What is the True Rate of Social Mobility? Surnames and Social Mobility in England, 1800-2012

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Using rare surnames we follow the socio-economic status of initial groups of rich, middling, and poor in England from 1800 until 2012. We measure social status through wealth, education, occupation, membership in political elites, and average age at death. Mobility rates are much lower than conventionally estimated, including for the most recent generations. There is considerable persistence of status, even after 200 years. Surprisingly the arrival of mass publicly funded education, and universal suffrage, does not improve mobility. Finally we show why mobility rates measured in this way provide better estimates of long run, social group, and generalized social mobility than conventional estimates.

Introduction

Linking seven generations through rare surnames, this paper estimates wealth, education, occupational status, and years lived for England in the years 1800-2011 for initial elite and underclass groups, defined by their status in the mid nineteenth century. These measures of status by surname produce a number of interesting results. For wealth, education, occupation and membership in political elites the rate of social mobility in all generations is much lower than modern studies would suggest. But also there is no indication of much increase in social mobility in recent generations, despite the great extension of public support for education 1870-1970, and periods of significantly progressive taxation. However, the original elites and underclasses do regress closer to the mean in all status dimensions by generation. Mobility will eventually be complete, sometime in the 23rd century. In the final

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section of the paper we explore why these social mobility rates are much lower than those conventionally estimated for England. We argue that conventional measures of mobility cannot be applied to estimating long-run mobility, and also cannot be applied to measuring mobility rates across more general measures of social status that consider earnings, wealth, education and occupation as an aggregate. For these purposes these surname estimates correctly indicate the true, much slower, rate of social mobility.

The key idea of this paper is not to look at specific family linkages across generations, but instead to exploit naming conventions to track families. In England from 1800 till now the overwhelming majority of children inherit their surname from either their father or mother.[2] Common surnames in England tend to vary little in average social status.[3] Rare surnames, however, do vary in average social status, and it is these we use to track elite and underclass groups across generations. [4]

In England, a significant fraction of surnames have always been rare. Figure 1, for example, shows the share of the population holding surnames held by 50 people or less, for each frequency grouping, for the 1881 census of England. The vagaries of spelling and transcribing handwriting mean that, particularly for many of the surnames in the 1-5 frequency range, this is just a recording or transcription error. But for names in the frequency ranges 6-50, most will be genuine rare surnames. Thus in England in 1881 5 percent of the population, 1.3 million people, held 92,000 such rare surnames.

Such rare surnames arose in various ways: immigration of foreigners to England, such as the Huguenots after 1685 (example, *Abauzit*, *Bazalgette*), spelling mutations from more common surnames (*Bisshopp*), or just names that were always held by very few people, such as *Pepys*, *Binford,* or *Blacksmith*.

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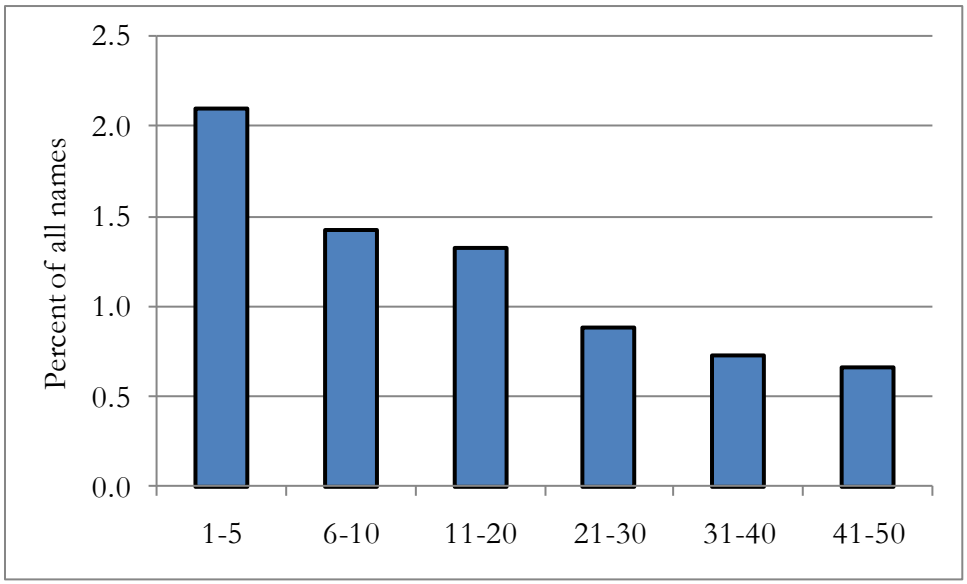
[2] Before 1960 birth records suggest 97% of children inherited their surname from their father, with the majority of the rest receiving it from their mother. Since then mothers have more often been the source of surnames, with now nearly 30% of children inheriting their mother's surname in birth records.

[3] When surnames were established in England in the Middle Ages many were a marker of social status. Slow but persistent social mobility, however, meant that by 1650 common surnames were of uniform average status.

[4] See the interesting study of Güell, Rodríguez Mora, Telmer (2007) which also measures social mobility through rare surnames, but using cross-section data. This paper, however, estimates a different mobility measure than the one identified below.

Figure 1: Relative Frequency of Rare Surnames, 1881 Census, England



Notes: From the transcribed 1881 census of England and Wales (Schurer and Woollard 2000).

Through two forces – the fact that many of those with rare names were related, and the operation of chance – the average social status of those with rare surnames varies greatly at any time. We can thus divide people in any generation into constructed social and economic classes of rich, middling, and poor by focusing on those with rare surnames. We will not often be able to discern exactly which later person with a surname was related to which earlier one. But by treating everyone with the surname as one large family we can follow people over many generations.

The economy of this method is that we do not need to trace individual linkages of parents and children. But suppose we are trying to estimate the intergenerational elasticity of wealth or education. How should measures based on surname cohorts compare to conventional measures? We would conventionally estimate this by estimating the value of b in the expression

$$y_{ij,t+1} = a + by_{it} + u_{ij,t+1} \qquad (1)$$

where y is log wealth, t indexes the generation, and i indexes the family, and j the individual children. Yet when we employ surname cohorts we instead estimate

$$\bar{y}_{kt+1} = a + b\bar{y}_{kt} + u_{kt+1} \quad (2)$$

$\bar{y}_{kt+1}$ and $\bar{y}_{kt}$ are now measured as average log wealth across a group of people with the surname type k in one generation, some of whom will not have any children, and a group of people with the same surname type in the next generation. Will the *b* estimated in this way be the same as that within families?

Suppose each person with surname type *k*, indexed by *i,* in generation *t* has n_{kit} children who carry this surname, and that the total number of members of each surname cohort is N_{kt} . Denote each child in the next generation with the given surname type as y_{kij}, $n_{kit} \geq j \geq 1$. Then

$$\bar{y}_{kt} = \sum_i \frac{y_{kit}}{N_{kt}}$$

and

$$\bar{y}_{kt+1} = \sum_i \sum_j \frac{y_{kijt+1}}{N_{kt+1}} = \frac{1}{N_{kt+1}} \sum_j \sum_1^{n_{kit}} (a + by_{kit} + u_{kit+1})$$

$$= a + b\frac{1}{N_{kt+1}} \sum_i n_{kit}\, y_{kit} + u_{t+1} \quad (3)$$

where $N_{kt+1} = \sum_i n_{kit}$.

To estimate b correctly we should thus weight every y_{kit} by the number of their children observed in the next generation, as above in (3). When we use expression (2) we weight all people of the previous generation with the surname equally, which thus weights equally people in generation t with no children as those who have many children. Thus it will introduce some measurement error in y_t, which should reduce the observed value of *b*.

Another potential bias on this estimate of b, compared to the true within family b, would come from a correlation between n_j and y_j. There is, for example, a negative correlation between n_j and y_j for births between 1850 and 1950. Richer fathers had fewer children. For this period thus, the surname method will tend to overweight the rich in the initial period, and thus underestimate the true b, since it will give too much weight to high y_{it}s in the earlier generation. However, we observe empirically below that this bias is modest. Splitting the rich into the very rich and the merely rich, and estimating the b's separately for each sub group produces b estimates that are similar for both groups, and no higher on average than the combined b estimates.

However, a key advantage of this method is that once we have defined the rich, medium and poor surnames in the first generation, our measures of b will not be downward biased in subsequent generations because of measurement error in wealth or other status measures. For after the first generation, these measurement errors will no longer be correlated with the error terms in the regression.

In this paper we construct of initial rich, medium and poor surname samples for the years 1800 on by choosing rare surnames where the average person at death in the interval 1858-1887 was either wealthy, middling, or poor. The exact way this is done is described below. This initial window was chosen because national measures of wealth at death become available only in 1858.

We can then measure the average wealth of these surnames for each of four subsequent death generations, 1888-1917, 1918-1952, 1953-1989, 1990-2024. Probate records give an indication of the wealth at death of everyone in England and Wales by name 1858 and later.[5] The generations were allocated on the assumption that the average child was born at age 30 of the parent. The average child would thus die 30 years later, plus any gain in average years lived by adults of that generation.

The *Bazalgette* surname, for example, yielded 19 deaths in the first generation, 17 in the second, 19 in the third, 18 in the fourth, and 12 in the fifth. We have measures of the stock of each name in 1881 from the census, and in 1998 from the Office of National Statistics.[6] We check against immigration of unrelated people with these surnames from outside England and Wales by making sure the stock in 1998 is close to that predicted by the 1881 stock plus all births since 1881 minus all deaths.

A drawback with such an analysis of wealth at death is that the average age at death was 80 by 2010. Thus the people dying in 2011 on average were born in 1933, and completed secondary schooling 1949-51. However the existence of birth and death registers for England and Wales from 1837 on, with age of death recorded after 1866, allows us to also divide our surnames into birth cohorts. Since the average adult 1858-1887 died around age 60, this means we can start with a birth generation of 1780-1809, and then follow with 5 more strict 30 year generations of

[5] Those not probated typically have wealth at death close to 0.
[6] A drawback of the ONS list of surname frequencies is that it excludes names with 4 or less occurrences.

1810-39, 1840-69, 1870-99, 1900-29, and 1930-59. Those in the last birth cohort will only be captured if they die age 81 or younger. And this allows us to consider people who completed secondary schooling as late as 1977.

We derive other measures of social status for these same surnames by generation. Most importantly we have measures of the numbers of people with these names who were or are students at Oxford and Cambridge, the elite universities that only the upper 0.7% of each cohort of students would attend. We can thus consider educational attainment over 8 generations of students: 1800-1829, 1830-59, 1860-89, 1890-1919, 1920-49, 1950-79, 1980-2009, and 2010-1. We can also independently define as another early elite those rare surnames found at Oxford and Cambridge 1800-29. We can then follow the representation of these two elites among high status occupations: physicians, 1830-2012, and attorneys, 1950-2012. And finally, as a measure of political elites, we have records of the numbers of Members of Parliament with these surnames 1830-2012.

The Data

Rare surname samples for the rich, prosperous, middling and poor were constructed as follows. Surnames were designated rich or prosperous based on the average log wealth at death (estimated as personalty) of all those 21 and above with a surname dying 1858-87. Throughout wealth was normalized by the average unskilled wage in England in the year of probate.[7] The rich were surnames where the average log of normalized wealth was 2.5 or more, the prosperous where average log normalized wealth was 0 to 2.5. We assumed throughout that those not probated had an average wealth of 0.1 of the average wage. This, as the appendix details, was generally about half the minimum estate value at which probate was required. The poor were taken as those surnames where no-one dying 1858-1887 was probated, and who thus had an average imputed log wealth of -2.3. Since in this period less than 16% of those dying were probated, the middling group was taken as those surnames where the average log wealth at death (as normalized) was between 0 and -2.3.

We found candidate surnames for each group from a variety of sources. For the rich and the prosperous surnames we had two lists of candidates. First we looked in

[7] Clark, 2011.

the years 1858-1861 at all probates of surnames beginning with the letters A-C held by 40 or fewer people in 1881, seeking those with substantial bequests that might be candidates to be rare surnames of high average wealth at death for the period 1858-1887. This process proved time consuming and produced only 38 rich surnames, and 22 prosperous ones. The second candidate source we had was a list of people who had died 1809-1839 leaving an estate of £100,000 or more from William Rubinstein.[8] This produced a set of 61 rich rare surnames, and 60 prosperous surnames for deaths in the years 1858-1887. Thus the bulk of the samples of rich and prosperous surnames dying 1858-1887 were identified by their surname wealth prior to 1840.

As candidates for the poor surnames we checked the probate records for rare surnames from two sources: a list of habitual paupers in 1861, and lists of the criminally indicted in London and Essex 1860-2. The appendix lists the details of these sources. As noted, rare surnames from these lists were allocated to the poor group where no-one dying with these surnames 1858-1887 was probated. This generated 211 such poor surnames. In the process of constructing the rich, prosperous and poor rare surname sample we were left with some rare surnames where someone with the surname was probated 1858-1887, but the average log normalized wealth was 0 to -2.3. These surnames were assigned to the middling group. There are 66 such surnames.

Table 1 lists the first 15 surnames alphabetically in each group. The complete listing is given in the appendix table A2. The important point here is that there is nothing in most of these surnames that signals their social status. Though there are a few of the rich surnames that would potentially signal great wealth – Rothschild, for example - most of the surnames themselves are neutral markers, not having any effects on outcomes. It is also important that no information about their status in years later than 1887 was used to assign surnames to the initial wealth type.

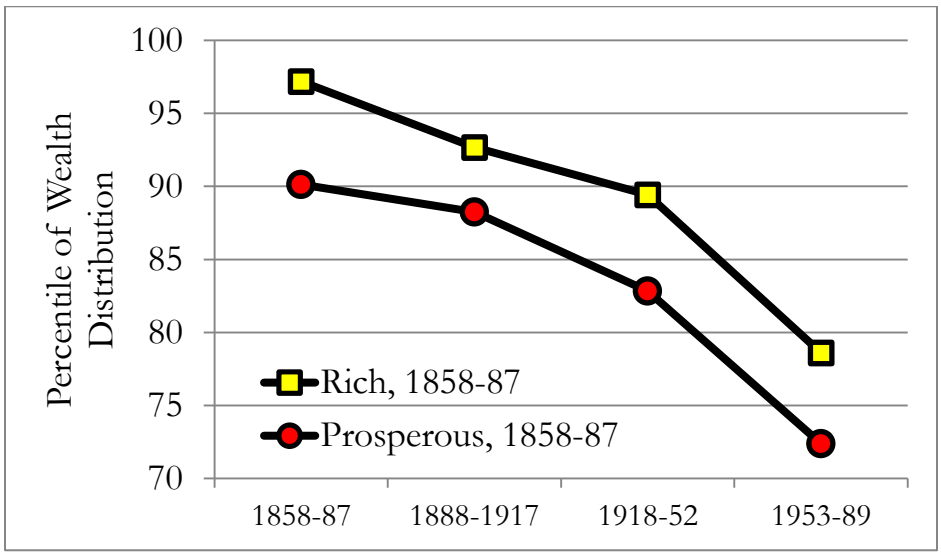
By design these surnames oversample the extremes of the wealth distribution in 1858-1887. However, even the surnames classified as *rich* or *prosperous* cover a wide range of wealth at death, particularly as we move to the second and later generations. Figure 2, for example, shows the location of the average normalized log wealth of the *rich* and *prosperous* surnames in the overall distribution of normalized log wealth, as represented by the *Brown* surname. By the fourth generation both of these richer surname types have average wealth that falls below the 80th percentile of all deceased.

