What is the True Rate of Social Mobility? Surnames and Social Mobility, 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. Our method allows unbiased estimates of mobility rates. Mobility rates are much lower than conventionally estimated, including the most recent generations. There is considerable persistence of status, even after 200 years. Surprisingly the arrival of universal publicly funded education, and universal suffrage, does not improve mobility. Finally we show why mobility rates measured in using surnames provide better estimates of long run and generalized social mobility than conventional estimates.

Introduction

Linking seven generations in England through rare surnames, this paper measures wealth and other aspects of social status for the years 1800-2011 for an early nineteenth century elite, and an underclass, defined through their average wealth at death 1858-1887. 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-

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1970, and periods of significantly progressive taxation. However, the original rich and poor do regress closer to the mean in all status dimensions by generation. Mobility will eventually be complete, sometime in the 23rd century.

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 before 1960 the overwhelming majority of children inherited the father's surname. Only where the birth was illegitimate would the child bear the mother's surname, and illegitimacy constituted 3% or less of births. Also adoption in England only became legally possible in 1926.[2] Thus before 1960 surnames are a tracer of the descent of Y-DNA. Since 1960 children increasingly derived their surnames from their mothers, with now 25-30% of surnames coming from this source, and adoption has become more common. But surnames still serve to link this generation with the previous one.

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. Common surnames were equally likely to be found at all levels of the social hierarchy.

To trace mobility through surnames after this we can, however, turn to rare surnames.[3] 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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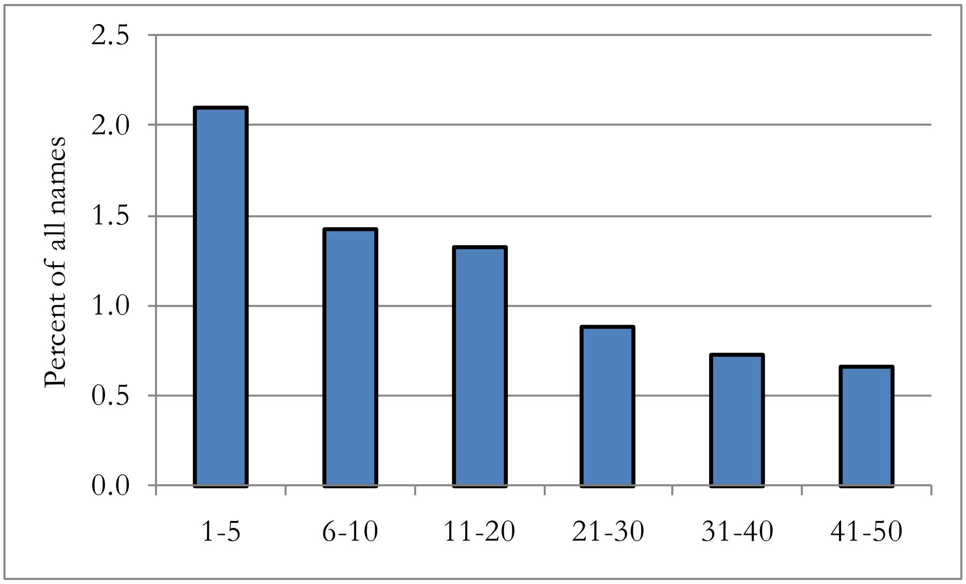
[2] McCauliff, 2006.

[3] See the interesting study of Güell, Rodríguez Mora, Telmer (2007) which also measures social mobility through rare surnames, but using cross-section data.

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. 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 k in one generation, some of whom will not have any children, and a group of people with the same surname in the next generation. Will the *b* estimated in this way be the same as that within families?

Suppose each person with surname *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 as y_{kij}, $n_{kit} \geq j \geq 1$. Then

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

and

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

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

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.[4] 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.[5] 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 close to 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

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[4] Those not probated typically have wealth at death close to 0.

[5] 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 also have measures of the numbers of physicians with these surnames 1830-2012, and attorneys (1950-2012). As a measure of political elites, we have records of the numbers of Members of Parliament with these surnames 1830-2012. We also have longevity for each generation.

Rich, Middling and Poor Surnames, probates 1858-1887

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.[6] Surnames were designated very rich, rich, middling or poor based on the log average wealth at death (estimated from personalty) of all those 21 and above with a surname dying in these 30 years. Throughout wealth is normalized by the average unskilled wage in England in the year of probate.[7] The very rich were surnames where the average log of normalized wealth was 2.5 or more, the rich where average log normalized wealth was 0 to 2.5. The poor were those surnames where no-one dying 1858-1857 was probated. The middling were those with average log normalized wealth 0 to -2.3.[8]

[6] As candidates for the poor and middling surnames we checked the probate records for rare surnames from two sources: lists of paupers in 1861, and lists of the criminally indicted 1860-2. Table 1 lists these sources.

[7] Clark, 2011.

[8] 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, 628). These values were generally close to 0.2 of the average wage. The minimum value requiring probate jumped from 0.15 of the wage to 0.73 of the wage in 1901. But 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.

In 1858-87, the average wealth at death of the very rich was 455 times the annual wage, that of the rich was 355 times the annual wage. The poor had an estimated wealth of 0.1 of the annual wage on average. The medium had average estimated bequests 18 times annual unskilled wages.

Table 1 gives a summary of the data by death generations. There are a declining number of surnames in the sample over time because some rare surnames die out due to the vagaries of fertility and mortality.[9]

Figure 2 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 3 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 are still higher in 2000-11. Finally figure 4 combines the information in figures 2 and 3 to produce an estimate of the average normalized log wealth at death of the rich and poor surname groups by decade.

[9] Since the death register 1858-1865 does not give 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 records 1837-1865.

