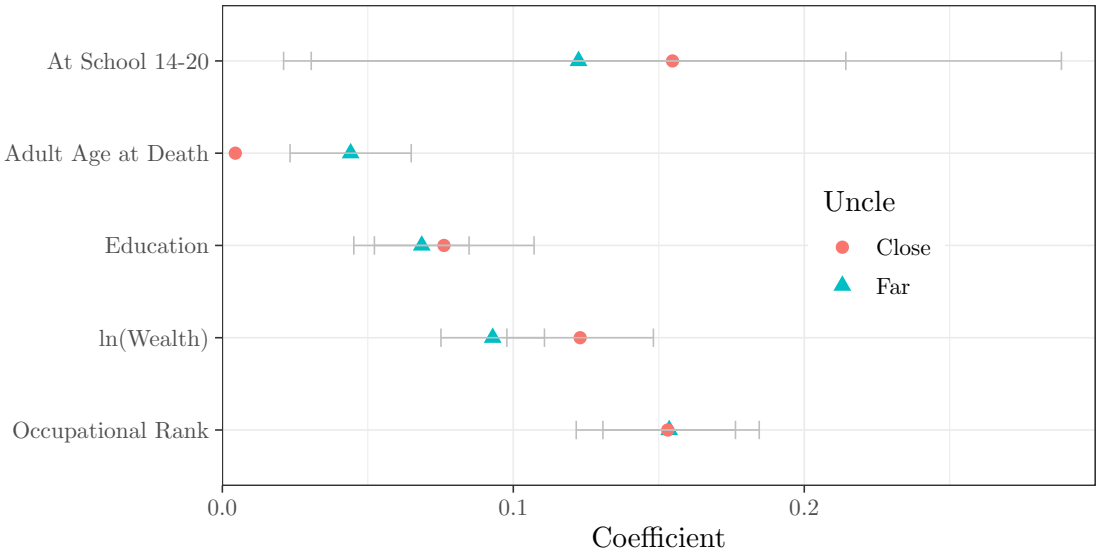

Figure 9: The Effect of Uncles: Far v Close

Table 13: Close versus Distant Cousins Outcomes

	Dependent variable:				
	Wealth	Occupation	Education	School, 14-20	Age, Death
	(1)	(2)	(3)	(4)	(5)
Close	$-.109^{*}$	.009	$-.015^{**}$	.009	$-.063^{***}$
	(.058)	(.006)	(.006)	(.030)	(.011)
Cousin Status	$.087^{***}$	$.124^{***}$	$.055^{***}$	$.117^{**}$	$.025^{**}$
	(.011)	(.013)	(.011)	(.059)	(.010)
Status*Close	.001	$-.050^{**}$	$-.015$	$-.030$	.014
	(.019)	(.022)	(.028)	(.108)	(.014)
Observations	8,678	4,893	7,692	4,288	19,455
R^2	.399	.628	.264	.094	.204

Note: *p<0.1; **p<0.05; ***p<0.01
OLS Regression.Controls included but not reported:
Father's status: Wealth, Occupation, education and age, death
Female, birth year, birth order, age of death.
Age at death is Z-score, based on 100% death sample.