[8] Rubinstein, 2009.

Table 1: The Rare Surname Groups, 1858-1887

Rich	Prosperous	Average	Poor
Ahmuty	Agace	Addaway	Aller
Allecock	Agar-Ellis	Adson	Almand
Angerstein	Aglen	Anspach	Angler
Appold	Aloof	Banbrook	Anglim
Auriol	Alsager	Barned	Annings
Bailward	Bagnold	Beioley	Austell
Basevi	Benthall	Benniworth	Backlake
Bazalgette	Berthon	Blacketer	Bagwill
Beague	Brandram	Bomber	Balsden
Berens	Brettingham	Briscombe	Bantham
Beridge	Brideoake	Bubbers	Bawson
Berners	Broadmead	Buggin	Beetchenow
Bigge	Broderip	Bullinger	Bemmer
Blegborough	Brouncker	Chandless	Bevill
Blicke	Brune	Coaffee	Bierley

Figure 2: Location by Wealth Percentiles, Richer Surname Types, by Generation



Thus within even these richer surname groupings there are many people dying with modest or no assets.

Table 2 gives a summary of the data by death generations. There are a declining number of surnames in the sample over time because rare surnames tend to die out due to the vagaries of fertility and mortality.[9]

Figure 3 shows the probate rates of the rich and poor surnames by decade, for those dying 21 and older. Also shown as a measure of the general indigenous English population are the probate rates for the surname *Brown*. The extreme difference in probate rates narrows over time. But even by 2000-2011 probate rates for the richest surname group are still above the average of England by at least 16%.

Figure 4 shows the average value of the logarithm of normalized probate values of those probated among rich and poor by decade, as well as for the *Brown* surname. In the years 1988-1998 the majority of probates were expressed in the form of a limited number of values that the estate was "not exceeding." Thus in 1990 there were 17 probates with actual values, 9 "not exceeding" £100,000 and 19 "not exceeding" £115,000. We consequently omitted the years 1988-1998 from the analysis of probate values. For 1981-87 when fewer probates had these value bands, and the so described limits were at the much lower levels of either £25,000 or £40,000, we replaced these values with an expected actual value for this range. This was the average of actual values for these years that fell below £25,000 and £40,000.

The average values for those probated among the rich approach those of the poor surname group over time, but were still higher in 2000-11. Finally figure 5 combines the information in figures 3 and 4 to produce an estimate of the average normalized log wealth at death of the rich and poor surname groups by decade.

Figure 5 shows that there is clearly a process of long run convergence in wealth of the two surname groups towards the social mean (represented by the *Browns*), and that process continued generation by generation, so that eventually there will be complete convergence in wealth of the two groups. For the indigenous population in England there are no permanent social classes, and all groups are regressing to the social mean.

[9] Since the death register 1858-1865 does not record age at death, for these years we estimated age at death where possible from records of age in the 1861, 1851, and 1841 censuses, as well as from the birth register 1837-1865.

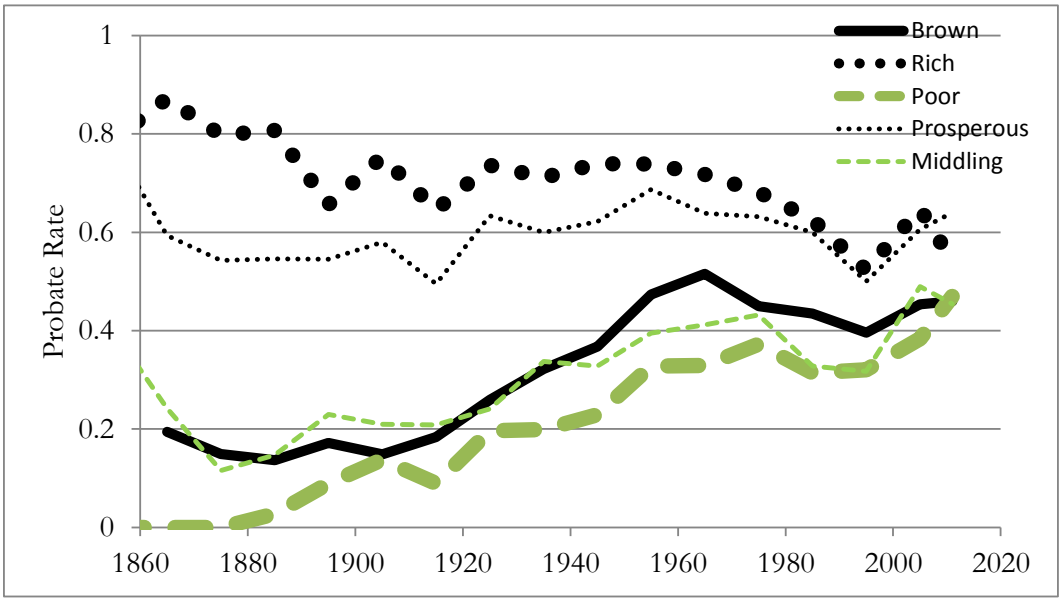
Table 2: Summary of the Sample

Period	Surnames	Probates	Deaths	Deaths 21+
RICH/PROSPEROUS				
1858-87	181	1,142	2,263	1,767*
1888-1917	172	1,072	1,987	1,792
1918-1952	168	1,582	2,478	2,383
1953-89	156	1,310	2,008	1,983
1990-2011	143	564	989	980
MIDDLING/POOR				
1858-87	273	107	3,300	1,798*
1888-1917	255	275	3,106	1,889
1918-1952	242	638	3,085	2,610
1953-89	246	1,305	3,776	3,654
1990-2011	214	836	2,165	2,135

Notes: All surnames were held by 40 or fewer people in the 1881 census. The Rich and Prosperous samples were those rare names which had an average log normalized wealth of over 2.5 and 0-2.5 respectively. Middling and Poor surnames had average log normalized wealth of -2.3 to 0, and -2.3 respectively. Deaths are from the General Registry Office (See References section).

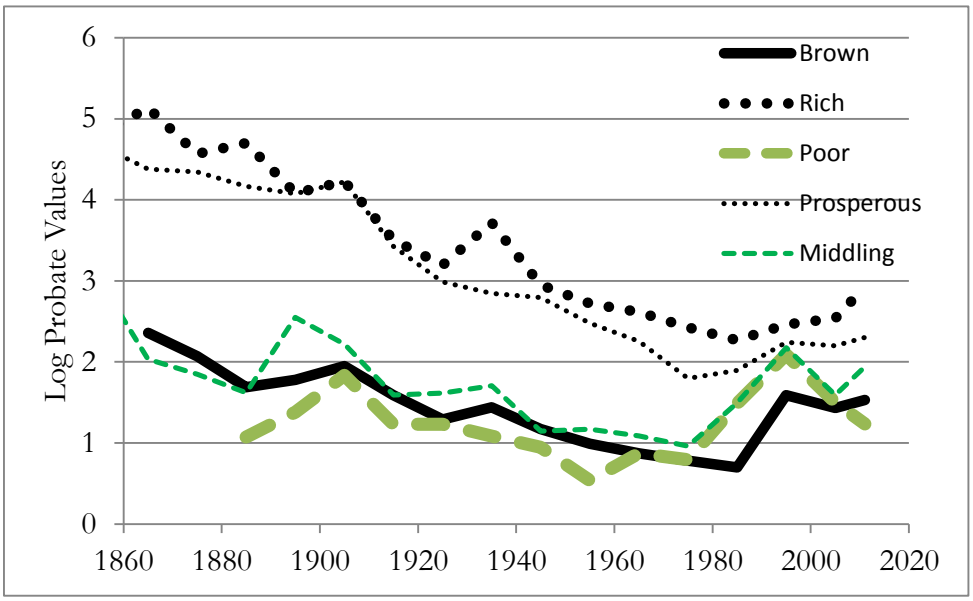
* Where age was unknown 1858-65, the fraction above 21 was estimated from the 1866-87 ratio of deaths 21+ to all deaths.

Figure 3: Probate Rates of Surname Types, by decade



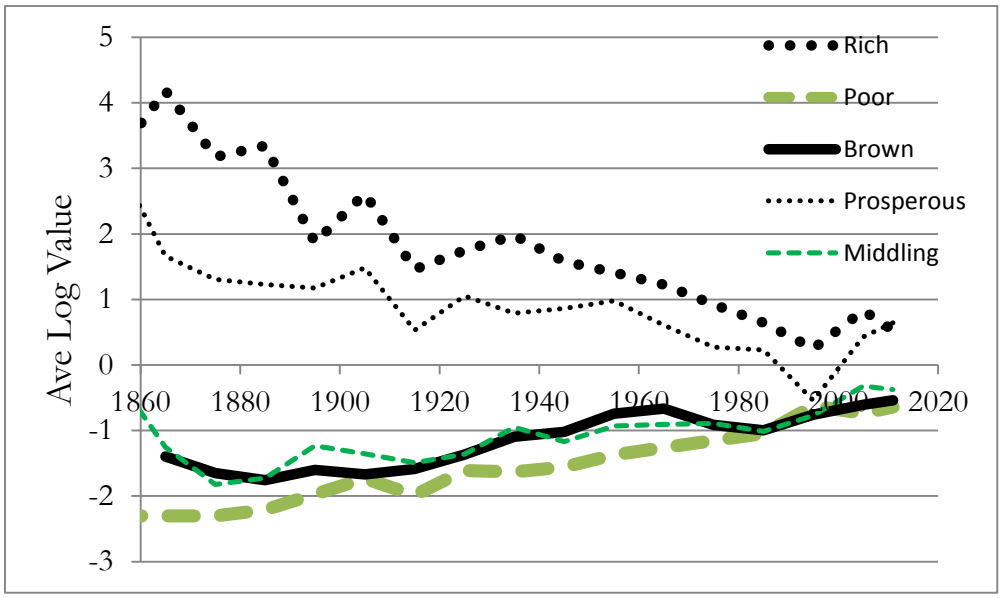
Notes: The probate rate in a given year is the number of people recorded in the probate registry divided by the number of people dying. (Source: Principal Probate Registry and GRO.)

Figure 4: Average Log Probate Value, those probated, by decade



Notes: Average log probate value is the log of real wage normalized probate wealth. For example, someone dying in 1940 with a probate valuation equal to the average annual wage in 1940 has a probate value of 1.

Figure 5: Average Log Probate Value, Including Those Not Probated



Notes: Those not probated are assigned a normalized probate value of .1 (10% of the average annual wage in the year they died).

But this process of convergence is much slower than recent estimates of *b*s for income, earnings and education would suggest. Average wealth at death in 2000-11 was still significantly higher for the group identified as rich in 1858-1887. Indeed the average wealth of the richest surname group from 1858-1887 was still 5.6 times that of the poorest surname group in 2000-11.

Estimated Wealth bs by generation

We can estimate the *b*s, for wealth, in several different ways. If we define $\bar{y}_{Rt}$ and $\bar{y}_{Pt}$ as the average of log normalized wealth for generation t for the richer and middling/poor surname groups, then the *b* linking this generation with the *n*th future generation can be measured simply as

$$\bar{y}_{Rt+n} - \bar{y}_{Pt+n} = \mathrm{b}(\bar{y}_{Rt} - \bar{y}_{Pt}) \qquad (4)$$

This measure will be, as described above, in expectation the same as the traditional intergenerational *b* estimates.

Figure 6: Average Log Probate value, by generation

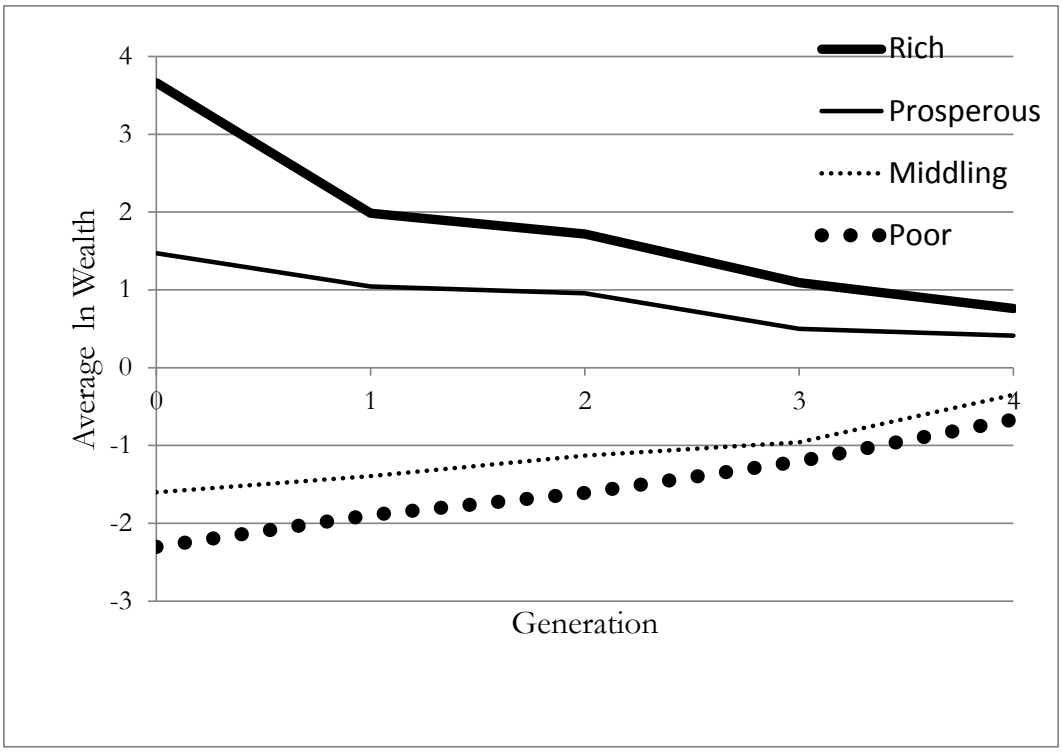


Table 3: b Values Between Death Generations

	1888-1917	**1918-1952**	**1953-1987**	**1999-2011**
1858-1887	**0.71** (.03)	0.62 (.02)	0.42 (.02)	0.26 (.03)
1888-1917		**0.86** (.03)	0.59 (.03)	0.36 (.04)
1918-1952			**0.68** (.03)	0.41 (.05)
1953-1987				**0.61** (.07)

Notes: Calculated from the formula; $\bar{y}_{Rt+n} - \bar{y}_{Pt+n} = \mathrm{b}(\bar{y}_{Rt} - \bar{y}_{Pt})$ where $\bar{y}$ is the log of average normalized wealth for the rich (subscript R) and poor/middling (subscript P) surname groups and $t, t+n$ denote the generation. Standard errors in parentheses.

