Jews, Gypsies, Brahmins, and Copts: a Theory of Social Mobility

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Using the information content of surnames to measure social mobility, it is shown that the true intergenerational correlation of social status is in the order of 0.7-0.8, much higher than is estimated by conventional methods. This intergenerational correlation is similar across dramatically different societies: medieval England, modern England, pre-industrial Sweden, modern Sweden, the USA, Quing and Communist China, Meiji and modern Japan, and Chile. Surnames also show mobility to follow a simple law-like process across many generations. One simple Law of Motion seems to capture all social mobility. In this paper I offer a theory as to why these measures differ from conventional mobility estimates. I also argue that the nature of the process suggests biological inheritance of abilities, as opposed to intergenerational capital transfers, is the main determinant of social position.

Introduction

This paper summarizes the results of Clark, 2012, 2013, Clark et al., 2012, Clark and Cummins 2012, 2013, Clark and Ishii, 2012, Clark and Landes 2013, and Hao and Clark, 2012, which examine social mobility rates over many generations, across countries, and across different measures of social status, using the information content of surnames. The framework adopted is very simple. We assume that we have measures of status that are cardinal, or can be approximated as cardinals: earnings, income, wealth, years of education, level of education, occupational status, or longevity. Then if y_t is this status measure (or in the case of income or wealth its logarithm), and is normalized to have a constant standard deviation and a mean of 0, the intergenerational correlation of y, β, is inferred just as the regression coefficient from

$$y_{t+1} = \beta y_t + v_t \qquad (1)$$

1-β is the rate of regression to mean. β^2 is share of social position variance derived by inheritance. If the process of transmission of status is Markov, then β^n is the intergenerational elasticity of status over n generations.

There have been over the last 40 years many measures of the intergenerational correlation of various measures of status within this framework, looking just at two generations. Figure 1, for example, shows estimates of the intergenerational elasticity of earnings for a variety of countries summarized by Corak, 2011. Figure 2 shows equivalent intergenerational correlation for years of education by Hertz et al., 2011.

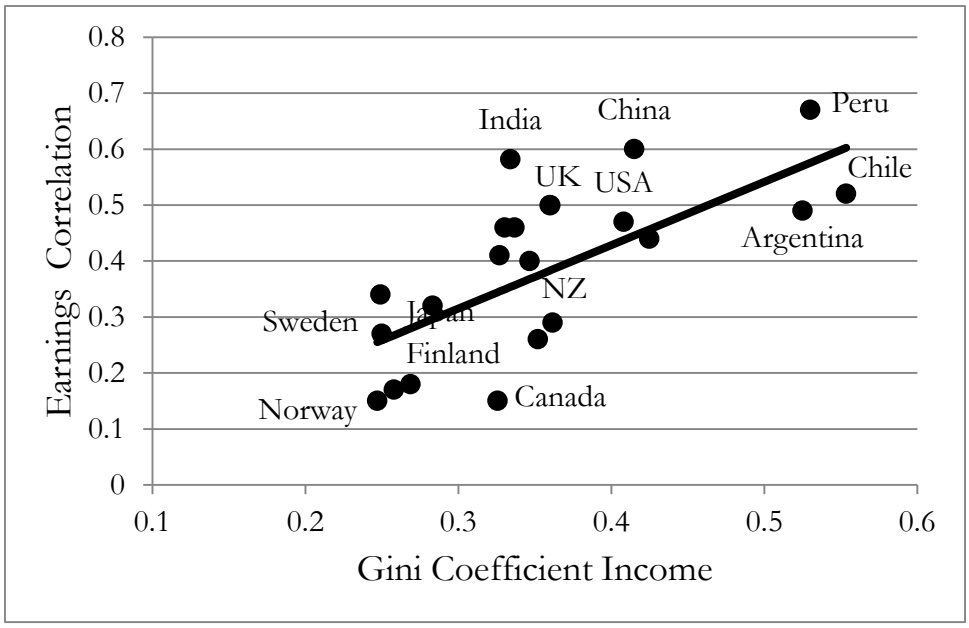
These studies suggest the following conclusions.