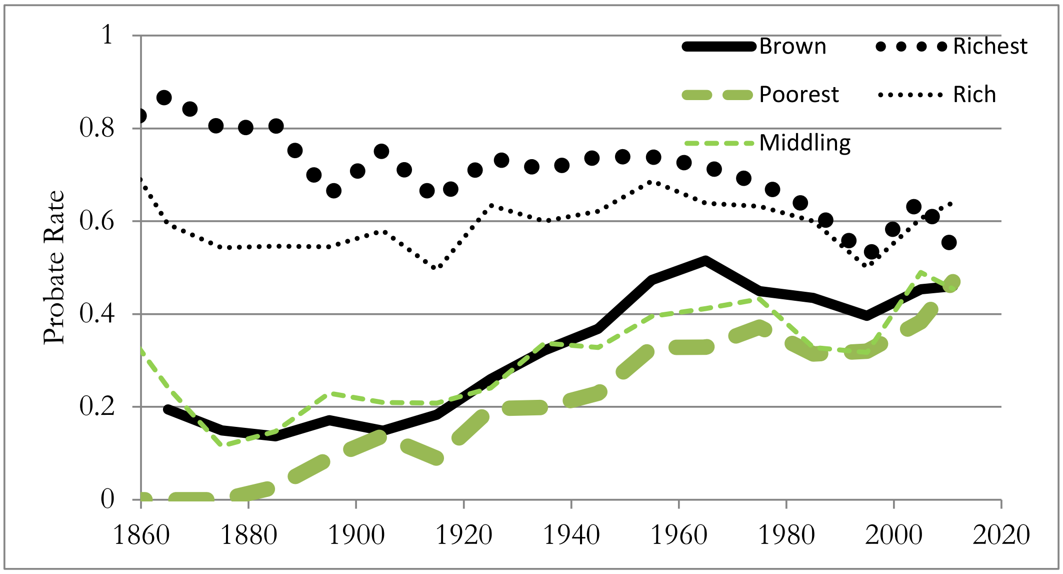
Table 1: Summary of the Sample

Period	Surnames	Probates	Deaths	Deaths 21+
VERY RICH/RICH				
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 (Schurer and Woollard 2000). The Very Rich and Rich samples were those rare names who had an average log normalized (by the real wage in a given decade) wealth of over 2.5 and 0-2.5 respectively (collected at the Principal Probate Registry). Middling and Poor surnames were from the 1861 Paupers report (UK, House of Commons 1861), convictions in Essex 1860-2 (Calendars of Prisoners) and London convictions 1860-2 (Proceedings of the Old bailey). Deaths are from the General Registry Office (See References section).

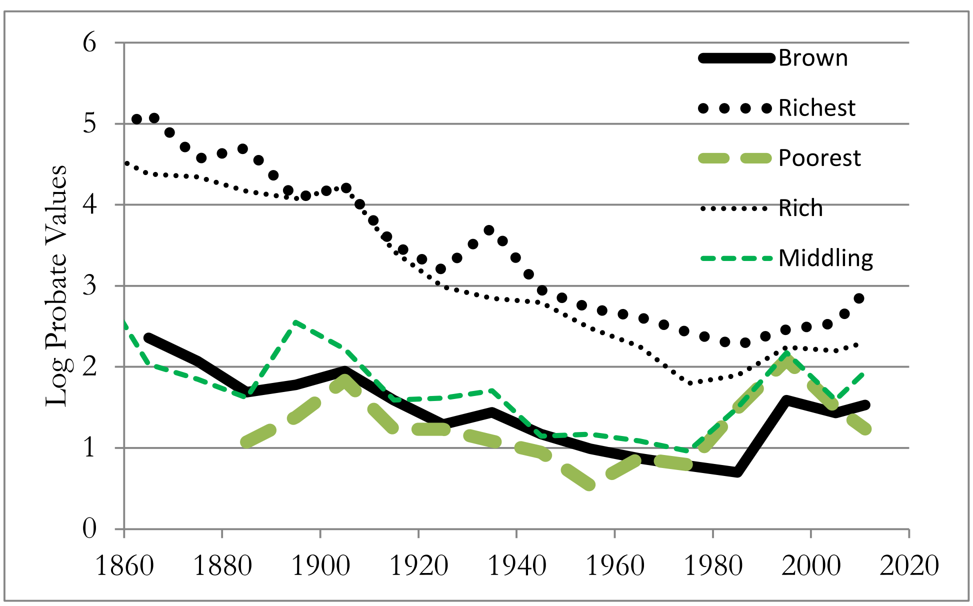
* Where age was unknown 1858-65, the fraction above 21 was estimated from the 1866-87 ratio of deaths 21+ to all deaths.

Figure 2: Probate Rates of Rich, Middling, Poor and *Brown* samples, by decade



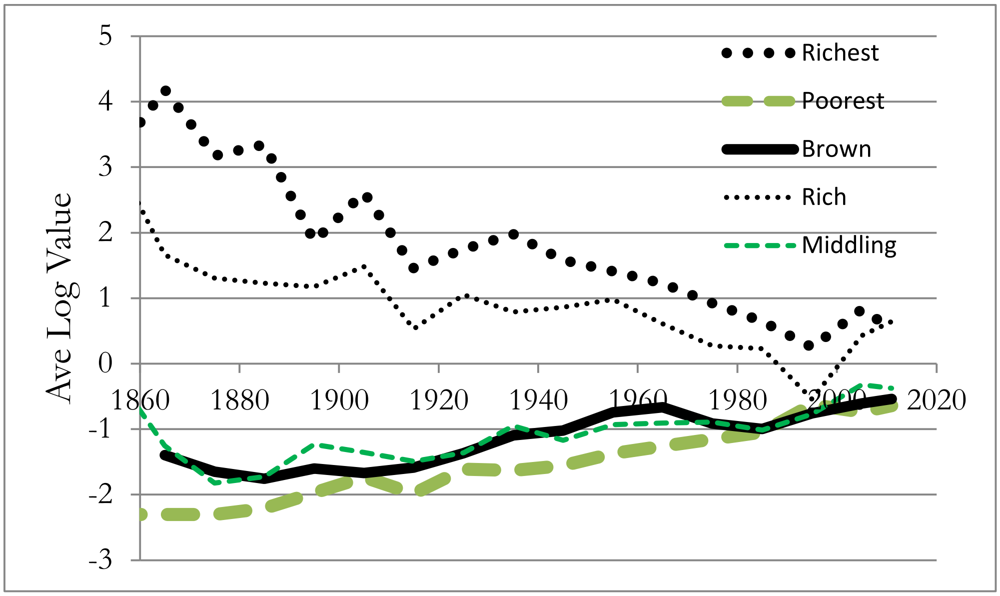
Notes: The probate rate in a given year is the number of people recorded in the probate registry divided by the number of people dying. (Source: Principal Probate Registry and GRO.)

Figure 3: 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 4: 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).

Figure 4 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.

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 ln normalized wealth for generation t for the rich and middling/poor surname groups, then the *b* linking this generation with the *n*th future generation can be measured simply as

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

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

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 5 shows the mean log wealth of each group by generation, and table 2 the implied *b*s, along with bootstrapped standard errors.

Table 2 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 2, 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 Secondary 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.