This estimation has an advantage described above that after the first generation, when rich and poor samples were chosen partly based on wealth, there is no tendency for the *b* estimate to be attenuated by measurement error in wealth, since the average measurement error for both rich and poor groups will be zero. Figure 6 shows the mean log wealth of each group by generation, and table 3 the implied *b*s, along with bootstrapped standard errors.[10]

Table 3 suggests two things. One is that the average *b* values between generations are much higher than are conventionally estimated. The average *b* value across 4 generations is 0.72. These values are so high that there is still a significant connection between wealth 4 generations after the first.

The second suggestion of table 3, however, is that the *b* may have fallen for the last generation, those dying 1999-2011. However, we shall see that there is other evidence that suggests little increase in the rate of mobility in recent generations, and clear evidence that complete equality between the original rich and poor in wealth at death will not be accomplished before 2100.

The rise in the average age of death, however, implies that this generation was born on average in 1927, and had left High School by 1945. To get an estimate of *b* that is a more contemporaneous we can instead divide testators into 30 year long birth cohorts, with the first such cohort 1780-1809, and the last (the sixth) 1930-59. The last cohort, however, will have only those who died relatively young for their generation. Since the age-wealth profile is steeper for the rich surname groups, this will bias us towards finding more convergence in this last truncated 1930-59 generation. We thus correct for this in the estimate.

Table 4 shows composition of these birth cohorts. The truncation of the sample at either end implies that the first cohort 1780-1809 dies unusually old for the period, while the last cohort represents people dying unusually young. The truncation also implies that at the ends we do not observe people on average at the midpoints of the 30 year birth cohort. Thus the average birth date for 1780-1809 is 1798, not 1795. And the average birth date for the 1930-59 birth cohort is 1939, not 1945.

[10] If b is indeed the ratio of two normally distributed variables, it would not possess an expected value or a variance. However, in practice when we bootstrapped b over many thousands of iterations, its value was always defined.

Table 4: Wealth at Death by Birth Cohorts, Summary

Birth Period	Surnames	Observations	Average Birth Year (21+)	Average Age at Death (21+)
RICH/PROSPEROUS				
1780-1809	172	828	1797	76.6
1810-39	164	1,489	1826	67.0
1840-69	159	2,134	1855	66.6
1870-99	147	2,121	1883	68.2
1900-29	142	1,144	1912	69.5
1930-59	80	181	1941	57.4
MIDDLING/POOR				
1780-1809	204	581	1798	76.0
1810-39	188	1,281	1826	65.1
1840-69	188	1,881	1855	62.3
1870-99	189	2,523	1885	67.1
1900-29	179	1,893	1912	68.7
1930-59	116	354	1942	57.0

Figure 7 shows the average log wealth of these birth cohorts. In the last truncated cohort, those born 1930-59, we observe few people aged 80 or above, and disproportionately many younger people. This will bias downwards, in particular, the estimated wealth of the higher status groups in the last period (since high status groups these have a stronger age-wealth gradient). We do not attempt to control for this, but it does imply that the last period estimated b is too low.

Again we get a nice pattern predicting eventual regression to the mean. As average wealth narrows across the groups they always retain their initial ranking in terms of wealth.

Table 5 shows the implied *b* estimates between each period, as well as the bootstrapped standard errors.[11] Over now six generations of these birth cohorts the average one period b is 0.70, compared with 0.72 for the death generations. But there is no longer clear sign that the b has declined for recent generations. Instead the b is lower just for one generation, the move from those born 1870-99 to those born 1900-29. In the last generation observed, 1930-59, who would all have finished secondary schooling post WWII, there is nearly as strong a connection of wealth with their parent's generation as in the nineteenth century. And, as noted, since this estimate does not include people aged 80 and above, who have much higher wealth among the descendants of the rich, this b estimate is downward biased.[12] However, this last estimate has high standard errors because of the small numbers of observations, and the declining difference in wealth between the original rich and poor groups.

Table 5 also shows that the wealth of people born before 1810 with rare surnames still correlates significantly with the wealth of people with those same surnames 6 generations later born 1930-59. The average wealth at death of the group identified as wealthiest in 1780-1809 still is 3 times as great as those with the surnames of the poorest in 1780-1809, for those dying 1999-2011 and born 1930-59. We will show below that that correlation will continue for those born 1960-1989, and 1990-2011.

People born 1930-1959 were mainly exposed to the post WWII education and access regimes, including the National Health Service, and quite high redistributive tax rates during their work lives. Yet there is no sign of any greater social mobility than in earlier generations.

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[11] The raw b's have been revised downwards, by and average of 4%, to allow for the slightly less than 30 interval between the birth dates of the observed cohorts.

[12] The appendix figure A3 shows the age effect on median ln wealth for the richer groups. A rough method of correction we can employ is to reweight the observations from the last period in terms of the age distributions of all those dying 1999-2011, using the wealth of those dying aged 70-79 to proxy for those dying 80 and above. This implies a b estimate for the last period of 0.89.

Figure 7: Average log wealth by Birth Generation, 1780-1959.

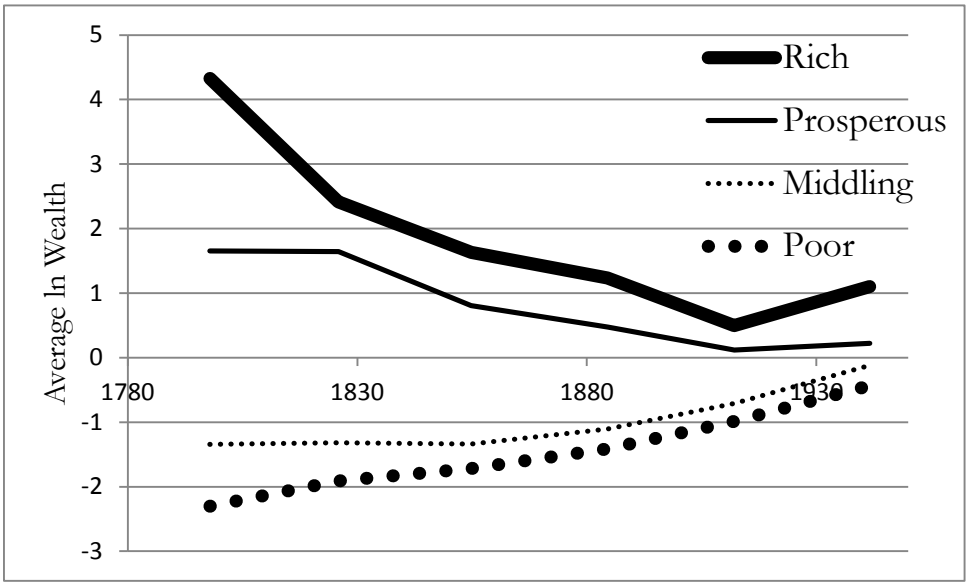


Table 5: b values between birth generations, 1780-1809 to 1930-1959

	1810-39	**1840-69**	**1870-99**	**1900-29**	**1930-59**
1780-1809	**0.72** (0.03)	0.54 (0.02)	0.41 (0.02)	0.23 (0.02)	0.16 (0.04)
1810-39		**0.75** (0.03)	0.57 (0.02)	0.32 (0.02)	0.22 (0.06)
1840-69			**0.76** (0.03)	0.41 (0.03)	0.29 (0.07)
1870-99				**0.56** (0.04)	0.39 (0.10)
1900-29					**0.69** (0.18)

Notes: Calculated from the formula; $\bar{y}_{Rt+n} - \bar{y}_{Pt+n} = \mathrm{b}(\bar{y}_{Rt} - \bar{y}_{Pt})$ where $\bar{y}$ is the log of average normalized wealth for the rich (subscript R) and poor/middling (subscript P) surname groups and $t, t+n$ denote the generation. Standard errors in parentheses. b values corrected to a 30 year generation gap. Standard errors were bootstrapped.

Because of the design of the surname sample it oversamples the rich, particularly in the early years. Could it be that regression to the mean is slower for the very rich than for the population as a whole? We can rule out this possibility for wealth, however. Our data suggests the rate of regression to the mean is similar for the rich, the prosperous and the poor. Table 6 thus shows separately for the rich, the prosperous, and the poor, the implied rate of regression to the mean in wealth between the generation dying 1858-1887, and that dying 1999-2011, where we take as the base group the surname *Brown(e)*, and estimate b from

$$\bar{y}_{Rt+1} - \bar{y}_{Bt+1} = \mathrm{b}(\bar{y}_{Rt} - \bar{y}_{Bt}) \qquad (5)$$

The average estimated b is 0.72 for the richest, 0.78 for the rich, and 0.73 for the poorest. There is no sign that slow regression to the mean is just a phenomenon of the very rich. Instead the b's are remarkably similar across groups. Because, however, the poor were much closer in average wealth to the *Brown(e)* surname, the estimates of b for this group are much less precise, and jump around from period to period.

We have to impute probate values for large numbers of people whose estates were not probated. Could this imputation be the source of the surprising persistence of wealth across the different surname groups? If we were estimating b through the conventional regression

$$y_{ij,t+1} = a + by_{it} + u_{ij,t+1} \qquad (1)$$

where y is log wealth, t indexes the generation, and i indexes the family, and j the individual children, then such imputation would indeed cause us to overestimate persistence, particularly among the poor surname group where there would be parents and children with the same exact imputed values. However, once we group people by surnames into hundreds in each generation to estimate b then the imputation has inconsequential effects on the estimate of b. Given that on average we are imputing the probate values for 530 people in each surname category per generation, even if we had the exact values of wealth for all those not probated these would average out in such a grouping close to the imputed values. However, as a check that this procedure is not introducing any spurious persistence we estimate b just from the fraction of people in each surname group probated in each period. The b estimates are still consistently high.

Table 6: Average b versus "Brown(e)" by Initial Wealth

	Gen 0 to Gen 4 Average	Gen 0 to Gen 1	Gen 1 to Gen 2	Gen 2 to Gen 3	Gen 3 to Gen 4
Rich	0.72	0.68	0.79	0.66	0.75
Prosperous	0.78	0.87	0.79	0.62	0.83
Poor	0.73	0.40	1.70	0.84	0.00

Notes: These b values are calculated by comparing the log of average normalized wealth for the surname groups with that of the Brown(e) surname via the formula; $\bar{y}_{Rt+1} - \bar{y}_{Bt+1} = \mathbf{b}(\bar{y}_{Rt} - \bar{y}_{Bt})$ where $\bar{y}_R$corresponds to the log of average normalized wealth for the rare surname groups and $\bar{y}_B$ is the log of average normalized wealth for the Brown(e) surname group.

Education

We find above very slow rates of regression to the mean for wealth at death in England. These wealth measures have drawbacks as a general index of social mobility. First it may be objected that of various components of social status – education, occupation, earnings, health, and wealth – wealth since it can be directly inherited will be the slowest to regress to the mean.[13] Second the wealth measures we have above are for people at the end of their lives, now typically 80. Thus even when we move to birth generations we can only observe the status of people born before 1959.

Using measures of educational attainment we can extend our coverage of the original rich group much closer to the present. The measure we use here is entry to Oxford or Cambridge, the two most elite English universities, which from 1800 to 2011 admitted only about 0.7% of each cohort of the eligible population. We have

[13] Becker and Tomes, 1986, find this possibility in their theoretical model of intergenerational mobility.

the complete record of Oxbridge attendees 1800-1893, and thereafter a large sample up to 2011. The last birth cohort we thus observe extends to 1993.

In the case of education, political elites, and occupation, what we observe is just the share of the general population in an elite group compared to the share of our rare surname samples. To extract implied bs for these cases we proceed as follows. Define the *relative representation* of each surname or surname type, z, in an elite group as

$$relative\ representation\ of\ z = \frac{Share\ of\ z\ in\ elite\ group}{Share\ of\ z\ in\ general\ population}$$

With social mobility any surname which in an initial period has a relative representation differing from 1 should tend towards 1, and the rate at which it tends to 1 is determined by the rate of social mobility.

To extract implied bs from information on the distribution of surnames among elites we proceed as follows. Assume that social status, y, follows a normal distribution, with mean 0 and variance σ^2. Suppose that a surname, z, has a relative representation greater than 1 among elite groups. The situation looks as in figure 8, which shows the general probability distribution function for status (assumed normally distributed) as well as the pdf for the elite group.