- Intergenerational correlations are typically of the order of 0.2-0.5 for income, years of education, occupational status, and even for wealth.
- Social mobility rates vary substantially across countries. In particular the more unequal is a society in income the lower are mobility rates.
- Social mobility rates vary substantially across different measures of status such as earnings and education within the same country. The intergenerational elasticity for earnings in Scandinavia is consistently lower, for example, than that for education.
- Thus mobility rates are "too low" in some societies. With better opportunities for the children of low income or status families, more mobility would be possible.
- If status transmission is Markov, earnings, occupational, and social mobility are all largely complete within 2-5 generations. The descendants of a person with an income 20 times above the average, or 1/20 of the average, 5 generations later will have expected incomes within 10% of the average.
- If the process is Markov, and the variance of status across generations is constant, then the fraction of variance of social position explained by inheritance is low. The above figures suggests this is 4% in Scandinavia, and 22% in the USA. Most of social status is not predictable at birth.
- Recent studies of multiple generations consistently suggest, however, that the process is not Markov. If we estimate

  $$y_{t+1} = \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 y_{t-2} + u_t$$

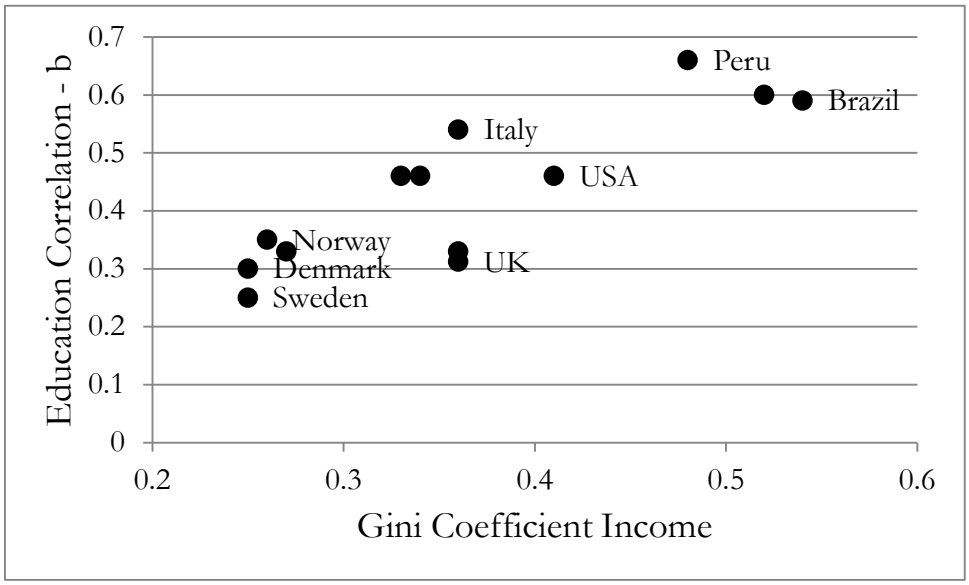
  then $b_2 > 0$, $b_3 > 0$ and so on. Even controlling for parents, the status of grandparents, and even great-grandparents is predictive of this generation's status (Lindahl et al., 2012, Long and Ferrie, 2012).

Figure 1: Intergenerational Earnings Correlations and Inequality



Source: Corak, 2012, Figure 2. Canada, personal communication from Miles Corak. India from Hnatkovska et al., 2013.

Figure 2: Intergenerational Education Correlation and Inequality



Sources: Hertz et al., 2011, table 2. Gini for Income, World Bank.

However, when we switch to measuring intergenerational correlations through the rate of regression to the mean of social groupings identified by surnames we find the following. Denoting the intergenerational correlation measured in this way as b we find:

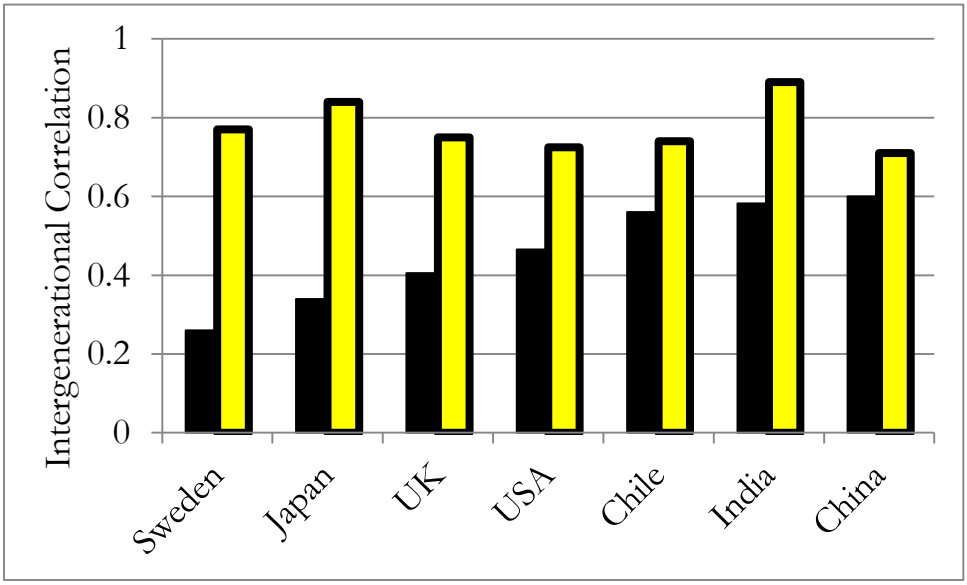
- Persistence, b, is much higher than conventionally measured for all aspects of status. Table 1 and figure 3 shows for various periods and countries estimates of persistence through surnames. The typical value is 0.7-0.8. Complete regression to the mean takes 10-16 generations, 300-500 years.
- The rate of persistence is similar for education, occupation and wealth. It is similar across the entire distribution of status, being the same for the upper tail as for the lower tale.
- The rate of persistence varies little between societies and epochs. There is little sign that rates of social mobility are "too low" in some societies.
- Regression to the mean measured in this way is indeed Markov. The social status of the next generation is predicted only by the status of the current generation.
- Since $b^2 = 0.5\text{-}0.65$ the majority of social status is determined at conception.
- We observe persistent elites and underclasses only in two cases. The first is an isolated elite with marital endogamy (as with Hindu castes in India, Muslims in India, or the Copts in Egypt, or Christians elsewhere in the Muslim world). The second is where an elite or an underclass is maintained by selective retention of members with the elite or underclass characteristics, and recruitment of outsiders with the characteristic.
- Assortative mating is what makes b so high. Mating has become more assortative in the modern world, so mobility rates may decline further (Herrnstein-Murray claim).
- The fact that regression to the mean does not occur when societies have completely endogamous marriage, and the failure of social institutions to have any systematic effects on mobility rates, suggests that social mobility is a largely biological process.