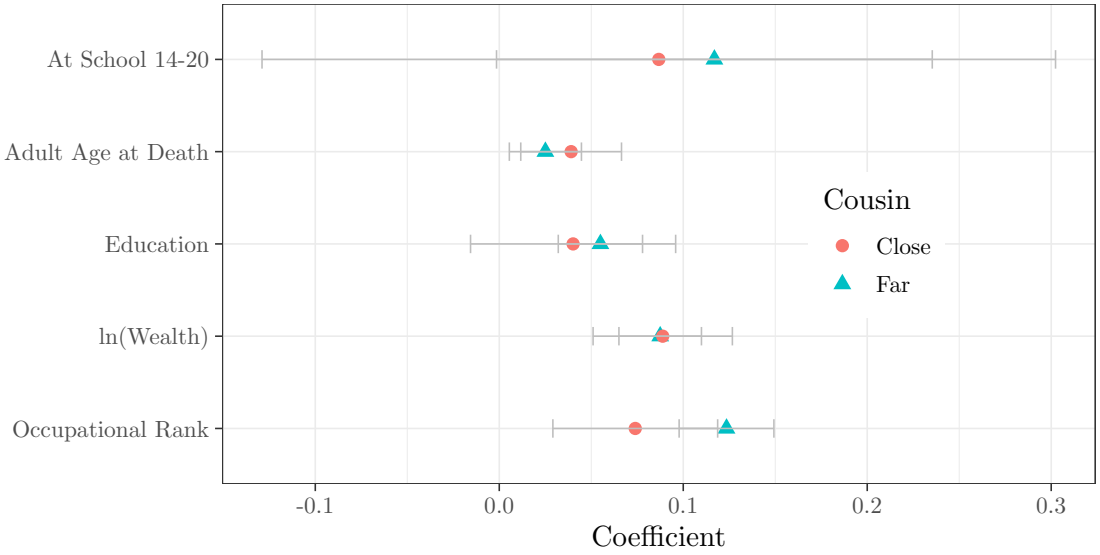

Figure 10: The Effect of Cousins: Far v Close

Table 14, and figure 11 report the differential effects of childess uncles on outcomes. The coefficients on "uncle status" refer to living uncles with children. The coefficients in the row "Childless*alive" show the addition predictive effect of the status of childless living uncles on the social status outcomes of nieces and nephews. For four of five outcomes childles uncles have no closer a connection in status to child outcomes than do uncles with children. In the fifth case, where the outcome is occupational rank, there is a greater effect from childless uncles. But that additional effect is only 15% of the main effect associated with uncles with children. There is no evidence again that there are substantial transfers of care and resources from childless uncles as opposed to those with children.

4.4 Grandfathers versus Uncles

Here we estimate for grandfathers versus uncles the amount of extra information they supply in predicting child status outcomes, once we have controlled for a menu of father characteristics. If relatives other than parents play a causative role in determining child status through bequests, child care, or other interactions, then we would expect the estimated grandfather influence would be greater than for uncles. Most uncles in this period would have their own families to care for. Their own children, for example, would be the overwhelming recipients of any bequests, unless the uncles were childless.

For each grandfather or uncle we include only one measure of status, to make the results comparable between grandfathers and uncles. Thus the equation estimated is (6).

$$y_i = a + \sum b_{ijF} y_{ijF} + b_Z y_{iZ} + \epsilon \tag{6}$$

The child outcomes are log of wealth at death, higher education attainment, occupational rank

Table 14: The Effect of Childless Uncle's Status on Children

	Dependent variable:				
	Wealth	Occupation	Education	School, 14-20	Age, Death
	(1)	(2)	(3)	(4)	(5)
Childless	.115***	.006	.014***	−.012	.035***
	(.036)	(.004)	(.004)	(.017)	(.012)
Uncle Status	.108***	.197***	.102***	.197***	.050***
	(.007)	(.008)	(.008)	(.035)	(.010)
Childless*Alive	0.00000	.024**	−.011	.036	−.022
	(.011)	(.011)	(.011)	(.046)	(.014)
Observations	18,974	14,617	18,095	12,178	35,431
R^2	.364	.550	.250	.093	.190

Note: *p<0.1; **p<0.05; ***p<0.01
OLS Regression.Controls included but not reported:
Father's status: Wealth, Occupation, education and age, death
Female, birth year, birth order, age of death.
Age at death is Z-score, based on 100% death sample.