The overrepresentation of the surname in this elite could be produced by a range of values for the mean status, $\bar{y}_{z0}$, and the variance of status, σ^2_{z0}, for this surname. But for any assumption about ($\bar{y}_{z0}$, σ^2_{z0}) there will be an implied path of relative representation of the surname over generations for each possible *b*. This is because

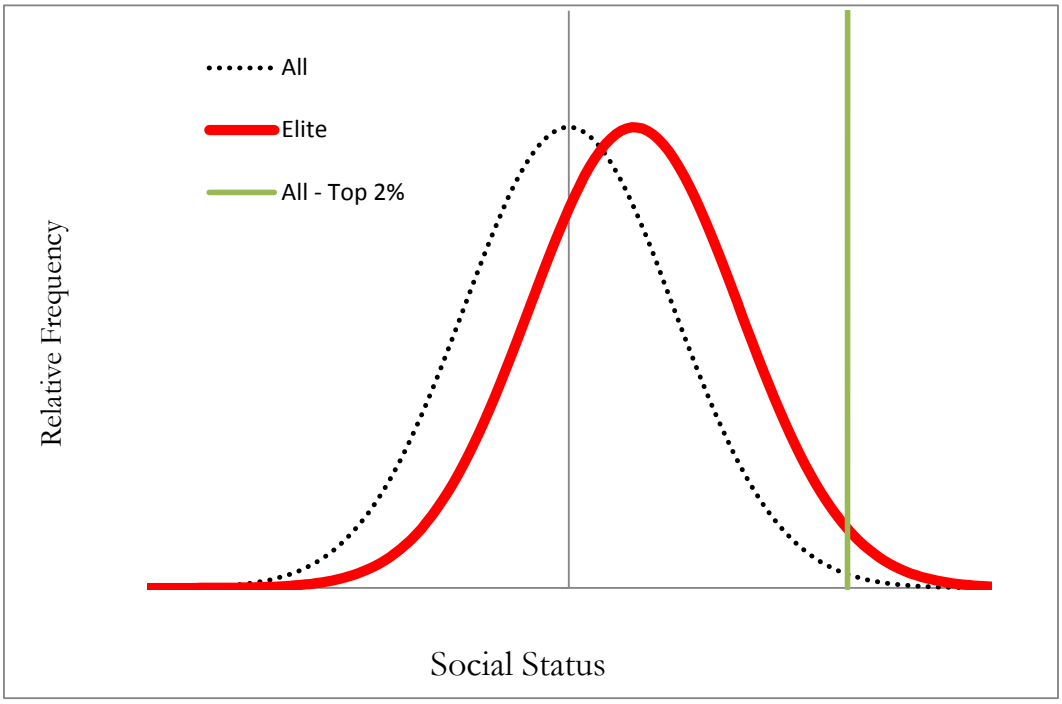
$$\bar{y}_{zt} = \bar{y}_{z0} b^t$$

Also since $var(y_{Zt}) = b^2 var(y_{Zt-1}) + (1 - b^2)\sigma^2$,

$$var(y_{zt}) = b^{2t}\sigma^2_{z0} + (1 - b^{2t})\sigma^2$$

With each generation, depending on *b,* the mean status of the elite surname will regress towards the population mean, and its variance increase to the population variance (assuming that $\sigma^2_{z0} < \sigma^2$). Its relative representation in the elite will decline in a particular pattern.

Figure 8: Initial Position of an Elite



Thus even though we cannot initially fix $\bar{y}_{z0}$ and σ_{z0}^2 for the elite surname just by observing its overrepresentation among an elite in the first period, we can fix these by choosing them along with *b* to best fit the relative representation of the elite surname z in the social elite in each subsequent generation. While we can in general expect that

$$0 < \sigma_{z0}^2 < \sigma^2$$

it turns out to matter little to the estimated size of b in later generations what specific initial variance is assumed. Below we assume that the initial variance of the elite surname status is the same as the overall variance, since this assumption fits the observed time path of relative representation well.

Table 7 shows the relative representation at Oxford and Cambridge of the rich and the prosperous rare surname groups, based on the wealth at death of those born 1780-1809 who died 1858 and later. In 1800-1829 the higher wealth surnames show

up at 94 times their share in the population among entrants to Oxford and Cambridge. The relative representation is estimated after 1837 using the birth registers, which allow us to approximate for each name the number of 18 year olds in each decade with each surname.[14] Relative representation for this elite group declines very little in the years 1830-59, for the children of the first generation. We thus take this second generation as the baseline, and ask what the subsequent decline implies about the rate of social mobility.

The table shows that the rich rare surnames steadily converging in relative representation towards 1. However, the rate of convergence is again slow. Even for the cohort entering Oxbridge 2010-1 the rich rare surnames are still 11 times more frequent relative to the stock of 18 year olds with that name than are common indigenous English names such as *Brown, Clark, Jones, Smith, Taylor* and *Williams*.

What does the pattern in decline of relative representation shown in table 7 imply about the b for education? The top curve in figure 9 shows the actual pattern of decline in relative representation of the rich/prosperous surnames at Oxbridge, as well as the fitted pattern if we assume a constant b and that in 1830-59 the variance in status among the wealthy/prosperous was the same as among the population as a whole.[15] This best fitting b is 0.81. Notice also that there is no sign that educational mobility has speeded up in the last few generations. The single b of 0.81 fits the pattern well in all generations. This estimated b for education is even higher than the b for wealth found above.

The rare surnames in this sample are all associated with wealth. We can form from the Oxbridge records another larger rare surname group which consists just of any other rare surnames that show up as entrants to Oxbridge 1800-29. Table 7 also shows the relative representation of these surnames at Oxbridge to 2011, as the lower curve. Here there is a large decline between 1800-29 and 1830-59. But to measure the long term b it is necessary to start with the generation 1830-59, where the elite surnames were selected based on their occurrence earlier, and so the rate of regression to the mean is not influenced by a preponderance of positive

[14] For the years 1800-1865 there have to be varying degrees of approximation to this stock of 20 year olds.
[15] Judged by minimizing the sum of squared deviations.

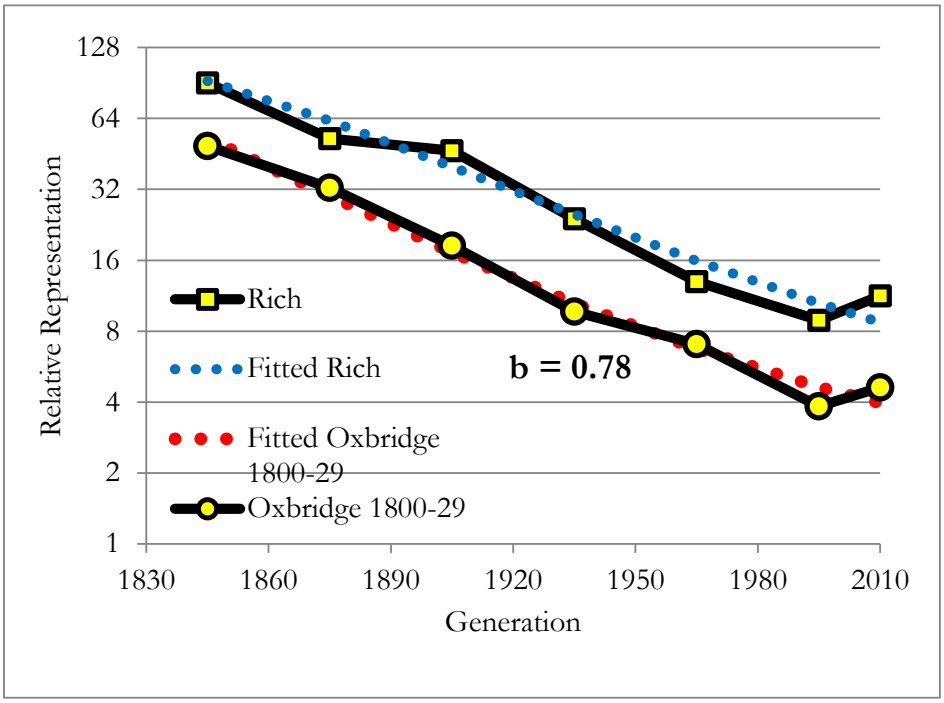
Table 7: Representation by Birth Cohorts at Oxbridge, 1800-2011

Period	Sample Size	N Wealthy Surnames	Relative Representation Wealthy Surnames	Relative Representation Oxbridge Rare Surnames 1800-29
1800-29	18,649	169	95	117
1830-59	24,415	210	91	49
1860-89	38,678	192	53	32
1890-1919	28,832	113	47	18
1920-49	66,516	114	24	9.7
1950-79	152,159	108	13	7.0
1980-2009	221,195	67	8.9	3.8
2010-1	26,388	9	11	4.6

Notes: Relative representation equals one where the surname has a representation at Oxbridge exactly the same as the average of Brown, Clark, Jones, Smith, Taylor, and Williams.

Sources: Venn, 1940-5, Cambridge University, 1954, 1976, 1998, 1999-2010, Foster, 1891-2, Foster, 1896, Oxford University, 1924, 1973, 1978, 1996-2010. 2010-11: Online student directories (See references for URLs).

Figure 9: Relative Representation at Oxbridge, 1830-2011



Notes: Sources as table 7.

errors among the surnames observed. As can be seen this group also remains an elite even to 2010-1. We can also calculate the implied b for the regression to the mean of this group 1830-59 to 1980-2010. It is 0.78, as is shown in figure 9. As before there is no sign of any speeding up of the process in the most recent generations. Just knowing that someone has a rare surname, where a holder of that surname was at Oxbridge 1800-29, allows us to predict that the name is three times as likely as common surnames that appear at Oxbridge 1980-2010. Thus the wealthy rare surnames are not unusual in their persistence among the educational elite.

These long term bs were based on assuming an initial variance of status among the elite surname groups – the wealthy born 1780-1809, and the Oxbridge attenders, 1800-29 – in 1830-59 that equaled that of the general population. If at the other extreme we assumed that there was no variance in status among these surnames in 1830-59, then it makes little difference to the implied long run b. In the case of the Oxbridge elite, for example, figure 10 shows what the best fit for b is in the cases where the initial variance of this elite in 1800-29 is assumed to be 0, and where it is

assumed to be the population variance. The b with an assumed initial 0 variance is 0.767, and with an assumed variance equal to that of the population 0.765. But, as can be seen in the figure, the assumption of an initial variance in social status of the elite surname group of 0 produces a less good fit initially with the observed pattern of decline in relative representation.

Thus despite the many changes in England over these generations, both the wealthier and the educationally advantaged of 1800-29 are losing their place only slowly. Yet in this interval the nature of universities, and the way in which they recruited students, changed dramatically.

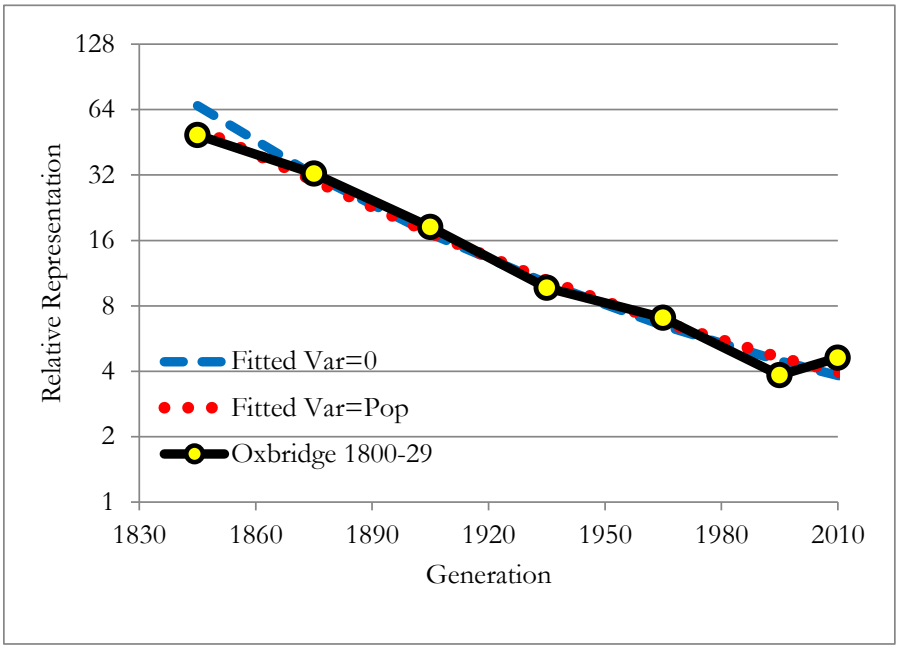
In the early nineteenth century, when Oxford and Cambridge were the only English universities, they were places largely closed to those outside the established Church of England. Not until 1871 were all religious tests for graduation from Oxford and Cambridge finally removed. As late as 1859 one of the rich group in our sample, Alfred de Rothschild, who was Jewish, had to petition to be excused attendance at Anglican service at Trinity College, Cambridge, which was granted as an especial indulgence.[16]

Before 1902 there was little or no public support for university education. Oxford and Cambridge supplied financial support for some students. But most of their scholarships went to students from elite endowed schools, who had the preparation to excel at the scholarship exams. In 1900-13, for example, nine schools, which had been identified as the elite of English secondary education in the Clarendon report of 1864, and which includes Eton, Harrow and Rugby, supplied 28% of male entrants to Oxford.[17] Another barrier lower class students faced was that before 1940 entrants to Oxford were required to complete a Latin entrance exam, which excluded students from less exclusive educational backgrounds.

Many more university students were provided financial support by local authorities 1920-1939. After World War II, there was a major increase in government financial support for secondary education, and for universities. Also

[16] Winstanley, 1940, 83.
[17] Greenstein, 1994, 47.

Figure 10: Assumed Initial Elite Status Variance, and Implied Relative Representation, Oxbridge, 1830-2010



Oxford and Cambridge devised entry procedures which should have reduced the admissions advantage of the tradition endowed feeder schools. This would seemingly imply a great deal more regression to the mean for elite surname frequencies at Oxford and Cambridge in the student generations 1950-79, 1980-2009, and 2010-14. Yet there is no evidence of this in figure 9. The elite we identified through wealth at death, born 1780-1809, has persisted just as tenaciously as an educational elite.[18]

The implied rate of mobility is so low that the rich elite names would not, at this rate, have a relative representation at Oxbridge below 1.1 until after another 20 generations (600 years).

[18] In potential explanation of this puzzle, Blanden, Gregg and Machin, 2005, note a significant decline in intergenerational mobility in Britain between cohorts born 1958 and 1970, which they attribute to a rise in educational inequality, driven by free tertiary education that overwhelmingly benefited the rich (p. 12). However, Blanden and Machin, 2007, reports no change in social mobility rates 1970-2000.

The Wealth b Inferred from Probate Rates

We can use exactly the same procedure as was done above for attendance at Oxbridge to infer the b implied by the movement of probate rates among the original rich, prosperous and poor surnames towards the social average probate rates as indicated by *Brown*. We just have to make allowance for the fact that the cutoff in the wealth distribution for being probated changed from the top 15.3% in 1858-87, to 16.8% in 1888-1917, 33.5% in 1918-1952, 47.3% in 1953-1989, and 42.5% in 1990-2011.

Table 8 shows the b fitted for each surname group and each period that matches the change in their relative representation among the probated. The fitted b is most stable for the rich, the group whose probate rates differs most from the average, and most noisy for the poor, whose probate rates are closest to the average.[19] But overall the rate of regression to the mean implied by the convergence of probate rates on the social average rate is very consistent with table 3, where the average b is estimated at 0.72. Here the average across he groups and periods is 0.78. There is also no sign, looking at the rich and the prosperous surnames, that regression to the measured by probate rates is any faster in the current generation than it was in earlier generations.

Since the purpose of this exercise is just to confirm that the imputation of wealth for those not probated in the sections above estimating wealth mobility is not likely to be driving up the estimated b values, we have not tried to bootstrap standard errors here. We just want to illustrate that the slow regression of wealth to the mean of these surname groups is robust to alternative ways of treating the data on wealth and probate rates.