Table 1: Estimates of b from Surnames

Country	Measure	Period	Intergenerational Correlation
MODERN			
USA	Attorneys	1950-2011	0.83-0.94
USA	Doctors	1950-2011	0.73-0.80
England	Attorneys, Doctors	1950-2012	0.69-1.00
England	Wealth	1950-2012	0.74
England	Education	1950-2012	0.80
Sweden	Education	1950-2011	0.65-0.88
Sweden	Attorneys, Doctors	1950-2011	0.70
Chile	Occupations	1940-2010	0.83
China	Education	1950-2011	0.66-0.92
Japan	Education	1950-2012	0.84
India	Doctors	1950-2009	0.89
HISTORIC			
England	Wealth	1650-1850	0.71-0.85
England	Wealth	1380-1650	0.74-0.85
England	Education	1200-1500	0.80-0.90
England	Education	1500-1800	0.80-0.90
Sweden	Education	1700-1900	0.75-0.88
Sweden	Doctors	1890-1950	0.70
India	Doctors	1860-1950	0.89
Japan	Education	1880-1900	0.72
China	Education	1700-1900	0.81

Sources: England, Clark, 2013, Clark and Cummins, 2012**,** China, Hua and Clark, 2012, India, Clark and Landes, 2012, Japan, Clark and Ishii, 2012, USA, Clark et al., 2012. Chile communication from Daniel Diaz.

Figure 3: Conventional versus Surname estimates of Status Persistence, 1950-2012



Why are these results so different from the conventional studies? One suggestion is that by looking at surname groupings we are implicitly controlling for errors in the measurement of current status that will reduce the estimated intergenerational correlation β, so estimating higher values for b. But the correlation estimates in figure 1 are those corrected for measurement error. And in the case of education in figure 2 measurement errors are believed to a relatively insignificant. The different bs estimated in these ways are not about different degrees of control for measurement errors.

The resolution proposed here that individuals and families have some underlying general level of social status in generation t, x_t, where x_t is always regressing toward the mean across generations to that

$$x_{t+1} = bx_t + e_t \qquad (2)$$

where x_t and x_{t+1} are assumed to have a mean of 0, and a constant variance σ^2 ., and x is normally distributed.

However, we do not typically directly observe the complete social status of families, but some partial measure, y_t , where such measures would be earnings, wealth, years of education, educational status, or occupational status. For each generation t

$$y_t = x_t + u_t \tag{3}$$

where u_t is a random component linking the underlying status of the family to the particular observed measure of status.

The random component linking aspects of social status to underlying social status exists for two reasons. First there is an element of luck in the status attained by individuals given their underlying competence. If we look at earnings, people happen to choose a successful field to work in, or a successful firm to work for. They just succeed in being admitted to Harvard, as opposed to just failing. They marry a supportive spouse, or end up instead shackled to a needy partner. But, second, people trade off income and wealth for other aspects of status. They choose a career as a philosophy professor as opposed to a lower occupational status, but more lucrative career, as a plumbing hardware salesman.