Figure 5: Average Log Probate value, by generation

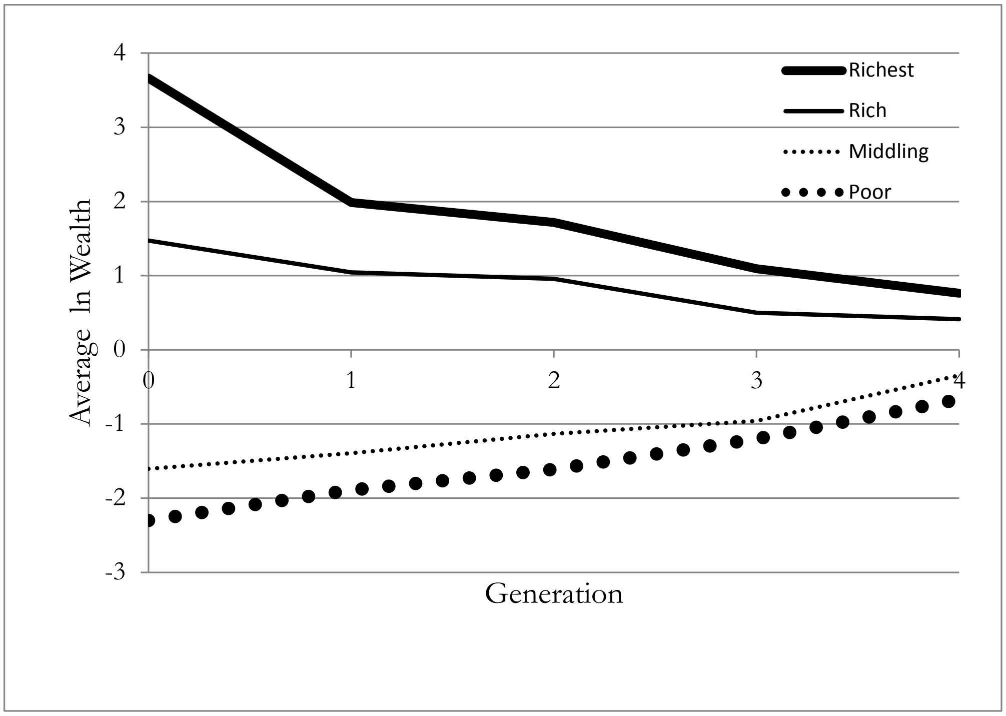


Table 2: b Values Between Death Generations

	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.

Table 3: Wealth at Death by Birth Cohorts, Summary

Birth Period	Surnames	Observations	Average Birth Year (21+)	Average Age at Death (21+)
VERY RICH/RICH				
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

Notes: Age at death is reported in English Civil Registers post-1866 thus enabling the assignment of birth years (GRO). The high longevity reported for the first birth cohort are a result of the censoring of death ages pre-1866.

Table 3 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.

Figure 6 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 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 4 shows the implied *b* estimates between each period, as well as the bootstrapped standard errors.[10] 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 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.[11] 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 4 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.

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[10] 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.

[11] 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 6: Average log wealth by Birth Generation, 1780-1959.

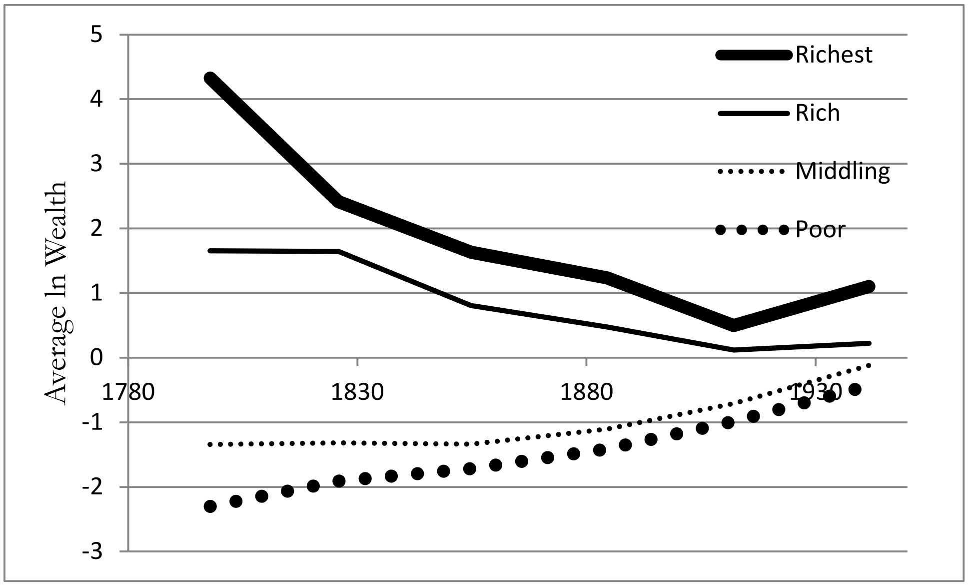

Table 4: b values between birth generations, 1780-1809 to 1930-1959

	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; $\bar{y}_{Rt+n} - \bar{y}_{Pt+n} = \text{b}(\bar{y}_{Rt} - \bar{y}_{Pt})$ 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.

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.

A more conventional way to estimate *b* is by taking the average wealth of each surname in each generation as the unit of observation, and then estimate by OLS the *b* values in the regressions

$$y_{i+n} = a + b^n y_i + u_{i+n} \tag{4}$$

where here y_{n+i} is the average log wealth by surname in period i+n, and we weight by the average number of observations in each surname group in the relevant periods. Table 5 shows these estimates and the associated standard errors. As discussed above the average estimate one period *b* is below that of the previous method (0.62 versus 0.72).

If, however, the one period *b*'s in table 6 were correctly estimated, then we would expect $\hat{b}_{04} = \hat{b}_{01}.\hat{b}_{12}.\hat{b}_{23}.\hat{b}_{34}$. In fact

$$\hat{b}_{04} = 0.28 > \hat{b}_{01}.\hat{b}_{12}.\hat{b}_{23}.\hat{b}_{34} = 0.66\times.71\times.60\times.53 = 0.15 \quad .$$

The long run regression to the mean is slower than the one period *b*s predict. Presumably this is because of measurement error, so that the estimated one period bs are the true bs times an attenuation factor $\theta < 1$. In particular the expected value of such an estimate of b, for the first to the second generation, $\hat{b}$ is

$$E(\widehat{b}) = b\theta$$

where $0 < \theta < 1$ is an unknown attenuation from measurement error. But when we look from the first to the third generation we similarly get an estimate of b^2 which has an expected value,

$$E(\widehat{b^2}) = b^2\theta$$

So by dividing the two estimates we will get an unbiased estimate of the true first generation *b*. By using multiple generations identified by surnames we can get around the problem of measurement error.[12]

[12] We are grateful to Colin Cameron for pointing this out.

Table 5: b Estimates between Death Generations, Conventional Regression

	1888-1917	1918-1952	1953-1987	1999-2011
1858-1887	**.66** (.030)	.58 (.026)	.38 (.025)	.28 (.038)
1888-1917		**.71** (.030)	.50 (.029)	.28 (.048)
1918-1952			**.60** (.029)	.37 (.052)
1953-1987				**.53** (.065)

Notes: The units of observation are individual surnames. Coefficients are from an OLS regression; $y_{i+n} = a + b^n y_i + u_{i+n}$, where y is the average log normalized wealth by surname, $i, i+n$ denote generation. The estimation is weighted by the number of surname observations in each generation. N: 3,094 two-way combinations. Standard errors in parentheses.