[19] Note that for the poor group we cannot estimate b for the first to second generation because by definition no-one in this group was probated in the first generation, which is not contemplated with an assumed normal distribution of wealth with a variance equal to the variance of the whole for each group.

Table 8: Wealth b Inferred from the Proportion Probated

Period	Rich	Prosperous	Poor	Average by period
1888-1917	0.70	0.87	-	0.78
1918-1952	0.74	0.79	1.28	0.94
1953-1989	0.59	0.48	1.07	0.71
1990-2011[a]	0.68	0.91	0.43	0.67
Average by group	0.68	0.76	0.93	0.78

Note: [a]b estimate adjusted down to reflect incomplete generation observed.

Other Elites

Another measure of group status is the shares of these surnames in the political elite, English and Welsh members of the House of Commons in the UK Parliament. There were about 500 MPs on average from England and Wales in the nineteenth century, rising to around 550 for the twentieth century. Between 1800 and 1920 there was a great change in the fraction of the adult population with the electoral franchise, as table 8 shows. The franchise extended to only 13% of men in 1830, but rose through a series of reforms to 100% by 1918. Thus MPs were elected mainly by electors of relatively high social status in 1830. By the 1923, under the new universal franchise, 191 MPs were elected to Parliament from the Labour Party (some of these, however, were Scottish). Thus we might expect to see a substantial decline of the rare surname elites among MPs associated with these social changes.

Table 9 shows how many MPs were recorded for each 30 year period (and 1980-2012). We count each surname when there is a change of MP in any constituency. This will thus mainly show members at the time of their entry to Parliament, though some changed constituency, or were defeated and then returned in the same constituency. Compared to Oxbridge attendees, this is a much smaller group, and will not identify well the relative representation of names as they approach average status.

Table 9: Rare Rich Surnames among MPs, 1830-2012

Period	Franchise (% adult males)	New MPs	Rare Surnames of the Rich	Relative Repres-entation Rich	Rare Surnames Oxbridge 1800-29	Relative Repres-entation Oxbridge
1830-59	14	2,473	46	147	73	49
1860-89	36	1,853	31	142	51	47
1890-1919	61	1,780	9	51	21	21
1920-49	100	1,918	5	32	5	5
1950-79	100	1,422	2	22	5	8
1980-2012	100	1,379	0	0	4	10

Source: http://www.leighrayment.com/commons.htm

Figure 11: Relative Representation in the House of Commons, 1830-2012

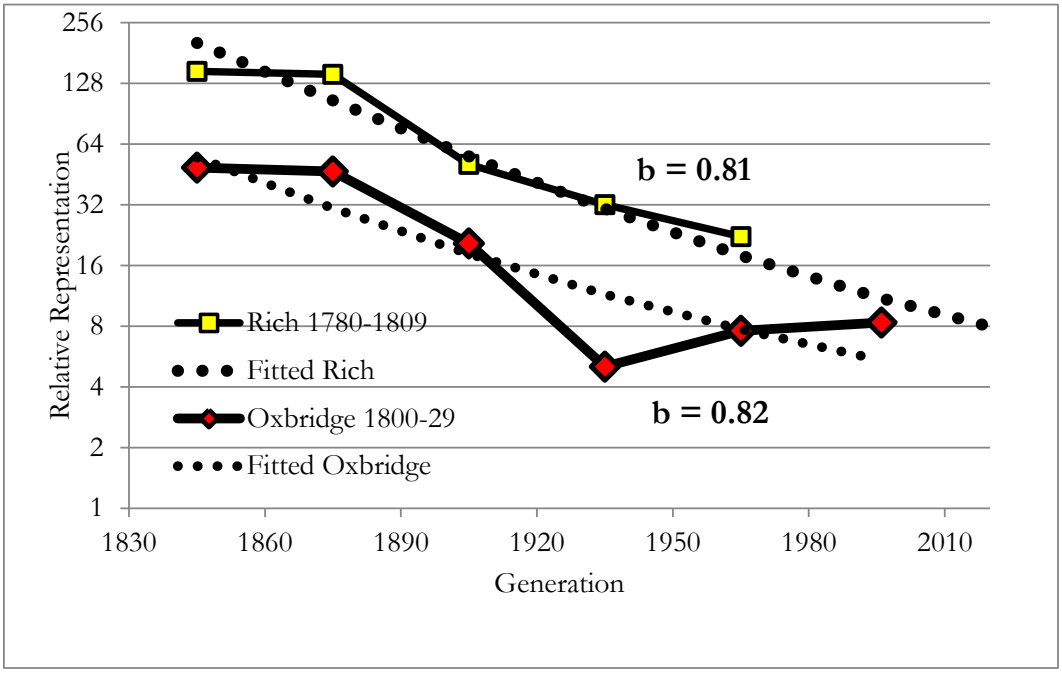


Table 9 also shows the numbers in each period of the rare surnames of the rich, and the numbers of the rare surnames of those attending Oxford and Cambridge 1800-29. The rich surnames, identified from those born 1780-1809, are greatly overrepresented in Parliament in the mid nineteenth century. In 1830-59 they were 1.86% of Parliament, even though we estimate those aged 30-40 with such surnames in this period were only 0.0127% of the population. Their relative representation declines steadily so that by 1980-2012 there were none of these surnames in Parliament. Figure 11 shows this decline. By 1980-2012 the number of new MPs relative to the population of England and Wales is so small that we would expect to see no MPs with the rare surnames even if there relative representation was as high as 8. So for the latter years this data tells us nothing about their social mobility. But the data for the earlier years, where the relative representation if the surnames is high, does imply a value for b again, the degree of persistence of elite status.

Assuming MPs represented the top 0.1% of society (there is only 1 MP per 100,000 people in the UK now), then the best fit for the pattern of decline of relative representation among the rich surnames is a b of 0.81, the same as for the rare surname elite at Oxbridge. This fit is shown in figure 11. The exact upper echelon in status that being an MP represents is not known, so we also estimated b under the assumption that MPs represented the top 0.01% and 0.5% of social status. The associated best fitting bs were 0.83, and 0.75.

For the Oxbridge rare surnames a similar pattern of decline in relative representation appears, with these names in 1980-2012 still 8 times overrepresented in Parliament (though based on very small numbers). The best fitting associated b is 0.82. For both of these groups of surnames, the rare rich and the rare Oxbridge attendees, the implied b for the generations from 1830 to 1919, when Parliament was still under substantial control of the propertied classes, is no higher than for the years 1890-2012 which witnessed the arrival of the universal franchise. Again the substantial institutional changes in the UK between 1832 and 1918 seem to have little perceptible effect on social mobility.

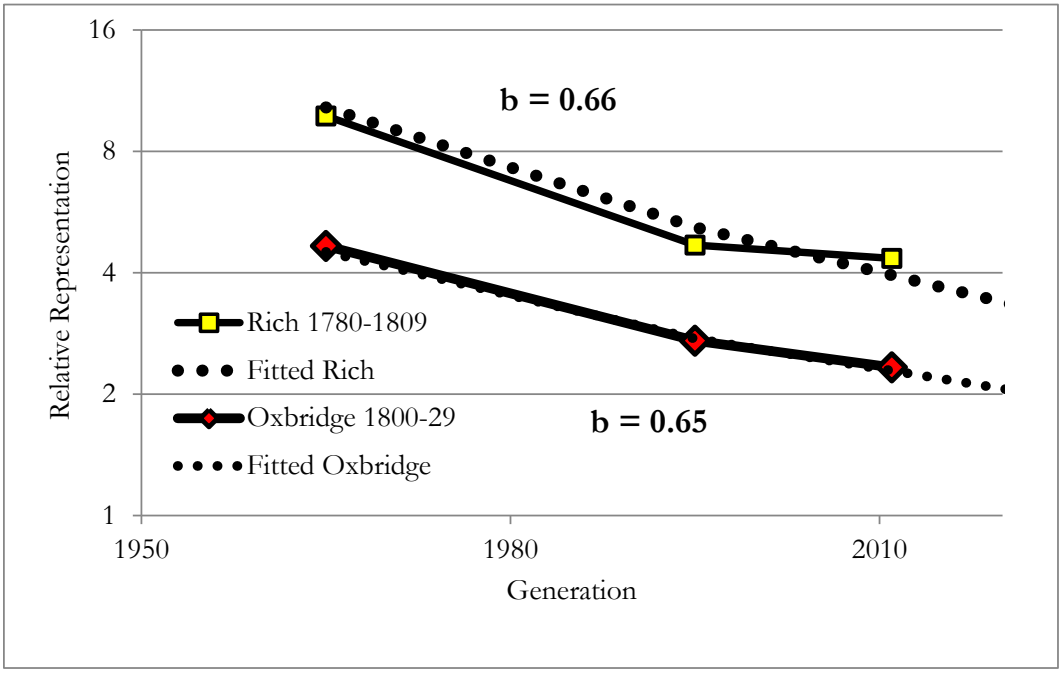
Attorneys are another relatively high status group that we can track mobility within in recent years. The Law Society has a register of 118,000 solicitors in the UK admitted to practice between 1952 and 2012. The Bar Council has a list of around 20,000 barristers, with year of call to the Bar. Combining these groups we have the information given in table 10 of the total stock of surnames by generations 1950-79, 1980-2009, and 2010-12, as well as the numbers of those with the rare surnames of

Table 10: Rare Rich Surnames among Solicitors and Barristers, 1950-2012

Period	"Clark", "Taylor" "Smith"	Rare Surnames of the Rich 1780-1809	Relative Repres-entation Rich	Rare Surnames Oxbridge 1800-29	Relative Repres-entation Oxbridge
1950-79	277	7	9.8	16	4.7
1980-2011	1,985	18	4.7	68	2.7
2010-2012	238	2	4.3	7	2.3

Sources: Law Society, Bar Council.

Figure 12: Relative Representation among Solicitors and Barristers, 1950-2012



the rich born 1780-1809, and the rare surnames of Oxbridge attendees 1800-29. Table 10 thus also shows the relative representation of our two groups of surnames. Several things stand out. Again the surnames of the rich or educated of 1800 show up even in the most recent years as overrepresented among attorneys. Again the rich of 1800 remain a more elite group even now than those identified just as attending Oxbridge. Social mobility over the long run is very slow. And again there is sign of slow but steady regression to the mean among both groups. Figure 12 shows that the implied b for the rich is 0.66, and that for the Oxbridge attendees 0.65.

Another high status occupation is that of physicians. We can get estimates of the relative representation of our rich surnames among physicians 1830-2012 from the UK Medical Register. This was instituted in 1859, and covers doctors throughout the UK. For 1859 and later we use the date of first admission to the medical register for each surname. For 1830-58, we use the date of first medical qualification for those registered first in 1859. For the years 1830-1959 we count only doctors with an address in England or Wales on registration. For 1859-2012 we count all doctors in the UK, where those in England and Wales would constitute 90% of the total.

Table 11 shows the sample size of all doctors for each generation, as well as the numbers of doctors in each generation with the surnames of the rare name cohorts. Also shown is the implied relative representation of these surnames compared to other surnames of domestic origin such as Smith. As before the rich surnames remain 5-6 times overrepresented among doctors even now, and the Oxbridge surnames of 1800-29 also remain overrepresented, but by a smaller margin of 3-4 times.

However, as figure 13 highlights, in this case there is no sign of any regression to the mean over the course of these six generations. Indeed these rare surnames are now, 2010-2 more overrepresented among doctors than they were in 1830-59. This effect is not a statistical artifact since it occurs in just the same way among the surname of the rich as for the surnames of the 1800-29 Oxbridge attendees. Thus the implied b for doctors would seem to be 1 or higher.

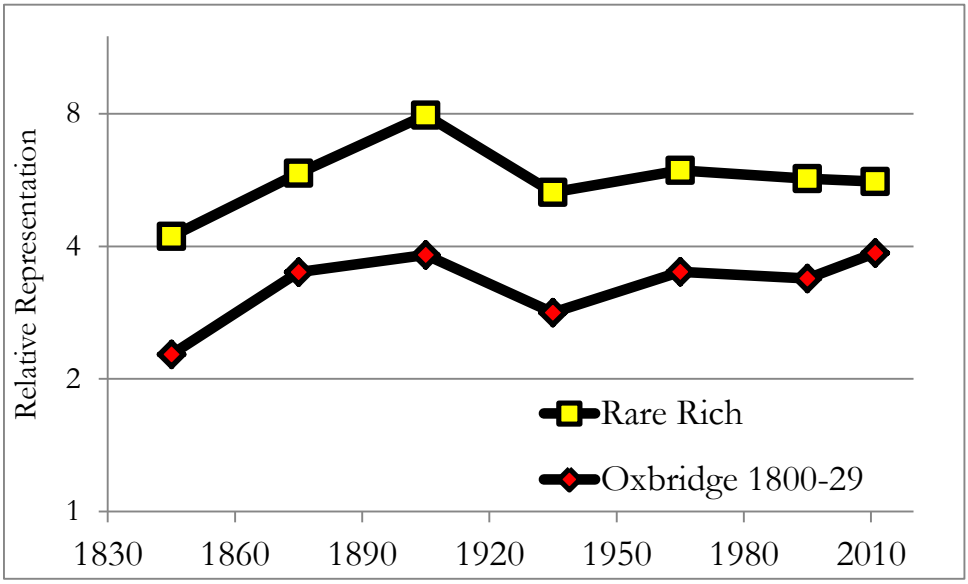
However, we think this effect is a product of the rising status of doctors over time. In 1830-59, for example, the rich surnames had a relative representation of 91 at Oxbridge, 147 among MPs, but only 4.2 among doctors. This suggests doctors then were a much less elite group than now. If doctors were rising in status over

Table 11: Representation among Doctors, 1830-2012

Period	Sample Size	N Wealthy Surnames	Relative Represent-ation Wealthy Surnames	N Wealthy Surnames	Relative Represent-ation Oxbridge Surnames
1830-59	9,547	8	4.2	20	2.3
1860-89	18,613	13	5.9	35	3.5
1890-1919	18,323	17	7.9	39	3.8
1920-49	28,063	11	5.3	30	2.8
1950-79	70,092	17	6.2	48	3.6
1980-2009	223,860	24	5.7	93	3.4
2010-12	14,996	2	5.6	9	3.9

Notes: Relative representation calculated relative to surnames containing Brown, Clark, Jones, Smith, Taylor, and Williams. *Sources*: General Medical Council, London, UK Medical Register, 1859-1959. General Medical Council, 2012, *List of Medical Practitioners*

Figure 13: Relative Representation among Doctors, 1830-2012



time, representing an ever smaller upper group of society in terms of status, then the regression to the mean of these surnames would be countered by this. For an elite group, the higher in the social ladder we look the greater will be their overrepresentation.