The above implies that the conventional studies of social mobility, based on estimating the β in the relationship

$$y_{t+1} = \beta y_t + v_t \tag{1}$$

will underestimate the true b linking underlying social status across generations. In particular the expected value of β will be not be b, but instead θb, where θ <1. The greater the random components linking underlying status and any measured aspect of status, the smaller will be θ. For

$$E(\hat{\beta}) = b\frac{1}{1+\left(\frac{\sigma_u^2}{\sigma_x^2}\right)} \tag{4}$$

Thus conventional estimates of social mobility, based as they are on one generation studies, and on partial measures of overall social status, will systematically tend to overestimate social mobility rates. However, the surname measures that we

use here over multiple generations, even when they are based on partial measures of social mobility such as educational or occupational status, will closely approximate to the true underlying b. This is because by aggregating over groups of individuals with the same surname we can make the error component linking observed status *y* and underlying status *x* go to zero.

Evidence of the loose connection of the various single aspects of status for single individuals is easy to find. Table 2 shows a summary of these correlations for the following aspects of status: academic aptitude (typically IQ), occupational status, education, earnings, and wealth. The correlations for any two attributes average only around 0.43. That means, for example, that if I know the academic aptitude (IQ) of my child I can typically predict less than a fifth of the variation in possible educational achievement, occupational status, earnings, or wealth.[1] This loose association for a person of the various aspects of status means that each aspect in general will have to also be weakly correlated across generations. But, the argument is, if we were to take the broadest possible measure of the aggregate status of an individual, that would be closely correlated across generations.

The one generation studies, as long as the particular aspect of status, *y*, is correctly measured, will indeed report what good estimates of what the correlation is across one generation, for any particular aspect of status. There is nothing intrinsically wrong with these estimates. However, the mistake is to infer from these studies that overall status regresses to the mean anything like as rapidly.

This simple switch in thinking about the mechanism of social mobility produces a number of testable predictions.

[1] Bowles and Gintis, 2002, point out this loose association between IQ and other social outcomes creates puzzles about how these other attributes are inherited as strongly as they are. IQ inheritance cannot be the primary pathway.

Table 2: Correlations between the Aspects of Status, Individuals

Status Element	Mental Aptitude (IQ etc.)	Education	Occupational Status	Earnings	Wealth
Mental Aptitude	-	.45-.62[1]	.16-.31[2]	.23-.30[3]	.16[4]
Education	-	-	.41-.85[5]	.32-.34[6]	.22-.38[7]
Occupational status	-	-	-	.34-.71[8]	.13-.34[9]
Earnings	-	-	-	-	.60-.61[10]

Sources: [1]Scarr and Weinberg, 1978, Husén, 1991, Zagorsky, 2007. [2]Cagney and Lauderdale, 2002, Hauser, 2002, Griliches, 1972. [3] Griliches, 1972, Zagorsky, 2007, Zax et al., 2002. [4]Zagorsky, 2007. [5]Scarr, 1981, Hauser and Warren, 2008, Pfeffer, 2011. [6]Cagney and Lauderdale, 2002, Griliches, 1972, Pfeffer, 2011. [7]Cagney and Lauderdale, 2002, Pfeffer, 2011. [8]Griliches, 1972, Hauser and Warren, 2008 (wages). [9]Pfeffer, 2011. [10]Budria *et al.*, 2002, Hendricks, 2007.

1. The observed rate of regression to the mean of individual aspects of status will be determined by how well they are predicted by the underlying status of families. The lower their correlation with this underlying status the less intergenerational connection there will seem.

2. In the long run all aspects of status will regress to the mean at the same rate. Underlying mobility measured through earnings, wealth, education, or occupational status will be the same. There will be a stable correlation between aspects of status

3. The underlying process of social mobility will be Markov. It will proceed at the same rate across all generations.

4. Social groups, such as in the USA such as Jews, Blacks, Latinos and Native-Americans, will appear to have lower rates of social mobility than the general population on conventional measures, but will in fact exhibit the same rate of regression to the mean as the society as a whole.

What causes the conventional measures to overestimate underlying social mobility rates is the presence of the error term, e, linking partial measures of status with underlying competence. However, when we look at groups of people, as long as they are grouped by identifiers that do not correlate with this error term, such as race, religion, national origin, or even, as we shall see, common surnames, then by averaging across people we reduce this error term. While

$$y_i = x + u_i \qquad (3)$$

at the individual level, at the group level,

$$\bar{y}_i = \bar{x} \ .$$

Now the $\bar{y}$ accurately tracks $\bar{x}$ without the intrusion of the errors, and we can correctly estimate social mobility just from observed partial measures of this.