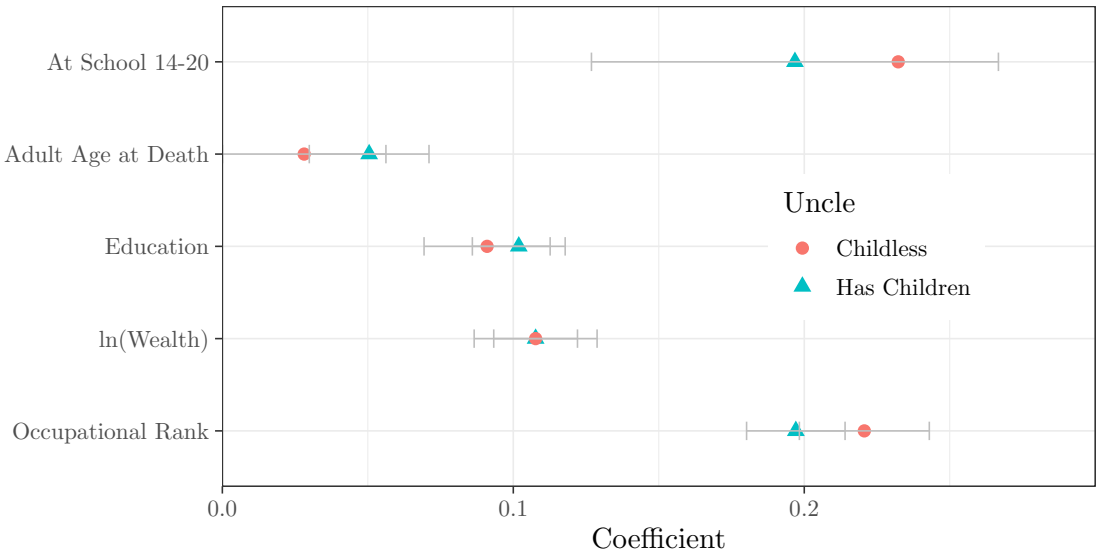

Figure 11: The Effect of Childless Uncles

Son Outcome	Predictor	Grandfather	Uncle	Difference
Ln(Wealth) at Death	Ln(Wealth) at Death	0.099***	0.103***	-0.004
		(.013)	(.008)	(.015)
Higher Education	Higher Education	0.116***	0.099***	0.017
		(.019)	(.013)	(.023)
Occupational Status	Occupational Status	0.174***	0.176***	-0.002
		(.015)	(.010)	(.018)
Normed adult age at death	Normed adult age at death	0.024**	0.021***	0.003
		(.012)	(0.006)	(.013)
At School 14-20	Occupational Status	0.402***	0.274***	0.124
		(.058)	(0.046)	(.074)

Notes: **p<0.05; ***p<0.01 OLS Regression. Controls included but not reported are fathers log wealth at death, higher education status, occupational rank. Difference is the grandfather estimate minus the uncle estimate. Estimates clustered on grandfathers and uncles.

Table 15: Comparative Predictive Effects of Grandparent versus Uncle Characteristics

at age 40, adult longevity, child schooling ages 14-20, and whether or not a child attained age 21. The non-parental relative status measures used for each child outcome are shown in table 15.

Table 15 shows the estimated information content of grandparent or uncle status for each of these 6 child outcomes, the difference in the estimated effects, and the statistical significance of that difference. As can be seen, on average the grandfather and uncle effects are remarkably similar for each attribute. This is illustrated in figure *12* which shows the uncle/grandfather coefficients compared to the line where the estimates are the same. Only one deviates in any substantive way from the line showing equivalence, and even that deviation is not statistically significant at the 5% level. If status is transmitted through additive genetics, then based on table 3, the correlation between child status on any aspect of social status and grandfather status should be the same as that between child and uncle, whether or not the grandfather lives and the uncle is childless. With relatives correlating with children on status because of a causal connection it is ambiguous in general whether the grandfather or uncle correlations would be greater. Both can provide support for children. But often the grandparents will be dead. However, if uncles have their own children this will be the first claim on their time and resources. On balance because there are more living grandfathers than childless uncles, the grandfather effect would be expected to be stronger.

Thus looking at these correlations we have a strong test of whether genetic transmission could explain most relative correlations, but a weak test of the causal effects of relatives.