Longevity

Another indicator of social status is average age at death. Longevity in England, as in other societies, has since at least the nineteenth century been dependent on socio-economic status. In 2002-2005 life expectancy for professionals in England and Wales was 82.5 years. For unskilled manual workers it was only 75.4.[20] Table 12 shows the average age of death of the rich, middling and poor surnames (measured from the death cohorts of 1858-1887), by death generation, and for 2000-11. In 1858-1887 average age of death by surname group differs dramatically: 51.6 for the richest, 31.6 for the poor.

Average longevity converges steadily over time. For the fifth generation, deaths 1990-2011 the average age of death of the original rich surname group was 79.3, compared to the 76.1 average for the middling/poor surname group, a difference of 3.2 years.[21] Again the poor surname group had converged on the average age at death, as represented by the *Brown* surname, by this generation. But the rich surname group was still dying at above average age. And at current rates of convergence, again complete convergence with require many further generations.

The reason for the extreme difference in measured average longevity in the first generation is actually a combination of lower death rates for the rich at each age, but also greater fertility by the poor which exposed more of the poor population in the early years to high child mortality risks. If we look instead just at years lived for those surviving to 21 and above, the difference is modest. Figure 14 shows these average years lived by the original surname type, by generation. The implied intergenerational persistence coefficient on longevity, between the original rich versus middling/poor is 0.91 between generations 3 and 4, and 0.70 between generations 2 and 3. As figure 14 shows, the gap between the original rich surnames

[20] Office of National Statistics, "Variations persist in life expectancy by social class", http://www.statistics.gov.uk/pdfdir/le1007.pdf.

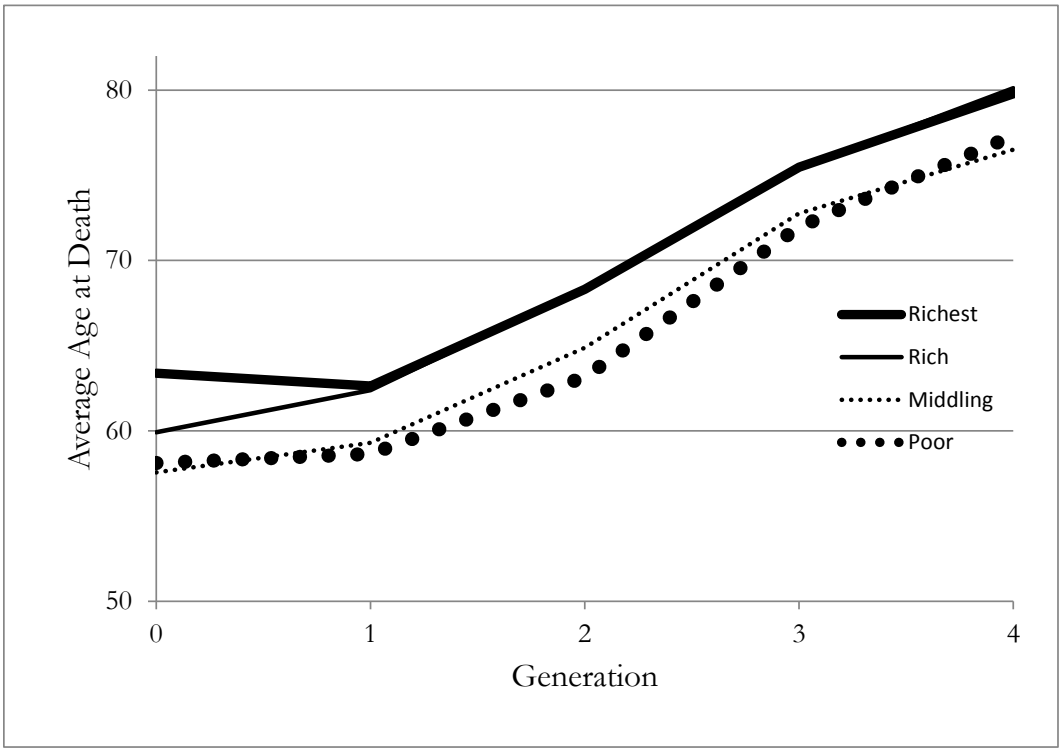
[21] Since the estimated standard error of the difference of mean ages at death is 0.59, this difference is highly significant statistically.

Table 12: Average Age at Death by Initial Wealth

Generation	Rich	Prosperous	Middling	Poor
1858-87	51.6	45.6	35.0	31.6
1888-1917	57.4	55.9	39.2	34.7
1918-1952	66.0	66.0	56.2	53.5
1953-89	74.8	74.2	71.1	69.5
1990-2011	79.5	79.5	75.4	76.4
2000-11	79.4	79.1	76.8	77.1

Source: GRO.

Figure 14: Average Age at Death (21+), by Death Generation



Source: Table 12.

and the rest hardly narrows over 150 years. Adult longevity is even more strongly inherited in the long run as wealth, education and occupational status for this group of families. This very slow regression to the mean is likely caused, however, by an increase over time in the effects of social status on longevity.

Why is Social Mobility so Slow for Surname Groupings?

The bs we find here for wealth, education, occupation, and longevity are high compared to the conventional estimates for the UK. It is this which allows for a significant connection between the wealth and educational attainment of people and their descendants 5-7 generations later. Table 13 shows a summary of recent estimates for b for the UK. These estimates of persistence are similar to those for the USA, and higher than in Scandinavia.[22] Long, 2012, also has occupational mobility estimates for England 1851-81, and 1881-1901 which suggest a b of 0.32-0.37. Note that the bs in table 13 are mainly those corrected for measurement errors. Why are the mobility rates derived using surnames, even for the modern era, substantially lower than most of these estimates?

Note that we do two things by forming people into surname cohorts. We group families in each generation, and we measure outcomes over multiple generations. To what extent are our slower rates of mobility the result of the aggregation of families, and to what extent is it the product of looking over multiple generations?

We hypothesize that the structure underlying our results is the following. Each family i in has an underlying status x_i which is regressing to the mean at a rate 1-b. Thus

$$x_{it+1} = bx_{it} + u_{it}$$

where x is measured with mean 0. However, we do not directly observe the underlying social status of families, which is a latent variable, but some partial measure for each member j, y_{ijt} , where such measures would be earnings, wealth, years of education, educational status, or occupational status. For each generation t

$$y_{ijt} = \theta x_{it} + e_{ijt}$$

[22] See the survey in Black and Devereux, 2011. Jäntti et al., 2006, compare intergenerational mobility between a small sample of nations; the UK lies in-between the relatively mobile Nordic countries and the relatively immobile US.

Table 13: Modern Intergenerational Elasticities for the UK

Measure	*b*	Source
Earnings	.22-.69	Dearden et al., 1997, Nicoletti and Ermisch, 2008
Wealth	.48-.59	Harbury and Hitchens, 1979
Education	.43-.71	Dearden et al., 1997, Hertz, 2007
Occupation	.08-.37	Francesconi and Nicoletti, 2006, Ermisch et al., 2005, Long, 2012
Longevity (adult)	.13-.17	Beeton and Pearson, 1899, Cohen, 1964

Notes: Education refers to years of education, occupation to an index of occupational prestige (the Hope-Goldthorpe score), or occupational status measured by average earnings. Longevity here is for fathers and sons living to 25 or greater, and is for the 17th-19th centuries.

where e_{ijt} is a random component linking the underlying status of the family to the particular observed measure of status in member j. This implies that the conventional studies of social mobility, based on estimating the β in the relationship

$$y_{ijt+1} = \beta y_{ijt} + v_{ijt}$$

will underestimate the true b indicating the mobility rate of this underlying family status across generations. In particular the expected value of $\hat{\beta}$ will be

$$E(\hat{\beta}) = b\frac{1}{1+\left(\frac{\sigma_e^2}{\theta^2\sigma_x^2}\right)} = \varphi b\,, \quad \varphi < 1\ .$$

The amount that the standard one generation estimate of β will underestimate the underlying b will depend on the importance of the random component linking this observed aspect of status to the underlying family status. That is why in table 13 different aspects of status seem to regress to the mean at different rates.

The random component linking underlying status to the various observed aspects exists for two reasons. First there is an element of luck in the status attained

by individuals given their underlying aptitudes. People happen to choose a successful field to work in, or firm to work for ("market luck" in the terminology of Becker and Tomes, 1986). They just succeed in being admitted to Oxbridge, as opposed to just failing. But second people make tradeoffs between income, education, occupational prestige, and other aspects of status. They choose to be philosophy professors as opposed to finance executives.

The conventional measures of regression to the mean are correct in the question that they answer. If a father, for example, has characteristic y, what is the predicted measure on this characteristic for his son unconditional on other information? But, we argue, if we want to predict inheritance of characteristics over multiple generations, or if we want to predict even in one generation how broader measures of family status will be inherited, these measures will fail, and there will be a much higher level of persistence b.[23]

For what this interpretation predicts is that if we were to follow individual families across *n* generations then the estimated $\hat{\beta}_n$ linking generation 0 and a subsequent generation *n* would be such that

$$E(\hat{\beta}) = \varphi b^n \ , \ \varphi < 1 \ . \ .$$

Regression to the mean would slow substantially after the first generation, and would thereafter be at a constant slower rate. So by looking across multiple generations on any partial measure of the social status of families we will see sign that the underlying rate of regression to the mean is indeed much slower than standardly measured mean regression. The stability of this underlying estimated b across many generations suggests that the process of social mobility is indeed AR1 measured in this way. Yet on conventional measures it will appear to have a more complicated dynamic structure with income in generation t, for example, depending on income in generation t-1, and t-2 and so on back through generations. [24]

[23] Indeed, if people are trading off aspects of status the individual error elements will be negatively correlated, so reducing even further the aggregate error.

[24] Confirming this Jason Long in a study of occupational mobility in England was able to link sons, fathers and grandfathers in 1851, 1881, and 1901. Even controlling for the occupation of fathers, the occupation of grandfathers was predictive of the occupation of sons. There was more persistence of occupational status long run than the one generation elasticity would suggest (personal communication from author).

The interpretation above also implies that if we aggregate people by any means that does not depend on their current status – such as their religion, social group, ethnicity, or status in some previous generation – so that on any measure y the expected error for the group in the first generation is 0, then we will observe even in the next generation the underlying b controlling regression to the mean.[25] This explains why the $\hat{b}$ estimated for every subsequent generation with our surname groupings is a good estimate of the underlying b. The fact that we are estimating the underlying b also explains why our long-run persistence parameters for very different aspects of social status cluster around 0.7-0.8 – wealth 0.74, education 0.80, political status 0.81, occupational status 0.65.

But why is the $\hat{b}$ estimated for wealth even in the first generation, 1858-87 to 1888-1917 still very high? Since we placed surnames into groupings based on their wealth shouldn't we observe faster regression to the mean in this first generation? The answer we believe to be the following. Our wealth estimate for each surname in the initial period is based on an average of 8 observations of wealth at death. Since wealth is highly correlated across these rare surnames (many of the people being related), this means that even though they are allocated to groups on the basis of their initial wealth, by such averaging we are substantially reducing the random component in the initial wealth measures. The observed average initial wealth of these surnames is a good proxy in this case for the underlying status of these families. That is why we also see these surnames as highly represented at the universities and in political office.

In contrast we formed a sample of rare surnames that attended Oxbridge in 1800-29 based on just observing one person with that surname at either Oxford or Cambridge in this period. In this case the implied intergenerational correlation for entry to this elite between this first generation and the next is 0.61. But for all subsequent generations the implied correlation rises to 0.79. The faster observed regression to the mean in the second generation is because the first generation of this elite contains many people who were the recipients of good luck in their admission to Oxford or Cambridge, but were not truly from high status families. But since for the second and subsequent generations there is no systematic positive luck

[25] In line with this Hertz, 2005, found that Blacks, Latinos and Jews in the US all have lower rates of social mobility than would be predicted by the standard bs.

component in any generation, thereafter we get unbiased estimates of the rate of decline of the underlying social status thereafter.

We can illustrate the differences between these measures of social mobility with the wealth data itself. Using the census, birth, death and marriage registers for England 1837-2011 we are able to link 1,342 adult children to fathers, much of the rare surname sample. This was done by cross referencing the probate and death records with the census enumerator forms from 1841 to 1911. After 1911, all marriage index records listed the maiden name of the bride. In addition, all birth index records contained the maiden name of the child's mother. It is thus possible to link children to marriages. Following this, marriages were linked to death and probate records. All ambiguous matches, where there was more than one potential match, were dropped.

Using this data we can estimate directly the b in

$$y_{ij,t+1} = a + by_{ij,t} + u_{ij,t+1} \qquad (1)$$

for individual families. Because the daughters observed are just those who were single at death (so retaining the family surname) we estimate

$$ln(WEALTH\ CHILD) = a + bln(WEALTH\ FATHER) + cDFEM + e$$

where DFEM is an indicator variable, 1 for a daughter. These estimates will be upward biased by the fact that for many parents and children we have to impute an estate value (normalized) of 0.1, because they were not probated. The lack of an error component in this imputation will drive up the estimated b. Table 14 shows the resulting b for children dying in each of our death generations, compared to our estimates of b from surname cohorts.[26] The b estimated directly from families is consistently lower. This again emphasizes that there is nothing unusual about our sample of individuals that is producing these high b estimates, it is the method itself.

The same pattern between individual and surname estimates appears if we look at longevity. Table 15 shows the intergenerational correlation of adult male longevity calculated in two ways, from fathers to sons, averaging across the same surnames, and as the average of the original rich and poor/middling surnames. The individual bs are extremely low, averaging 0.06, but in line with the established literature on the

[26] The coefficient on the indicator variable for daughters is always negative.

Table 14: Wealth bs from Surnames and Families, by death generation

Child Death Period	Surname Types b	Linked Children Number	Individual Families b
1888-1917	0.71	202	0.59
1918-1952	0.86	466	0.65
1953-1987	0.68	389	0.51
1988-2011	0.61	239	0.29
Average	0.72	-	0.51

Table 15: Longevity bs from Surnames and Fathers-Sons, by death generation

Child Death Period	Surname Types b	Linked Sons Number	Fathers-sons b
1888-1917	1.01	83	0.02
1918-1952	1.27	205	0.10
1953-1987	0.70	195	0.16
1988-2011	0.91	262	-0.05
Average	0.97	-	0.06

inheritance of longevity.[27] But calculated from the average longevity of the descendants of the rich and middling/poor of the original generation the bs rise to average 0.97.[28] Again, grouping by surnames, we get an estimate of much greater persistence. But in this case the random elements determining age at death are so great that the individual correlation between fathers and sons is extremely low, even though at the level of the surname groups there is strong inheritance of longevity.