Thus when we look at such groups of individuals the underlying slow rate of social mobility becomes apparent, even when we only have the usual partial indicators of underlying social competence. Table 3 thus shows for the US the effects including separate intercept terms for Blacks, Latinos and Jews in estimating the intergenerational elasticity of family income in the US for a sample of 3,568 parental incomes in 1967-71, and the income of adult children in 1994-2000.

The regression estimates imply that, even when we control for all other measured attributes of parents in 1967-71 such as education, occupation, and household cleanliness, we can predict that Black, Latino and Jewish families are all regressing more slowly to the mean than is found for the population as a whole.[2] The Hertz interpretation is that this is because of special characteristics of these groups. My interpretation, however, is that if we included a dummy for membership in any high or low income group then it would have a significant coefficient also. This is because the underlying rate of regression to the mean for all families is much

[2] Hertz, 2005.

Table 3: Regression to the mean controlling for race and religion, USA

Independent Variable	No controls	Only Race	All Observable Parental Characteristics
Ln Family Income of Parents	0.52**	0.43**	0.20**
Black	-	-0.33**	-0.28**
Latino	-	-0.27**	-0.15
Jewish	-	-	0.33**

Notes: ** = significant at the 1 percent level. Only 3 percent of the sample was Latino.
Source: Hertz, 2005, table 6.

lower than the conventional regression estimates imply. Thus once we can identify families as collectively belonging to groups of on average high or low incomes, we can predict much better the expected income in the next generation.

This same effect of group background was found by George Borjas in his study of immigrants where he regressed

$$y_{ijt+1} = b_0 y_{ijt} + b_1 \bar{y}_{jt}$$

where y was log wage or years of education, i indexed families, j the country of origin of fathers, and t the generation (Borjas, 1995). $\bar{y}_{jt}$ was the average log wage or years of education of all men from that country, estimated from the 1980 census reports of education and occupation. In both the case of education and earnings the average status of people from the country of origin was predictive of the outcome for sons (b_0+b_1 equalled 0.44 for education and 0.70 for earnings) (Borjas, 1995, table 8).

Borjas interprets this as the result of "ethnic capital" externalities. Sons from ethnic groups with high average education levels do better than would be predicted from the education of the father alone, because of spillovers from the education of others in the community. But again our interpretation would be that there is likely little or no externality. It is just that information on the country of origin allows a better prediction of the likely "true" underlying status of families, and so a better prediction of the son's outcomes. That is why the same effect appears below for the wealthy of 1923-4 in the USA, who span many ethnic communities.

This simple understanding of social mobility can resolve more than the puzzles of group status persistence. For it can also explain the connection detailed in figure 1 between income mobility rates across countries and the inequality of income. The greater are the random components in determining measures of status such as income, relative to the systematic elements stemming from underlying status, the greater will be the degree of mismatch between such partial one generation estimates of regression to the mean, and the underlying regression of fundamental social status.

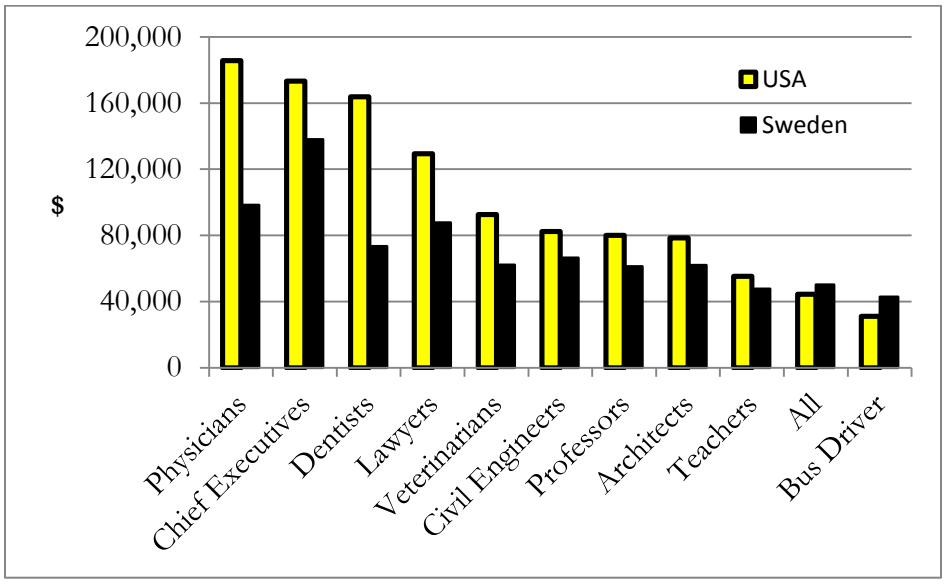
The USA, for example, has much greater inequality in earnings than does Sweden. Figure 4 shows, for example, the salaries in $2010 for some comparable high and low status occupations in Sweden and the USA. A US doctor earns six times the wage of a bus driver, while in Sweden the ratio is only 2.3 times. A US professor earns sixty percent more than a bus driver, in Sweden it is only forty percent more.