4.5 Great Grandfathers versus Cousins

With causal transmission of status, the predictive effects of great grandfathers, controlling for fathers, would be zero, since they will rarely be alive at the time a child is born. Cousins who will

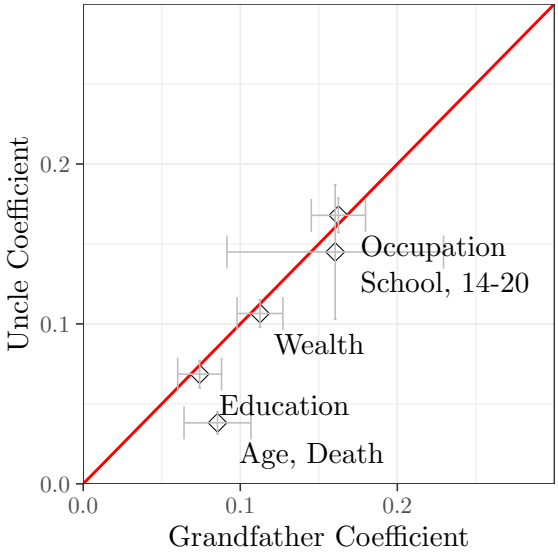

Figure 12: Comparative Predictive Effects of Grandparent versus Uncle Characteristics

be contemporaneous can potentially play a much greater role.

In table 16 we perform a similar exercise for the additional information content of great grandfathers compared to cousins. Two things stand out. The first is that even though great grandfathers will rarely interact with great-grandchildren, they typically supply statistically significant amounts of additional status information about their great-grandchildren, even controlling for father characteristics. The second is that the amount of information they supply is on average equivalent to that supplied by a cousin, even though cousins have much greater chances of interaction. The only case with a significant difference is for wealth, where the predictive information from grandfathers is less than that from cousins.

This equivalence of grandfather versus uncle effects, or great-grandfather versus cousins, is unexpected in a world where the effects arise mainly from the interactions of relatives with a child.

An interesting element of the test in this section of the nature of the link between the status of collateral relatives and children is that here there is no issue of selection. We are comparing all grandparent-child pairings with all uncle-child pairings. Similarly we compare all great-grandfather-child pairings with all cousin pairings.

Son Outcome	Predictor	Great Grandfather	Cousin	Difference
Ln(Wealth) at Death	Ln(Wealth) at Death	0.064*** (.014)	0.109*** (.007)	-0.045*** (.016)
Higher Education	Higher Education	0.055*** (.016)	0.063*** (.009)	-0.008 (.018)
Occupational Status	Occupational Status	0.145*** (.017)	0.170*** (.011)	-0.025 (.020)
Normed adult age at death	Normed adult age at death	0.029** (.013)	0.011*** (.004)	0.018 (.014)
At School 14-20	Occupational Status	0.235*** (.070)	0.234*** (.032)	0.001 (.077)
Survival to age 21	Occupational Status	0.037*** (.020)	0.065*** (.015)	-0.028 (.025)

Notes: **p<0.05; ***p<0.01 OLS Regression. Controls included but not reported are fathers log wealth at death, higher education status, occupational rank. Difference is the grandfather estimate minus the uncle estimate. Estimates clustered on grandfathers and uncles.

Table 16: Comparative Predictive Effects of Great Grandparent versus Cousin Characteristics

5 CONCLUSION

We see in tables 1 and 2 that even controlling for the status of parents, the characteristics of other relatives – grandfathers, uncles, and cousins – all are predictive of social outcomes for children. There is a significant literature in anthropology, sociology, and economics that ascribes a causal role to these associations. In this paper we have tested for sign of causal effects by looking to see if the association between the status of relatives and that of a child is stronger when the relative had the opportunity to play a causal role: the relative was alive at the birth of the child, or the relative was living in geographic proximity. In almost all cases we do not detect such an effect. We cannot test for this effect by looking at whether living or close relatives improve the social status of children, since this is observational data and children with living or close relatives can have differences in status from those with dead or distant relatives. But we can test for whether there is more information conveyed about child status when relatives have at least an opportunity to play a much greater causal role. The connection, however, between dead relatives' status and social outcomes is as close as for living. The connection between living distant relatives' status and social outcomes is as close as for living distant relatives.