These results for England, consistent but slow long-run social mobility have been replicated by one of the authors in a similar surname study for Sweden, 1700-2012 (Clark, 2012). Despite the conventional evidence that income mobility is rapid in Sweden, for example, elite surname groups identified from their status circa 1700 are still overrepresented in modern Sweden in medicine, law, and universities. They have higher incomes, more wealth, and live in higher prestige locations. The underlying b implied by the Swedish data is very similar to that discerned in England, 0.7-0.8. Again in Sweden there is no sign of any increase in mobility rates in recent generations. Thus these findings for England reflect a general pattern whereby social mobility rates measured through surnames tend to be much lower than conventional estimates.

The compression of earned incomes in Sweden relative to the UK means the random error components contribute a much greater share of earnings variance in Sweden.[29] This will make the conventional intergenerational correlation estimated for earnings in Sweden correspondingly a more downward biased estimate of the underlying b than in the UK. Internationally there appears to be a correlation between earnings inequality and the intergenerational mobility of earnings (Corak, 2012). But the evidence above that the conventional estimates of social mobility will be a better proxy for the underlying mobility rates the less important are random elements in earnings suggests that measured rates of social mobility may be less good proxies for the underlying rates the more equal are earnings.

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[27] We use just fathers-sons here because of the difficulty of linking daughters. On the intergenerational link in other samples of parents and children see Beeton and Pearson, 1899, Cohen, 1964.

[28] Changes in the conditions governing mortality make this b very difficult to interpret, and we merely emphasize here how different this is from the individual level bs.

[29] In terms of our specification above that $y_t = \theta x_t + e_t$, the θ is smaller in Sweden, but the error variance is the same.

Conclusions

Following the English through 5-8 generations using rare surnames suggests somewhat paradoxical conclusions. On the one hand we see in each generation on most measures a steady tendency of both rich and poor to regress to the mean. This tendency implies that ultimately the descendants of both groups will have average social status.

On the other hand, the long run persistence of wealth, education, occupational status, and longevity is much higher than would be expected from modern two-generation studies. The *b* for underlying social status in England in these years averages 0.7-0.8, compared to an average of about 0.4-0.5 found in conventional studies. As noted, the conventional *b* measures something different from the *b* estimated here. But for generalized measures of social status the b derived here is the appropriate one.

Because the amount of variance in status in future generations explained by inheritance is b^2, if the true *b* for social status generally is 0.7-0.8 as opposed to 0.4-0.5, then the importance of inheritance in explaining outcomes rises sharply. A *b* of 0.4-0.5 implies inheritance explains 16-25% of status variation, but a *b* of 0.7-0.8 means it explains 49-64%, more than twice as much.

A further surprise is that the rate of regression to the mean for both wealth and other status measures changes little over time, even though between 1800 and 2011 there have been substantial institutional changes in England. Wealth and income was lightly taxed, or not taxed at all, for most of the nineteenth century, but heavily taxed for much of the late twentieth century. Nineteenth century Oxford and Cambridge were exclusive clubs with strong ties to particular private high schools. By the 1940s they began a process of opening up admissions to students from a wider variety of educational backgrounds. And state financial support for students from poorer backgrounds became considerable. Our measures look at what is happening at the top of the educational ladder, but the conclusion that there is no gain in rates of social mobility for the society as a whole is supported by the finding of Jason Long that there was at best modest gains in occupational mobility between 1851 and 1973 (Long, 2012).

The modest effects of major institutional changes on social mobility implies that the important determination of persistence is transmission within families – either

through genes or family environments – and that there may be modest prospect of increasing mobility through state action.

Data Sources

Wealth:

England and Wales, Index to Wills and Administrations, 1858-2011. Principal Probate registry, London (available online 1861-1898, 1903-1942 at Ancestry.co.uk).
Prerogative Court of Canterbury and Related Probate Jurisdictions: Probate Act Books. Volumes: 1850-57. Held at the National Archives, Kew. (Catalogue Reference: PROB 8/243-250.)

Births and Deaths:

General Register Office. England and Wales Civil Registration Indexes. London, England: General Register Office.

Online Sources:

FreeBMD. *England & Wales, FreeBMD Death Index: 1837-1915* [database on-line]. Provo, UT, USA: Ancestry.com Operations Inc, 2006.
FreeBMD. *England & Wales, FreeBMD Birth Index, 1837-1915* [database on-line]. Provo, UT, USA: Ancestry.com Operations Inc, 2006.
Ancestry.com. *England & Wales, Birth Index: 1916-2005* [database on-line]. Provo, UT, USA: Ancestry.com Operations Inc, 2008.
Ancestry.com. *England & Wales, Death Index: 1916-2006* [database on-line]. Provo, UT, USA: Ancestry.com Operations Inc, 2007.

Births post 2005 and deaths post 2006 were collected from the London Metropolitan Archives.

University Attendance:

Venn, J. A. 1940-54. *Alumni Cantabrigienses, 1752-1900*, 6 vols. Cambridge, Cambridge University Press.
Cambridge University. 1954. *Annual Register of the University of Cambridge, 1954-5.* Cambridge: Cambridge University Press.

Cambridge University. 1976. *The Cambridge University List of Members, 1976*. Cambridge: Cambridge University Press.
Cambridge University. 1998. *The Cambridge University List of Members, 1998*. Cambridge: Cambridge University Press.
Cambridge University. 1999-2010. *Cambridge University Reporter*. Cambridge: Cambridge University Press.
Foster, Joseph. 1891-2**.** *Alumni Oxonienses 1715-1886. Oxford: Clarendon Press.*
Oxford University. 1924, 1996-2010. *The Oxford University Calendar*. Oxford: Clarendon Press.
Student E-mail Directories (2010-11):
Oxford: http://www.ox.ac.uk/applications/contact_search/
Cambridge: http://jackdaw.cam.ac.uk/mailsearch/

Others:

Calendars of Prisoners, 1860-9. Calendars of prisoners for Essex Quarter Sessions, Essex Assizes and Special Sessions of Gaol Delivery. Essex Record Office, Q/SMC 9.
England and Wales, Censuses, 1841-1901. Available online at http://www.nationalarchives.gov.uk/records/census-records.htm
General Medical Council, 2012, *List of Medical Practitioners*. Available online at www.gmc-uk.org/doctors/register/LRMP.asp
List of UK MPS, 1660-2012. Available online at http://www.leighrayment.com/commons.htm
Office for National Statistics, *Surnames*. Available online at http://www.taliesin-arlein.net/names/search.php
Proceedings of the Old Bailey, 1674-1913. Available at http://www.oldbaileyonline.org/
Schurer, Kevin and Woollard, Matthew, 1881 Census for England and Wales, the Channel Islands and the Isle of Man (Enhanced Version) [computer file]. Genealogical Society of Utah, Federation of Family History Societies, [original data producer(s)]. Colchester, Essex: UK Data Archive [distributor], 2000. SN: 4177, http://dx.doi.org/10.5255/UKDA-SN-4177-1
Solicitors Regulation Authority, *The UK Roll of Solicitors*, 2012. Available online at http://www.lawsociety.org.uk

The General Council of the Bar/Sweet and Maxwell. *The Bar Directory*, 2011. Available online at http://www.legalhub.co.uk

UK, House of Commons Papers. 1861. *Paupers in workhouses. Returns from each workhouse in England and Wales, of the name of every adult pauper who has been an inmate of the workhouse during a continuous period of five years*. Vol LV, 201. Cmd. 490.

References

Becker, Gary and Nigel Tomes. 1986. "Human Capital and the Rise and Fall of Families." *Journal of Labor Economics, 4*(3): S1-S39.

Beeton, M. and K. Pearson. 1899. "Data for the problem of evolution in man. II. A first study of the inheritance of longevity and the selective death-rate in man." *Proceedings of the Royal Society of London*, *65*: 290-305.

Black, Sandra E. and Paul J. Devereux. 2011. "Recent Developments in Intergenerational Mobility." *Handbook of Labor Economics, Vol. 4B, Chapter 16,* Eds. Orley Ashenfelter and David Card. Amsterdam: Elsevier, 2011.

Blanden, Jo, Goodman, A., Gregg, P., and Stephen Machin. 2004. "Changes in intergenerational mobility in Britain." In Miles Corak (ed.), *Generational income mobility in North America and Europe*, 122-146.

Blanden, Jo, Gregg, P., and Stephen Machin. 2005. *Intergenerational mobility in Europe and North America.* London: Centre for Economic Performance.

Blanden, Jo, and Stephen Machin. 2007. *Recent changes in intergenerational mobility in Britain.* London: Sutton Trust.

Card, David, John DiNardo and Eugena Estes, 2000. "The More Things Change: Immigrants and the Children of Immigrants in the 1940s, the 1970s, and the 1990s*," Issues in the Economics of Immigration*, 227-270.

Clark, Gregory. 2010. "The Macroeconomic Aggregates for England, 1209-1869." *Research in Economic History, 27*: 51-140.

Clark, Gregory. 2011. "Average Earnings and Retail Prices, UK, 1209-2010" Working Paper, UC Davis.

Clark, Gregory. 2012. "What is the True Rate of Social Mobility in Sweden? A Surname Analysis, 1700-2012." Working Paper, UC Davis.

Cohen, H. Bernice. 1964 "Family patterns of mortality and life span." *The Quarterly Review of Biology*, *39*: 130–181.

Corak, Miles. 2006. "Do Poor Children Become Poor Adults? Lessons from a Cross Country Comparison of Generational Earnings Mobility." IZA Discussion Paper No. 1993.

Corak, Miles. 2012. "Inequality from Generation to Generation: The United States in Comparison," in Robert Rycroft (editor), *The Economics of Inequality, Poverty, and Discrimination in the 21st Century,* ABC-CLIO, forthcoming.

Dearden, Lorraine, Stephen Machin and Howard Reed. 1997. "Intergenerational mobility in Britain." *Economic Journal,* 107: 47-66.

Ermisch, John, Marco Francesconi and Thomas Siedler. 2005. "Intergenerational mobility and marital sorting", *Economic Journal* 116: 659-679.

Francesconi, Marco, and Cheti Nicoletti. 2006. "Intergenerational mobility and sample selection in short panels." *Journal of Applied Econometrics*, 21: 1265-1293.

Greenstein, Daniel I. 1994. "The junior members, 1900-1990: a profile." In Brian Harrison (ed.), *The History of the University of Oxford*, *Volume VIII*. Oxford: Clarendon Press.

Güell, Maia, José V. Rodríguez Mora, and Telmer, Chris. 2007. "Intergenerational Mobility and the Informative Content of Surnames." Working Paper, Edinburgh University.

Harbury, C. D. and Hitchens, D. M. W. N. 1979. *Inheritance and Wealth Inequality in Britain.* London: Allen and Unwin.

Hertz, Thomas. 2005. "Rags, Riches and Race: The Intergenerational Mobility of Black and White Families in the United States" in Samuel Bowles, Herbert Gintis and Melissa Osborne (eds.), *Unequal Chances: Family Background and Economic Success*, 165-191. New York: Russell Sage and Princeton University Press.

Hertz, Thomas, Tamara Jayasundera, Patrizio Piraino, Sibel Selcuk, Nicole Smith and AlinaVerashchagina. 2007. "The inheritance of educational inequality: International comparisons and fifty-year trends." *The B.E. Journal of Economic Analysis & Policy* 7, Article 10.

Jäntti, Markus, Bernt Bratsberg, Knut Røed, Oddbjørn Raaum, Robin Naylor, Eva Österbacka, Anders Björklund and Tor Eriksson. 2006. "American exceptionalism in a new Light: A comparison of intergenerational earnings mobility in the Nordic countries, the United Kingdom and the United States," Discussion paper no. 1938, Institute for the Study of Labor (IZA), Bonn.

Jebb, Richard. 1858. *The act to amend the law relating to probates and letters of administration in England. London:* V. & R. Stevens and G.S. Norton, H. Sweet, and W. Maxwell.

Long, Jason. 2012. "The Surprising Social Mobility of Victorian Britain." Forthcoming, *European Review of Economic History*.

Nicoletti, Cheti and John Ermisch. 2007. "Intergenerational earnings mobility: Changes across cohorts in Britain", *B.E. Journal of Economic Analysis and Policy* 7, Article 9

Rubinstein, William D. 2009. *Who Were the Rich? A Biographical Directory of British Wealth-Holders. Volume One, 1809-1839*. London: Social Affairs Unit.

Solon, Gary. 1999. "Intergenerational mobility in the labor market," in *Handbook of Labor Economics*, Vol. 3A, Orley C. Ashenfelter and David Card (eds.), Amsterdam: Elsevier.

Solon, Gary. 2002. "Cross Country Differences in Intergenerational Earnings Mobility," *Journal of Economic Perspectives, 16*(3): 59-66.

Turner, John D. 2010. "Wealth concentration in the European periphery: Ireland, 1858–2001." *Oxford Economic Papers, 62*: 625-646.

Winstanley, D. A. 1940. *Early Victorian Cambridge*. Cambridge: Cambridge University Press.

Appendix

1. Construction of the Surname Samples

Rare surname samples were created from surnames held by 40 or less people in 1881, where there was at least one adult death in 1858-1887. Surnames were designated as rich, prosperous, average, or poor based on the log average wealth at death, estimated as personalty, of all those 21 and above with a surname dying in these 30 years. Personalty is all property other than real estate. In this period on average only about 15 percent of adults in England had their estates probates after death. The value of the other 85 percent fell below the minimum estate value of £10 at which probate was required. Thus table A1 shows the numbers and distribution of probate values in 1858 compared to all deaths aged 21 and above, from the report of the Registrar General.

Since nominal values of probates were changing over time with economic growth, and later with inflation, we normalize these values throughout by dividing by an estimated average annual wage for England (Clark, 2011). This wage was constructed for the years 1906 and later from ONS series. For earlier years it was extrapolated using the day wages of building workers and farm workers, detailed in Clark, 2010. In 1858 this estimated annual wage is £36.1. Table A1 also shows the distribution of this normalized wealth and of it natural logarithm in 1858

We identified candidate rare surnames in a number of ways. For the rich and prosperous samples we checked the probate records in 1858-61 looking for rare surnames with high probate values. We also checked rare surnames from Rubinstein's list of the very rich dying 1810-1839 (Rubinstein, 2009). To identify the middling and poor surnames we checked the probate records for rare surnames from three sources. First there was the 1861 list of paupers who had been in workhouses across England and Wales for at least 5 years, issued by Parliament. Then there were people convicted of crimes in Essex courts 1860-1862. Finally there were those convicted of crimes in the Old Bailey in London in these same years.