We can represent this by modifying equation (3) above to

$$y_t = \psi x_t + u_t$$

where the ψ linking social competence to earnings is higher in the US than in Sweden. ψ in the US could be as much as twice the ψ in Sweden. This implies that the proportion of variation in earnings in the USA that is explained just by random factors is lower. This will mean that the downwards bias in estimates of social mobility coming from earnings will be lower in the US. Thus the US will appear, because of greater wage inequalities, as more immobile across generations than Sweden. Just the greater wage inequality in the US can easily double the measured intergenerational correlation if the true intergenerational correlation of status is 0.75.

Figure 4: Average Earnings by Occupation, Sweden and the USA, 2008



Sources: USA – Bureau of Labor Statistics, National Occupational Employment and Wage Estimates, May 2010. Sweden – Statistics Sweden, *Wage and salary structures, private sector* (SLP), 2011.

This explanation can also explain why the proposition that as earnings inequality has increased in the past forty years in the USA, social mobility rates have declined, is wrong.[3] All that is happening is that the standard measures of mobility now more accurately reflect the underlying mobility rates.

This simple model also explains another puzzle of conventional mobility estimates, the stronger than expected correlation of social status between grandparents and grandchildren, and great-grandparents and great-grandchildren.[4] For this model contains the prediction that after the second generation, measured social mobility rates will slow down to the underlying mobility rate of social competence. Measured downwards mobility for a high income family will be fast in

[3] Though this notion has gained popular currency (see, for example, Foroohar, 2011) there seem to be no academic studies suggesting it.
[4] See, for example, Long and Ferrie, 2013. Lindahl, et al., 2012.

the generation of the children, but then much slower for the generation of the grandchildren, the great-grandchildren and so on measured relative to the first generation.

The link between children and parents, the β normally estimated, will relate to the underlying persistence of status in the form

$$\hat{b} = \varphi b$$

where φ is the attenuation factor caused by the random components linking observed status on any one dimension with underlying status. When we look, however, at the correlation between grandparents and grandchildren, and estimate now $\widehat{b_2}$, the correlation across two generations, we will find that it is not $\hat{b}^2 = \varphi^2 b^2$ as would be expected from simple models of social mobility, but instead φb^2. The downward bias caused by the error component in the measure of status is the same across all generations. Thus if $\hat{b} = \frac{3}{8}, b = \frac{3}{4}, \varphi = \frac{1}{2}$, then $\widehat{b_2}$ will not be the 0.14 expected on conventional mobility estimates, but double the size at 0.28.

There is data on the intergenerational correlation of education and earnings, estimated from occupations, for four generations of families in Malmo, Sweden which allow us to test this claim. Table 4 shows the correlations in years of education across generations. The one generation correlation averages 0.35.

The bottom panel in the table now shows what the estimated $\hat{b}_n$ s would be if the underlying rate of persistence for status is actually double this at 0.7, but there is an attenuation factor of 0.5. This produces predicted correlations for the educational status of grandchildren and great-grandchildren that are a bit on the high side compared with the actual results, but the difference is not statistically significant. The underlying b that would best fit this pattern of intergenerational correlations would be b = 0.61, still substantially higher than the observed correlation of 0.35 between adjacent generations.

Thus we see that in all these cases that represent anomalies for the standard estimates of fast social mobility, the simple alternative model of a much slower underlying rate of mobility for a deeper, unobserved, social competence can account for the results.

Table 4: Persistence in Education Across Multiple Generations in Sweden

Last Generation	Great-Grandparents	Grandparents	Parents
OBSERVED			
Grandparents	0.334		
Parents	0.229	0.312	
Children	0.123	0.202	0.412
PREDICTED, b = 0.7			
Grandparents	0.334		
Parents	**0.226**	0.312	
Children	**0.173**	**0.253**	0.412

Source: Lindahl et al., 2012, table 2.

Another feature of conventional estimates of social mobility is that the suggested rates of mobility for different characteristics are different. Cognitive abilities in Sweden, for example, are found to be strongly correlated across generations, with a β of 0.77. But at least in Scandinavia income and educational attainment have a much lower hereditability, with βs of 0.2 to 0.3.

Suppose, for example, that we began with a Swedish elite that was distinguished by high cognitive abilities. Since cognitive abilities are correlated with income and educational attainment this group would also be distinguished on these dimensions. But they would be less distinguished, since the correlation between cognitive abilities and income or educational attainment is no more than 0.5. However, within a few generations the descendants of this group would have regressed to the mean in terms of income and educational attainment.