Table 6: Attenuation Corrected b Values between Death Generations

	1888-1917	1918-1952	1953-1987	1999-2011
1858-1887	**.82**	.64	.54	-
1888-1917		**.86**	.54	.47
1918-1952			**.70**	.46
1953-1987				**.61**

Notes: These values are the b values corrected for attenuation from table 5. Assuming a constant attenuation factor (θ), the estimates for the b between generations 0 and 1 are corrected by applying the formula $\frac{b_{02}\theta}{b_{12}\theta} = \frac{b_{01}b_{12}}{b_{12}} = b_{01}$.

Table 7: b Estimates between Birth Generations, Conventional Regressions

	1810-39	1840-69	1870-99	1900-29	1930-59
1780-1809	**0.63**	0.56	0.40	0.21	0.12
	(.029)	(.025)	(.024)	(.027)	(.045)
1810-39		**0.57**	0.51	0.28	0.13
		(.032)	(.027)	(.031)	(.053)
1840-69			**0.71**	0.37	0.22
			(.028)	(.037)	(.064)
1870-99				**0.48**	0.26
				(.040)	(.075)
1900-29					**0.31**
					(.097)

Notes: The units of observation are individual surnames. Coefficients are from an OLS regression; $y_{i+n} = a + b^n y_i + u_{i+n}$,. The estimation is weighted by the number of surname observations. N: 3,961 two-way combinations. Standard errors in parentheses.

In this case

$$E(\hat{b}_{04}) = b_{04}\theta > E(\hat{b}_{01}.\hat{b}_{12}.\hat{b}_{23}.\hat{b}_{34}) = b_{01}\theta.b_{12}\theta.b_{23}\theta.b_{34}\theta = b_{04}\theta^4$$

With a constant attenuation factor can get better estimates of the true bs between periods by taking the ratios of the estimated bs. Thus, for example,

$$\frac{E(\hat{b}_{02})}{E(\hat{b}_{12})} = \frac{b_{02}\theta}{b_{12}\theta} = \frac{b_{01}b_{12}}{b_{12}} = b_{01}$$

Table 6 shows these attenuation corrected b estimates. These echo those of table 2, except for being significantly higher between the first and second generations. But as noted earlier the estimates in table 2 for the first generation will also suffer from attenuation bias. The one generation corrected bs average 0.75.

Table 8: Attenuation Corrected b Values between Birth Generations

	1810-39	1840-69	1870-99	1900-29	1930-59
1780-1809	**0.89**	0.56	0.43	0.38	-
1810-39		**0.77**	0.61	0.38	0.18
1840-69			**0.84**	0.62	0.23
1870-99				**0.68**	0.32
1900-29					**0.54**

Notes: These values are the b values corrected for attenuation from table 7. Assuming a constant attenuation factor (θ), the estimates for the b between generations 0 and 1 are corrected by applying the formula $\frac{b_{02}\theta}{b_{12}\theta} = \frac{b_{01}b_{12}}{b_{12}} = b_{01}$.

Table 7 shows the conventional regression estimates of b's between birth generations, and table 8 the attenuation corrected estimates. The one generation b's again average about 0.75. The pattern of estimates here again suggest some decline in b in the most recent generations, but the final period b is underestimated because of the exclusion of the rich descendants born 1930-59 who have not yet died.

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 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.

The measure we use is the *relative representation* of each surname group at university, where the relative representation is the share of a surname at the university relative to the population share of that surname among those aged 18. Relative representation will be 1 for a surname that is distributed as is the general population in terms of educational status. We look at Oxbridge entrants in the periods 1800-29, 1830-59, 1860-89, 1890-1919, 1920-49, 1950-79, 1980-2009, and 2010-1. These measures thus span eight generations. These show, again, universal regression to the mean, but at similarly slow rates as for wealth, so that even now there are differences in educational attainment between the descendants of the 1780-1809 generation.

Table 9 shows the relative representation of the high average wealth rare surnames, based on the wealth at death of those born 1780-1809 who died 1858 and later. In 1800-1829 the high 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

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

[14] For the years 1800-1865 there have to be varying degrees of approximation to this stock of 20 year olds.

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 9 imply about the b for education? As described in the appendix if we assume a normal distribution of status, and that those of high average status had the same status variance as the general population, then we can estimate what the b for educational status 1830-2010. Since the high status surnames had a relative representation of 91 among the top 0.7% of the educational hierarchy in 1830-59, this fixes what the mean status of those names had to be, relative to the social mean.[15] For each possible b their relative representation would decline generation by generation in a predictable manner. Figure 7 shows the actual pattern, as well as the single b that best fits the data.[16] For the rare surname wealthy group, that is $b = 0.81$. 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 9 also shows the relative representation of these surnames at Oxbridge to 2011. Here there is a large decline between 1800-29 and 1830-59. But to measure the true implied 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 data is not contaminated by error. 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-

[15] If the elite started with a lower dispersion of status than the general population then the implied bs would be even higher.
[16] Judged by minimizing the sum of squared deviations.

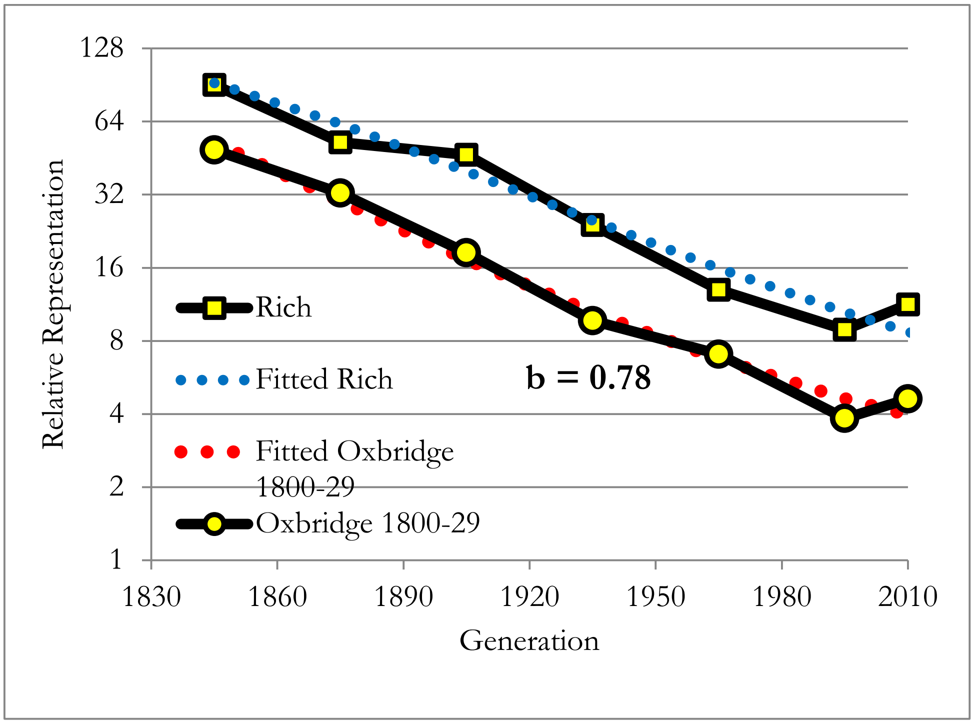
Table 9: Representation by Birth Cohorts at Oxbridge, 1800-2011