We assumed throughout that those not probated had an average wealth of 0.1 of the average wage. We do this because the minimum values for required probate were £10 (1858-1900), £50 (1901-1930), £50-500 (1931-1965), £500 (1965-1974), £1,500 (1975-1983), and £5,000 (1984-2011) (Turner, 2010, 628). These values were generally close to 0.2 of the average wage series detailed above. The minimum value requiring probate jumped from 0.15 of the wage to 0.73 of the wage in 1901. But

Table A1: Probates 1858, England and Wales

Wealth (less than) £	Normalized Wealth (Wealth/wage)	Log Normalized Wealth	Number of probates	Proportion of adult deaths
-	0.1	-2.30	-	0.8584
10	0.28	-1.28	1,935	0.0091
60	1.66	0.51	6,368	0.0301
200	5.54	1.71	7,182	0.0339
450	12.47	2.52	4,303	0.0203
800	22.16	3.10	2,725	0.0129
1500	41.55	3.73	2,671	0.0126
3000	83.10	4.42	2,058	0.0097
5000	138.51	4.93	806	0.0038
7000	193.91	5.27	439	0.0021
9000	249.31	5.52	303	0.0014
15000	415.52	6.03	602	0.0028
25000	692.54	6.54	231	0.0011
40000	1108.06	7.01	187	0.0009
75000	2077.62	7.64	102	0.0005
100000*	2770.16	7.93	67	0.0003

Notes: *Personal estates of £100,000 and above.

this had little effect on the implied value of the omitted probates in 1901 compared to 1900. Thus whatever the exact cutoff the bulk of the omitted probates were close to 0 in value.

For 1858-1887 deaths, rare surnames were classified in one of four groups based on the average value of the log of normalized wealth, as shown in table A2.

Rich: The rich group is surnames with average ln of normalized probate values 2.5 or above. This corresponds to the top 6.8% of wealth for individual probate values in 1858 in table A1. This group includes some distinguished baronial surnames, such as Leveson-Gower. But there are also surnames such as Clarke-

Jervoise where the largest probate value in the period was £4,000, below even the top 1% of wealth at death in 1858.

Prosperous: The second group of surnames is designated "prosperous" since surnames with an average personalty at death as low as £36 in 1858, the estimated average annual wage, would qualify for inclusion in this group. In terms of individual probates this corresponds to the next 6.4% of the population dying 1858.

Middling: In this group at least one person dying with the surname was probated 1858-87, but the average normalized probate value lay below the average estimated wage.

Poor: The poor were those surnames where no-one dying 1858-1887 was probated. The average ln normalized wealth of this group in 1858-87 was thus assigned to be -2.30 (= ln(0.1)).

Table A2 shows the surnames identified under each group.

Surname Mutation

The principle way in which surnames would change over these years that we could observe was by the adoption of hyphenated double names. Thus some Uthwatts became Andrewes-Uthwatt, some Heneages, Heneage-Vivian. This process was mainly found among the surnames of the rich and the prosperous. We included all such hyphenated versions of each rare surname in our data.

Immigration

We calculated the expected stock of each surname in our sample for 2002 using the 1881 stock combined with births and deaths, 1881-2002 (Schurer and Woollard 2000, GRO). This estimate was then compared with ONS data on the 2002 surname distribution of England and Wales. For some names, it was obvious that considerable in migration had occurred in recent years. These surnames, whose 2002 stock did not reasonably correspond with that expected from the 1881 census and the GRO vital records were dropped from the sample.

Table A2: The Rare Surname Groups

Rich	Prosperous	Average	Poor
AHMUTY	AGACE	ADDAWAY	ALLER
ALLECOCK	AGAR-ELLIS	ADSON	ALMAND
ANGERSTEIN	AGLEN	ANSPACH	ANGLER
Appold	Aloof	Banbrook	Anglim
Auriol	Alsager	Barned	Annings
Bailward	Bagnold	Beioley	Austell
Basevi	Benthall	Benniworth	Backlake
Bazalgette	Berthon	Blacketer	Bagwill
Beague	Brandram	Bomber	Balsden
Berens	Brettingham	Briscombe	Bantham
Beridge	Brideoake	Bubbers	Bawson
Berners	Broadmead	Buggin	Beetchenow
Bigge	Broderip	Bullinger	Bemmer
Blegborough	Brouncker	Chandless	Bevill
Blicke	Brune	Coaffee	Bierley
Boger	Calrow	Connibeer	Biker
Bouwens	Champernowne	County	Bilcock
Braikenridge	Chaplyn	Cowsell	Bivens
Brightwen	Chatteris	Craggy	Blacksall
Brudenell-Bruce	Cludde	Craster	Blind
Brunel	Cookney	Dame	Boate
Bulteel	Cothay	De La Chaumette	Bollingbrook
Burmester	Creyke	Demmer	Booman
Burrard	Croasdaile	Devaynes	Bowel
Buttanshaw	Cruso	Edmett	Brandfield
Cankrien	Cruttwell	Faville	Brenham
Carbonell	Daukes	Gildon	Brickham
Cazalet	De Grey	Greenberry	Broan
Cazenove	Dilke	Greenhaigh	Brummage
Champion De Crespigny	Du Boulay	Griston	Buffee
Clagett	Faulconer	Hatsell	Buie
Claypon	Favre	Hazleby	Bulmore
Cleoburey	Filder	Heitman	Bundley
Coape	Goodford	Hewlings	Burlin
Colfox	Goodhart	Inglish	Butfoy

Colvile	Grazebrook	Isacke	Byott
Conduitt	Greame	Lambird	Caddie
Conyngham	Grimshawe	Loosely	Camac
Cornwallis	Hecker	Maltwood	Camamile
Coryton	Heneage	Merredew	Camel
Cotesworth	Hetley	Minnican	Canary
Courtauld	Hollwey	Naters	Cansell
Crokat	Jeakes	Nutsey	Casseldine
Daubuz	Lamotte	Oldhams	Chauncey
D'aubuz	Lechmere	Porrill	Cholmondley
De Gatacre	Leir	Puncheon	Colcutt
De Lousada	Leycester	Robjent	Colmar
Du Cane	Lillingston	Sauter	Colo
Elmsall	Linzee	Saxey	Comm
Fector	Lombe	Seabourn	Concoran
Fludyer	Magenis	Seeger	Coniston
Garle	Manners-Sutton	Shaves	Cooler
Gatacre	Merewether	Sheerwood	Coten
Gaussen	Methold	Skee	Courtoy
Haldimand	Mildmay	Suett	Crage
Haselfoot	Minet	Syret	Cresson
Hilhouse	Monins	Tassiker	Cripple
Holbech	Nedham	Thynn	Crix
Hugonin	Nottidge	Trilloe	Croud
Jervoise	Novelli	Wimbleton	Dadey
Knowlys	Oliverson		Damery
Labouchere	Pepys		Damson
Lane-Fox	Perryn		Dazley
Legrew	Pickmere		Dealing
Leschallas	Pigou		Dearey
Leveson-Gower	Poulett		Defoe
Loddiges	Proby		Delmer
Lousada	Reynardson		Demar
Lucena	Rothschild		Dement
Lutyens	Rusbridger		Denmar
Marryat	Sapte		Detnon
Merceron	Senhouse		Diccox
Meux	Severne		Dinon
Micklethwait	Sich		Doss
Montefiore	Teissier		Draby
Morier	Thellusson		Drone

Musters	Thoyts	Earing
Oglander	Tyssen	Eggs
Orred	Uppleby	Ellmers
Papillon	Uthwatt	Etton
Penoyre	Villebois	Fabey
Penrhyn	Weyland	Flinch
Perigal		Follington
Puget		Furrow
Pulteney		Garan
Roupell		Girl
Rushout		Glansford
Skipwith		Glassonbury
Sotheby		Goodhill
Strangways		Goodlud
Streatfeild		Grangey
Taddy		Greaveson
Thoroton		Gricks
Trebeck		Gussen
Trelawny		Gyle
Tunno		Hallick
Usticke		Hallos
Vansittart		Halm
Watlington		Harriet
Weguelin		Haupt
Willoughby De Broke		Hestford
Willyams		Hoborough
		Holloron
		Horny
		Hugger
		Hutch
		Illesley
		Jeays
		Jenne
		Jerden
		Jerratt
		Joins
		Junes
		Kilborne
		Lamer
		Lansfield

Layle
Ledge
Ledwell
Lennington
Lerner
Leserve
Leverno
Liebman
Linker
Livard
Lofton
Magary
Mallindine
Mallow
Manes
Masten
Maunton
Medus
Mien
Mincke
Mittens
Modell
Molly
Monis
Mountaney
Mune
Mutt
Nies
Noddles
Osterman
Pagnum
Passan
Pelle
Pitters
Pordham
Potterell
Pounceby
Prop
Purvor
Readington
Reddich

Rent
Riddalls
Rowthorn
Ruffitt
Sammy
Savers
Scaresbrook
Scharff
Seawood
Seears
Seeby
Sherbourn
Sherrie
Sheville
Shimmons
Showman
Sideway
Sidwells
Sifton
Sinnot
Sissey
Sitter
Sling
Starker
Stint
Stopper
Stringle
Strut
Sturr
Susan
Talk
Tamen
Tanks
Tidder
Tonbridge
Tosbell
Toung
Trencher
Trevellyan
Trivess
Tunnel

	Tusker
	Vallett
	Vickerage
	Vino
	Waldrum
	Waldwyn
	Wathews
	Waude
	Weathersby
	Weet
	Witticks
	Wressle
	Wrest
	Yearn
	Zouch

2. Wealth Distributions of the Rich and the Prosperous, Later Generations

Figures A1 and A2 compare the wealth distribution of our "Rich" and "Prosperous" surname groupings with that of the "Brown" surname for death generations 2 and 3 respectively. As can be seen, while these groups remain wealthy on average, their distribution overlaps substantially with the population distribution.

Figure A1: Wealth Distributions, Death Generation 2

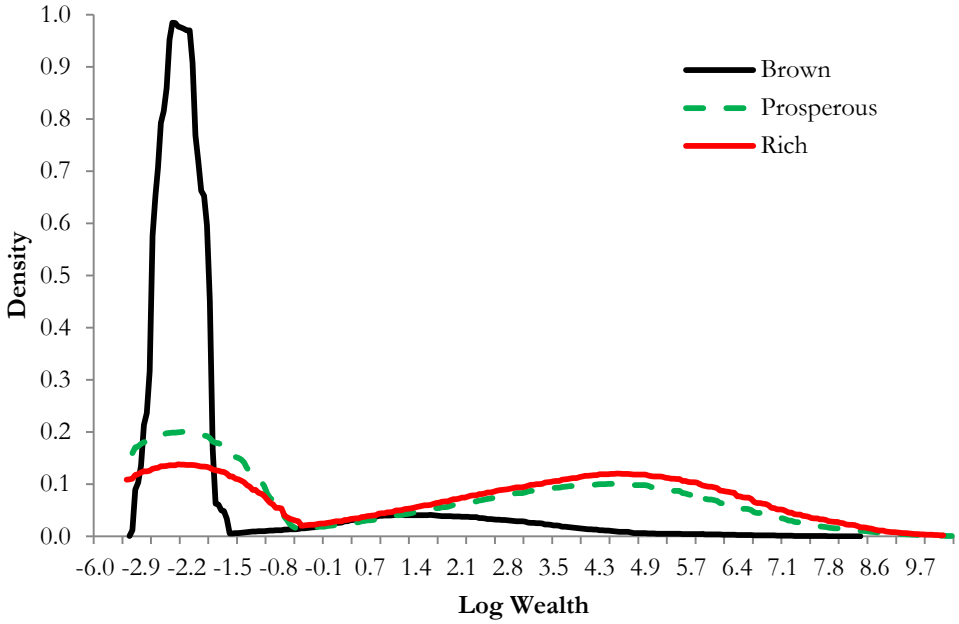
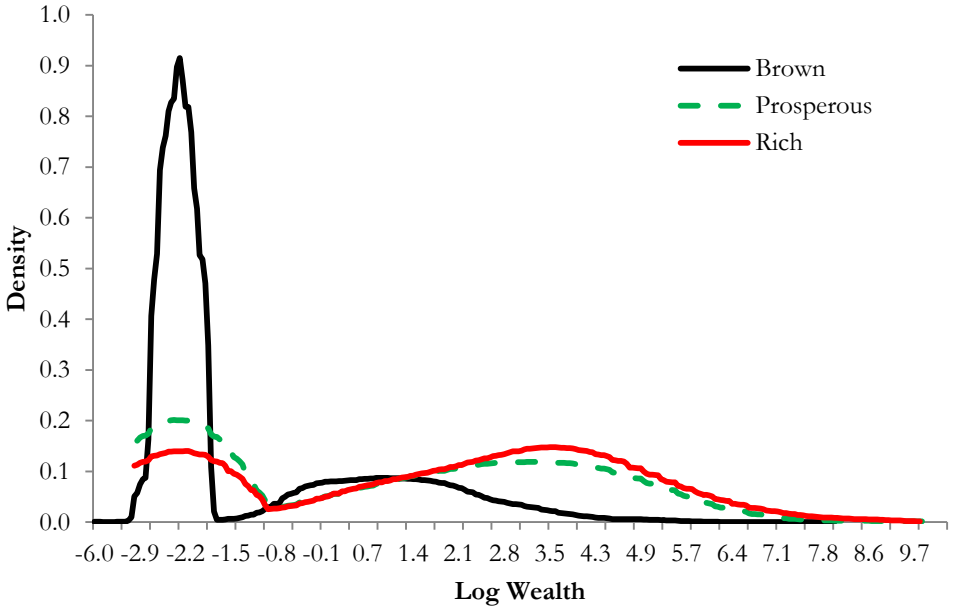


Figure A2: Wealth Distributions, Death Generation 3



3. The Age-Wealth Profile for 1953-2011

Figure A3 shows the median log normalized wealth by decade of age at death for the years of death 1953-2011 (the last two death generations). As can be seen for the poorest groups wealth is flat with age of death, but for the two richer groups wealth rises substantially. Thus the average wealth of the rich in the 1930-59 birth cohort will be understated compared to the middling/poor, because the people from the richer group who have still to die will have greater assets than those dying already.

Figure A3: Median Wealth by Age and Surname Group