Since the regression to the mean of cognitive abilities is so much slower, however, they would still be distinctive in this dimension. So we would have a group

of people with a factor that normally predicts both higher earnings and educational attainment, yet with average attainment in both these respects. This seems a troubling implication of current estimates of social mobility for different aspects of social status.

In contrast the model of one underlying measure of social competence that is suggested here would predict that the families scoring highly on this underlying measure, the regression to the mean would be the same for all aspects of status: cognitive abilities, non-cognitive abilities, earnings, wealth, education, occupations and longevity. The different rates of mobility seen on this individual measures reflects just how much random component there is linking them to underlying social competence.

Surnames

To investigate the rate of regression to the mean of this deeper underlying social status (and by implication the long run rate of regression to the mean of income, wealth, occupational status and education) this study traces people not through individual family linkages, but through surnames over multiple generations.

In many societies surnames are inherited unchanged from one generation to the next, typically through the patriline. If at some generation surnames differ in social status, we can then trace through surnames the descendants of the current generation for many generations. As long as there is nothing peculiar about the path of descent of surnames, the surnames link the status of groups of families many generations in the past with their descendants in the present.[5]

When initially formed, surnames in many societies were associated with social status. For example, in England some high status land owners already possessed surnames at the time of the Domesday Book of 1086, which listed the major landholders of England. Most of these people were the Norman, Breton and Flemish followers of Duke William of Normandy, who seized the throne of England in 1066. These surnames thus constitute a distinctive subset of modern English surnames: Baskerville, Beaumont, D'Arcy, de Vere, Mandeville, Montgomery, Vernon, and Villiers, for example. In England also about 10 percent of surnames derive from the occupations of the original holder, and these occupations had a range of social statuses: Smith, Baker, Shepherd, Clark, Chamberlain, Butler.

In Sweden, surnames started as patronyms which changed with each generation. Sven, son of Lars, was Sven Larsson. But his son Gunnar would be Gunnar Svensson. For the ordinary people patronyms did not become fixed across generations until the late nineteenth century. However, from at least the 17th century two groups of high status individuals were acquiring permanent and distinctive surnames. The first were those who attended universities, who adopted latinized or grecified surnames such as Celsius, Linnaeus, and Melander. The second was the aristocracy, often imported mercenary commanders, who imported surnames from

[5]Olivetti and Paserman, 2012, find that there is no difference in the occupational status of sons-in-law compared to sons in the USA 1850-1930, so that there is no sign that the social mobility along the patriline is any slower than in the matriline.

Germany, Scotland and elsewhere or created their own distinctive family names when inducted into the house of nobles such as Leijonhufvud.

Even in societies such as England where the early introduction of universal surnames by 1300 meant that by 1800 common surnames all had the same average social status, we can study modern long run social mobility through the use of rare surnames. Through processes of chance in each generation some such rare surnames will be on average of high status, others of low status. If in some initial generation, surnames are predictive of social status, then over time, as long as b is less than 1, surnames should lose this information. And the rate at which they lose it is a measure of the rate of social mobility. If the high rates of mobility typically found in one generation studies are predictive of long-run rates of social mobility, then within a few generations surnames should contain no systematic information on social status.

The crucial advantage the surname linkages give is that we can identify high and low status groups in some initial period, and then track them over multiple generations using their initial classification of status into high and low groups. This means that after the first generation the average error from the underlying status associated with each surname group in each generation is 0, so that for the surname cohorts

$$b_y = b_x$$

where x is the underlying broader social status of families or groups.

The b_x estimated for surnames, however, is not identical to that within families, if we could estimate that. This is because in surname cohorts, when we estimate

$$\bar{y}_{kt+1} = a + b\bar{y}_{kt} + u_{kt+1} \quad (4)$$

$\bar{y}_{kt}$ measures, for example, the average log wealth across a group of people with the surname k in the initial generation. But some of these people will not have any children, and would not be included in the within family regression. And those with 1 child from generation t get weighted as much as those with 10 children. Thus surname cohorts themselves introduce some measurement error in y_t, which will reduce the observed value of b. The magnitude of this downwards bias will decline, however, the larger the size of the surname groupings unless there is some systematic connection between social status and child numbers.

In the years 1890-1980 fertility was consistently higher for lower status families in countries such as the USA, England, and Sweden. In this case the surname estimate of b will be biased towards 0 for elite surnames, and away from 0 for underclass surnames in these years. In the years before 1800 in England and Sweden fertility was substantially higher for upper class groups. Thus for elite surnames in the pre-industrial world, the estimate of b will be biased upwards, and for underclass groups biased downwards. We shall see below that for some groups, this demographic bias can be so strong that a surname will appear to be moving away from the mean.