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 7: Relative Representation at Oxbridge, 1830-2011



Notes: Sources as table 9.

2010. It is 0.74, as is shown in figure 7. 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 to appear at Oxbridge 1980-2010. Thus the wealthy rare surnames are not unusual in their persistence among the educational elite.

Thus despite the many changes in England over these generations, both the wealth and educational elites 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.[17]

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.[18] 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 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 7. The elite we identified through wealth at death, born 1780-1809, has persisted just as tenaciously as an educational elite.

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).

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

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 10 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 10 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.

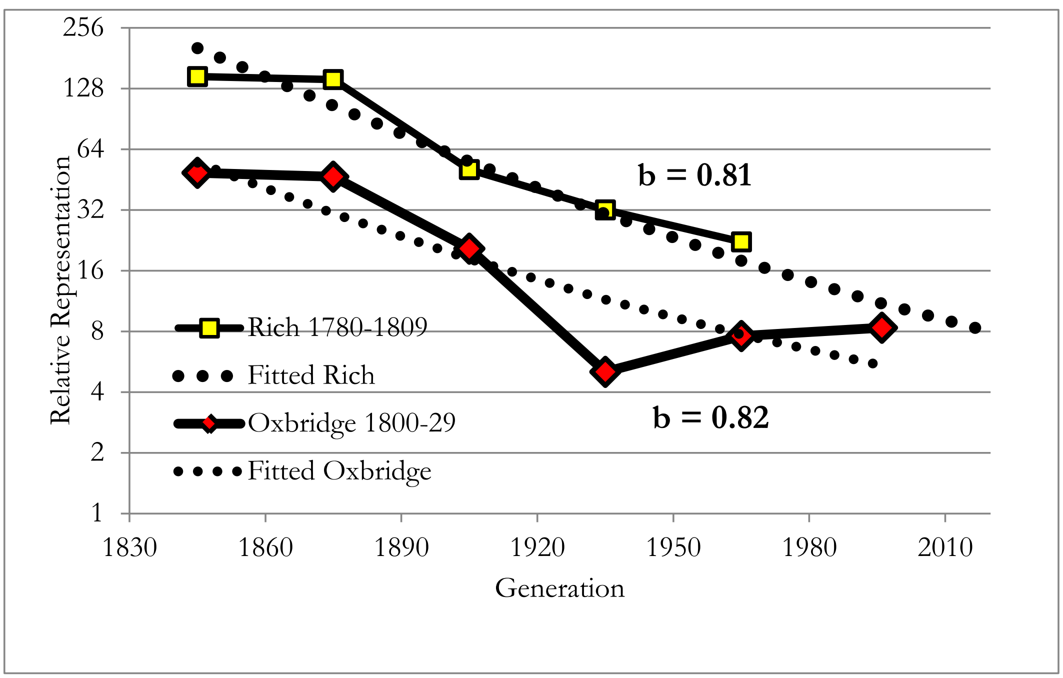
Table 10 also shows the numbers in each period of the rare surnames of the rich, and the numbers of the rare surnames of those attending Oxford and Cambridge 1800-29. The rich surnames, identified from those born 1780-1809, are greatly overrepresented in Parliament in the mid nineteenth century. In 1830-59 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 8 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.

Table 10: 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 8: Relative Representation in the House of Commons, 1830-2012



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 8. 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.

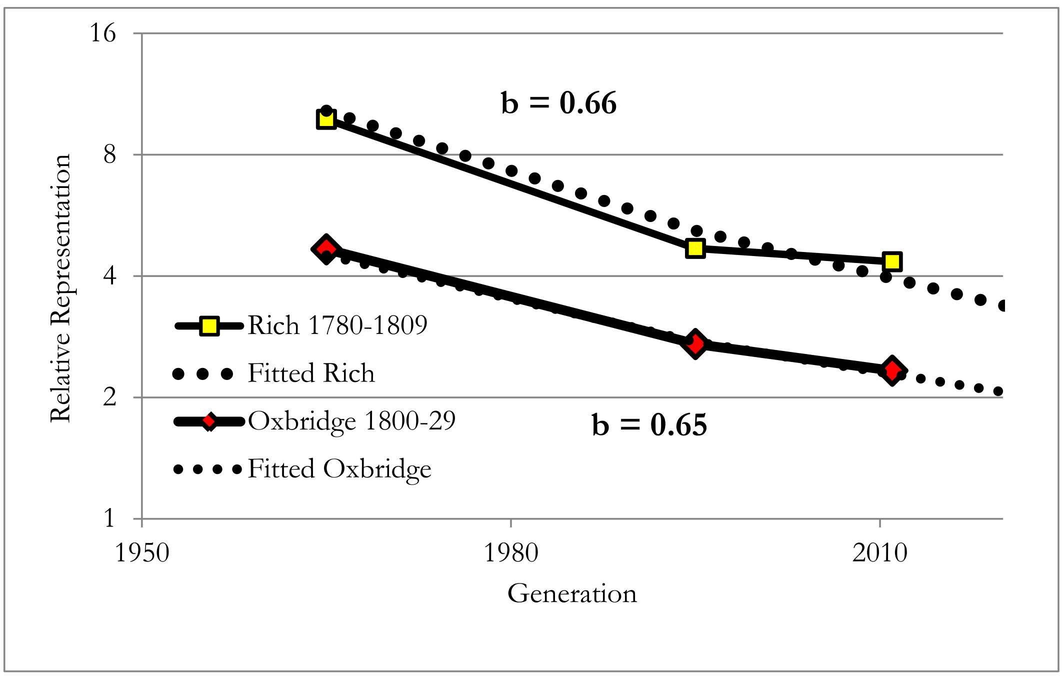
Attorneys are another relatively high status group that we can track mobility within in recent years. The Law Society has a register of 118,000 solicitors in the UK admitted to practice between 1952 and 2012. The Bar Council has a list of around 20,000 barristers, with year of call to the bar. Combining these groups we have the information given in table 11 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 the rich born 1780-1809, and the rare surnames of Oxbridge attendees 1800-29. Table 11 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 9 shows that the implied b for the rich is 0.66, and that for the Oxbridge attendees 0.65.