The interpretation is that at least in the context of English families with children born in the interval 1830-1929, relatives other than parents did not play a significant causal role in child outcomes. This was a period with already significant investments in child education and training. As shown in table 6, 38% of children in the sample observed aged 14-20 were still at school or in an apprenticeship. Relatives other than parents had plenty of opportunity to help get children into more lucrative careers through their social and work connections, and through financial support. The results thus seem generalizable to all modern Western European societies, which have very similar family structures in terms of the co-residence of grandparents and other relatives.

These results are consistent with a model of status transmission across generations, such as that of Clark et al. (2014) where the process is actually first-order Markov, but the observed social outcomes in each generation are affected also by transitory elements, so that the status of other relatives conveys information about the likely outcomes for children independent of the status of the parents. One variant of such a process would be the case where the transmission from parents to children is through genetics.

References

Chan, Tak Wing and Vikki Boliver, "The grandparents effect in social mobility: Evidence from British birth cohort studies," *American Sociological Review*, 2013, *78* (4), 662–678.

Clark, Gregory and Neil Cummins, "Intergenerational Wealth Mobility in England, 1858–2012: Surnames and Social Mobility," *The Economic Journal*, 2015, *125* (582), 61–85.

_ , _ , Daniel Diaz Vidal, Yu Hao, Tatsuya Ishii, Zach Landes, Daniel Marcin, Kuk Kuk Mo Jung, Ariel Marek, and Kevin Williams, *The Son Also Rises: Surnames and the History of Social Mobility: Surnames and the History of Social Mobility*, Princeton University Press, 2014.

Dribe, Martin and Jonas Helgertz, "The Lasting Impact of Grandfathers: Class, Occupational Status, and Earnings over Three Generations in Sweden 1815–2011," *The Journal of Economic History*, 2016, *76* (4), 969–1000.

Ferrie, Joseph, Catherine Massey, and Jonathan Rothbaum, "Do Grandparents and Great-Grandparents Matter? Multigenerational Mobility in the US, 1910-2013," Working Paper 22635, National Bureau of Economic Research September 2016.

Hrdy, Sarah Blaffer, *A History of Mothers, Infants and Natural Selection*, New York: Pantheon, 1999.

Knigge, Antonie, "Beyond the Parental Generation: The Influence of Grandfathers and Great-grandfathers on Status Attainment," *Demography*, 2016, pp. 1–26.

Lahdenperä, Mirkka, Virpi Lummaa, Samuli Helle, Marc Tremblay, and Andrew F Russell, "Fitness benefits of prolonged post-reproductive lifespan in women," *Nature*, 2004, *428* (6979), 178.

Long, Jason and Joseph Ferrie, "Grandfathers Matter(ed): Occupational Mobility Across Three Generations in the US and Britain, 1850ï¿œ??1911," *The Economic Journal*, 2018, *128* (612), F422–F445.

Mace, Ruth and Rebecca Sear, "Are humans cooperative breeders," in E. Voland, ed., *Grandmotherhood. The evolutionary significance of the second half of female life*, 2005, pp. 143–59.

Møllegaard, Stine and Mads Meier Jæger, "The effect of grandparents' economic, cultural, and social capital on grandchildren's educational success," *Research in Social Stratification and Mobility*, 2015, *42*, 11 – 19.

Williams, George C., "Pleiotropy, Natural Selection, And The Evolution Of Senescence," *Evolution*, 1957, *11* (4), 398–411.

Zeng, Zhen and Yu Xie, "The Effects of Grandparents on Children's Schooling: Evidence From Rural China," *Demography*, 2014, *51* (2), 599–617.

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