Table 11: Rare Rich Surnames among Solicitors and Barristers, 1950-2012

Period	"Clark", "Taylor" "Smith"	Rare Surnames of the Rich	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 9: Relative Representation among Solicitors and Barristers, 1950-2012



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 12 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 10 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.

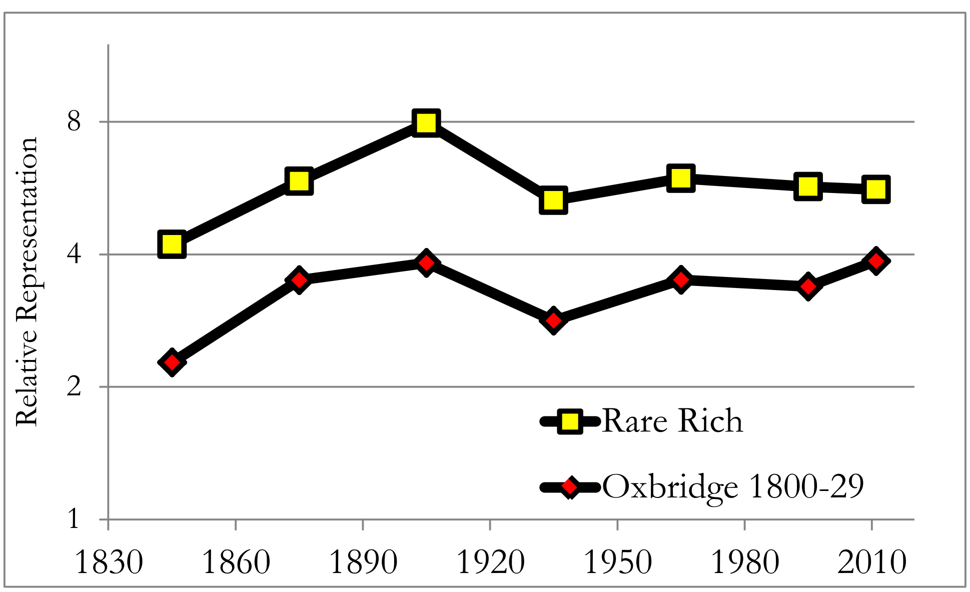
However, we think this effect is a product of the rising status of doctors over time. In 1830-59, for example, the rich surnames had a relative representation of 91 at Oxbridge, 147 among MPs, but only 4.2 among doctors. This suggests doctors then were a much less elite group than now. If doctors were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

Table 12: 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 10: Relative Representation among Doctors, 1830-2012



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.[19] Table 13 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.[20] 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 11 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 11 shows the gap between the original rich surnames 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.

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

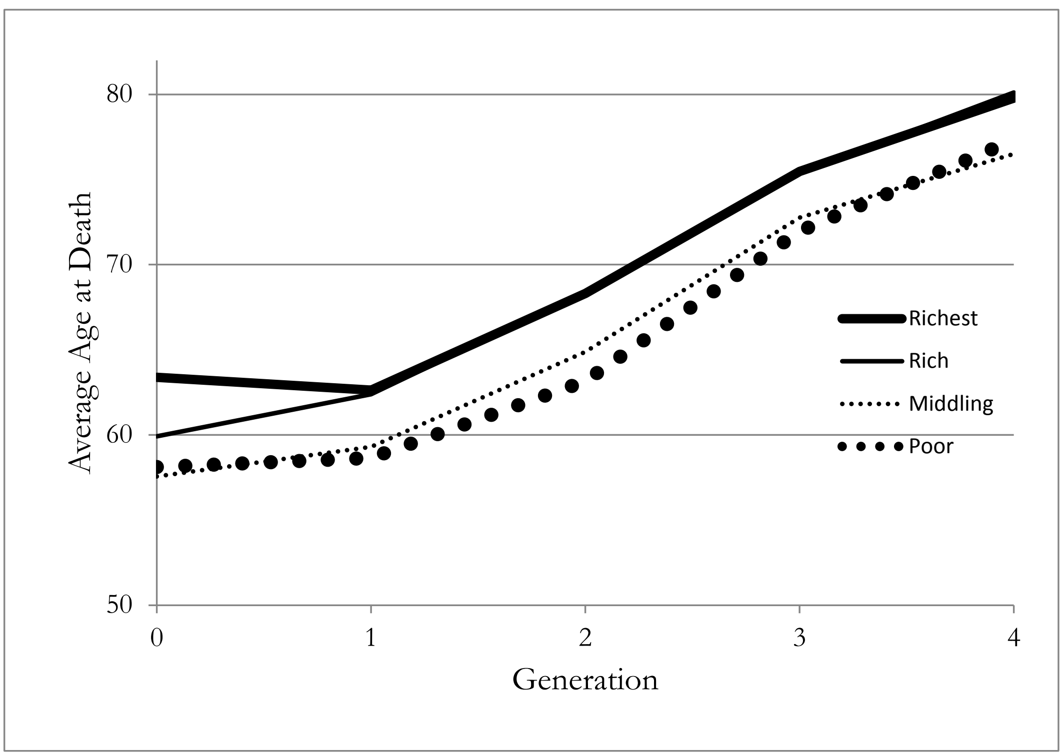
[20] Since the estimated standard error of the difference of mean ages at death is 0.59, this difference is highly significant statistically.

Table 13: Average Age at Death by Initial Wealth

Generation	Richest	Rich	Middling	Poor
0	51.6	45.6	35.0	31.6
1	57.4	55.9	39.2	34.7
2	66.0	66.0	56.2	53.5
3	74.8	74.2	71.1	69.5
4	79.5	79.5	75.4	76.4
2000-11	79.4	79.1	76.8	77.1

Source: GRO.

Figure 11: Average Age at Death (21+), by Death Generation



Source: Table 13.

Why is Regression to the Mean 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 12 shows a summary of recent estimates for b for the UK.[21] These estimates are similar to those for the USA, and higher than in Scandinavia (Black and Devereux, 2010). Long, 2012, also has occupational mobility estimates for England 1851-81, and 1881-1901 which suggest a b of 0.32-0.37.

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 very rich, the rich and the poor. Table 13 thus shows separately for the very rich, the rich, 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

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

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 also see in the Oxbridge data that as the wealth of the rich group becomes closer to the average in later generations, there is no sign of a speeding up of the decline of this group of surnames as an educational elite.

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

[21] 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 12: 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, 2005, Ermisch et al., 2006, 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 17^{th}-19^{th} centuries.

Table 13: 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**
Richest	**0.72**	0.68	0.79	0.66	0.75
Rich	**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; $\bar{y}_{Rt+1} - \bar{y}_{Bt+1} = b(\bar{y}_{Rt} - \bar{y}_{Bt})$ 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.

maiden name of the child's mother. It was 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

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

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. Table 14 shows these estimates for children dying in each of our death generations, compared to our estimates of b from surname cohorts.[22] Despite the expectation derived above that the b estimated from surname generations should if anything be lower than that estimated directly from parent-child estimates, the b estimated from surnames is consistently higher.

The estimates in table 14 suggest that the slow regression to the mean of our surname groups is not because of any unusual persistence of wealth in England by conventional standards. The bs estimated for the family linkages for recent years are at the low end of the range reported for the modern UK in table 12.

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 three 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 inheritance of longevity.[23] Calculated at the surname level the bs rise to average 0.15. 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. Again, grouping by surnames, we get an estimate of much greater persistence.

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

[23] 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.

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

Child Death Period	Surname Types b	Individual Surnames b	Linked Children Number	Individual Families b
1888-1917	0.71	0.66	202	0.59
1918-1952	0.86	0.71	466	0.65
1953-1987	0.68	0.60	389	0.51
1988-2011	0.61	0.53	239	0.29
Average	0.72	0.62	-	0.51

Notes: Sources for surname group and individual surname bs are Table 2 and Table 5. Individual family b are from an OLS regression; *ln(WEALTH CHILD) = a + bln(WEALTH FATHER) + cDFEM + e* where *DFEM* is an indicator variable for daughters.

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

Child Death Period	Surname Types b	Individual Surnames b	Linked Sons Number	Fathers-sons b
1888-1917	1.01	0.14	83	0.02
1918-1952	1.27	0.09	205	0.10
1953-1987	0.70	0.13	195	0.16
1988-2011	0.91	0.17	262	-0.05
Average	0.97	0.14	-	0.06

Notes: Age at death from the GRO.

So why are the b's estimated through surname linkages higher than those estimated through direct familial linkages, even using conventional regression estimates to recover the bs, as in tables 14 and 15?

Our interpretation is the following. Even when aspects of status such as wealth, income, education, occupation or longevity are correctly measured, they are all only partial indicators of the underlying social status of families. Earnings, for example, will always be an imperfect indicator of the true social status of people, since people trade off earnings and wealth for other work conditions. And years of education are an imperfect proxy for the status, earnings and other satisfactions conferred by different types of education. Further, even when correctly measured, there are important random components in each of these measures ("market luck" in the terminology of Becker and Tomes, 1979). Individuals will happen to be employed by successful businesses, as opposed to those which go bankrupt. Some will just pass the test for Oxbridge admission, others will just fail.

Conventional estimates of the intergenerational elasticity of wealth, earnings, education, and occupation, once corrected for measurement errors, correctly answer the question about what the inheritance of any of these aspects of underlying status is in one generation, incorporating the random elements. But they will underestimate the intergenerational elasticity of any of these aspects of status across subsequent generations, once that initial random element has been removed. They will also underestimate what the intergenerational elasticity of a broader measure of socio-economic status, which averages wealth, earnings, occupation, education, health, and other aspects of status. Such an aggregate would measure the underlying status of families with much smaller random components. Conventional measures thus systematically overestimate overall social mobility, even across single generations.

By switching to surname cohorts, we avoid this problem of estimating long run and more general social mobility by being able to identify cohorts of surnames based on their earlier status. In subsequent generations these cohorts on average have a 0 random component in all measures of social status. We thus get a measure of intergenerational mobility from these cohorts which applies to the latent social status of the families. Our consistently high b estimates for aspects of status using surnames are consistent with the rate of regression to the mean of this latent social status being very slow, accounting for similar persistence across all these measures in the long run. The stability of this underlying 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]

The difference between conventional measures of mobility, and the measures derived from surnames is illustrated by last column of table 10, showing Oxbridge attendance among rare surnames. If we identify a rare surname elite by entry to Oxbridge 1800-29 of someone with this surname, then the implied intergenerational elasticity for entry to this elite between this first generation and the next is 0.61. This is because the first generation of this elite contains many people who were the recipients of good luck. But for all subsequent generations the implied elasticity drops to 0.79. Since for the second and subsequent generations there is no systematic positive luck component in any generation, we can get unbiased estimates of the rate of decline of the underlying social status.

The fact that our long-run persistence parameters for very different aspects of social status are all high, and cluster around 0.7-0.8 – wealth 0.74, education 0.80, political status 0.81, occupational status 0.65 – suggests that it is even possible that there is one underlying latent variable for social status, which persists strongly, but it connected with various degrees of randomness to the various measured aspects of status.

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.

[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).

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. It is dramatically higher than Gary Becker and Nigel Tomes assumed when they wrote

> *Almost all earnings advantages and disadvantages of ancestors are wiped out in three generations. Poverty would not seem to be a "culture" that persists for several generations* (Becker and Tomes, 1986, S32).

The true *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 suggested by other studies. Because the amount of variance in status in future generations explained by inheritance is b^2, difference in terms of the importance of inheritance in explaining outcomes is much greater than might appear. A *b* of 0.5 implies inheritance explains 25% of status variation, but a *b* of 0.75 means it explains 56%, more than twice as much.

A further surprise is that the rate of regression to the mean for both wealth and other status measures seems to have changed little over time, even though between 1800 and 2011 there have been enormous 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. The 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 very considerable.

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 little prospect of increasing mobility through state action.

Appendix: Inferring b from Surname Distributions

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. 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 1A, 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_{z0}^2, for this surname. But for any assumption about ($\bar{y}_{z0}, \sigma_{z0}^2$) there will be an implied path of relative representation of the surname over generations for each possible *b*. This is because

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

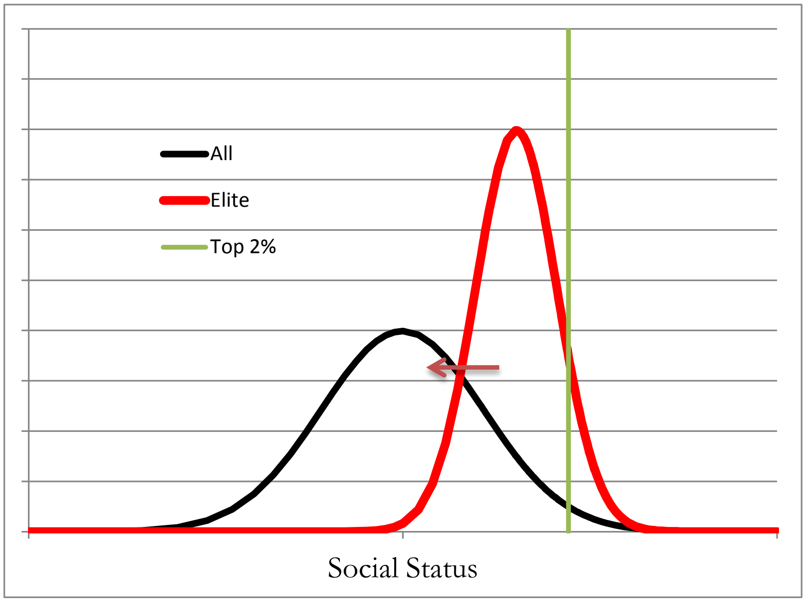
Also since $var(y_{Zt}) = b^2 var(y_{Zt-1}) + (1-b^2)\sigma^2$,

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

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 $\sigma_{z0}^2 < \sigma^2$). Its relative representation in the elite will decline in a particular pattern.

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.

Figure A1: Initial Position of an Elite

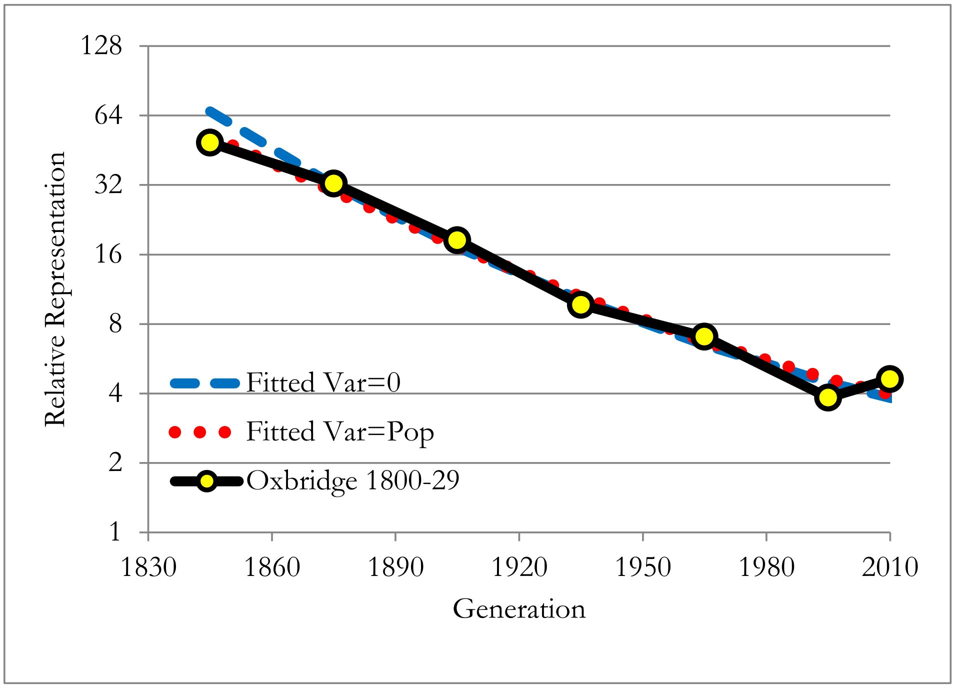


While we can in general expect that

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

it turns out to matter little to the estimated size of b what specific initial variance is assumed. Consider the case, as in figure 3, where the majority of the high status surname group still lies outside the observed elite. If we assume $\sigma_{z0}^2 = \sigma^2$ then for a given b we will have the quickest convergence on the population distribution, since the variance of this surname's status is already at the population average, and the implied initial average status of this surname, $\bar{y}_{z0}$ will be closest to the population mean. In contrast the case in which for a given b the elite would take the longest time to be distributed as is the general population is that where $\sigma_{z0}^2 = 0$, and the mean status of the elite group is exactly at the upper 2% level of the distribution. So for any length of time T until effective convergence we can easily find the upper and lower bound implied for b. In contrast where a majority of a group lies above the observed threshold, the assumption that would provide quickest convergence for a given b would be 0 variance in the group, since that would produce the lowest group mean status.

Figure A2: Assumed Initial Elite Status Variance and Implied Relative Representation, Oxbridge, 1830-2010



Suppose for example that the relative representation of an elite in the top 2% of the status distribution is 8, and that it takes 10 generations for that relative representation to fall below 1.1. If status is normally distributed both among the general population, and among the elite, what is the possible range of b? The answer is that b lies between 0.65 and 0.70: 0.65 if the initial variance of the elite status was 0, 0.70 if their initial variance was the same as that for the population.

In the examples in the paper we always assume that the initial variance in status among the elite surnames is the same as that of the population, because this assumption is the one that best fits the pattern of convergence observed. In the case of the Oxbridge elite, for example, figure A2 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. This makes almost no difference in the estimated b: 0.767 as opposed to 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.

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. 1988. "Family Economics and Macro Behavior." *American Economic Review, 78*: 1-13.

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.

Biblarz, Timothy J., Vern L. Bengtson and Alexander Bucur. 1996. "Social Mobility Across Three Generations." *Journal of Marriage and the Family, 58(1)*: 188-200.

Black, Sandra E. and Paul J. Devereux. 2010. "Recent Developments in Intergenerational Mobility." *Handbook of Labor Economics*.

Bowles, Samuel and Herbert Gintis. 2002. "The Inheritance of Inequality" *Journal of Economic Perspectives*. Volume 16, Number 3, 1 August 2002, pp. 3-30(28).

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," NBER, Chapters in: Issues in the Economics of Immigration, 227-270.

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

Charles Kerwin K. and Erik Hurst Charles. 2003. "The correlation of wealth across generations", *Journal of Political Economy 111*: 1155-1182.

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.

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

Ermisch, John, Marco Francesconi and Thomas Siedler. 2006. "Intergenerational mobility and marital Sorting", *Economic Journal* 116: 659-679.

Francesconi, Marco, Nicoletti, Cheti. 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.

Herrnstein, Richard J. and Charles Murray. 1996. *The Bell Curve: Intelligence and Class Structure in American Life*. New York: Free Press.

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.*

Long, Jason and Joseph Ferrie. 2012. "Intergenerational Occupational Mobility in Britain and the U.S. Since 1850," *American Economic Review*, forthcoming.

McCauliff, C.M.A. 1986. "The First English Adoption Law and its American Precursors." *Seton Hall Law Review*: 16:656-677.

Menchik, Paul. 1979. "Intergenerational Transmission of Inequality: An Empirical Study of Wealth Mobility." *Economica*, *46*: 349-362.

Mulligan, Casey B. 1997. *Parental priorities and economic inequality*. Chicago: University of Chicago Press.

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

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.