In looking at social mobility through surnames in some cases we have direct measures such as wealth in England 1858-2012 (Clark and Cummins, 2012). Then it is easy to estimate b from the equation

$$\bar{y}_{Rt+1} - \bar{y}_{t+1} = \mathrm{b}(\bar{y}_{Rt} - \bar{y}_t)$$

where $\bar{y}_{R,t}$ is the average log wealth at death of surname group R, and $\bar{y}_t$ is the average wealth at death of England as a whole. Figure 5 shows this information for England for three initial rare surname groups: wealthy surnames at death 1858-87, prosperous surnames at death 1858-87, and poor surnames at death 1858-87. A sample of the surnames used are shown in table 5, labelled just as samples A, B and C. These surnames are rare enough that the surnames themselves are not doing any work in slowing the regression to the mean. Thus most people reading this will not be able to discern which surnames belonged to the rich, prosperous and poor samples.[6]

Table 6 shows the average implied estimate of b for each period, and across the 5 generations as a whole. Since the poor group is much closer to average wealth than the two richer groups, the b estimate here is much noisier, as can be seen in the variance of the estimates in the last row of table 6. Looking at the top two wealth groups we see quite stable average estimates of b across the 5 generations - 0.75, 0.66, 0.73, and 0.74 – for an overall average of 0.72.

[6] Sample A is the rich, B the poor, and C the prosperous.

Figure 5: Log Average Wealth relative to the Average, 1858-2011

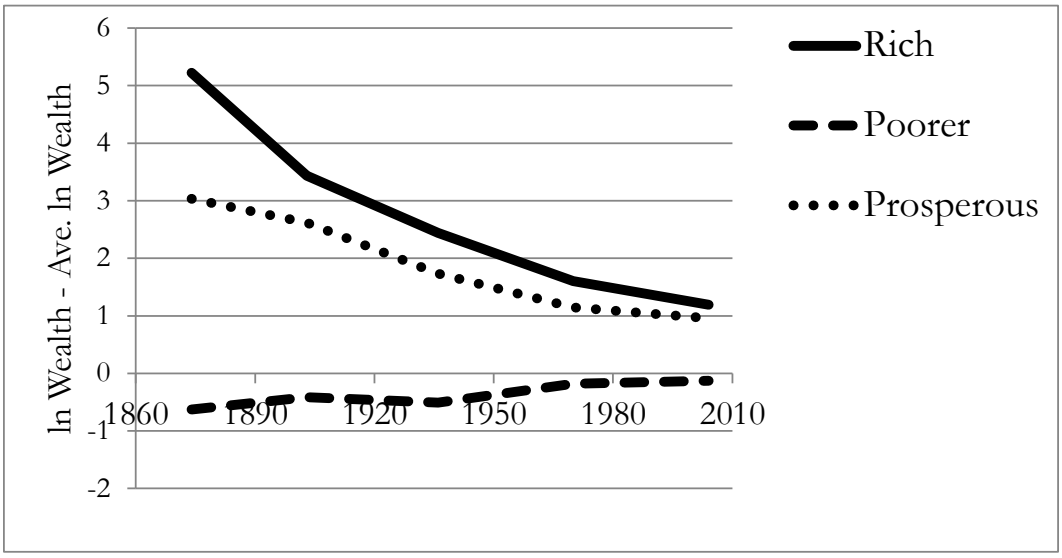


Table 5: Rare English Surname Samples, 1858-1887

Sample A	Sample B	Sample C
Ahmuty	Aller	Agace
Allecock	Almand	Agar-Ellis
Angerstein	Angler	Aglen
Appold	Anglim	Aloof
Auriol	Annings	Alsager
Bailward	Austell	Bagnold
Basevi	Backlake	Benthall
Bazalgette	Bagwill	Berthon
Beague	Balsden	Brandram
Berens	Bantham	Brettingham
Beridge	Bawson	Brideoake
Berners	Beetchenow	Broadmead
Bigge	Bemmer	Broderip
Blegborough	Bevill	Brouncker
Blicke	Bierley	Brune

Table 6: b Values Between Death Generations

Generation	Rich	Prosperous	Rich and Prosperous	Poor
1888-1917	0.66 (0.026)	0.86 (0.052)	0.75 (0.028)	0.66 (0.061)
1918-1959	0.68 (0.031)	0.64 (0.041)	0.66 (0.030)	1.12 (0.136)
1960-1987	0.73 (0.040)	0.74 (0.051)	0.73 (0.035)	0.30 (.076)
1999-2011[a]	0.70 (0.098)	0.80 (0.125)	0.74 (0.078)	0.41 (0.615)
Average	0.69	0.76	0.72	0.61

Notes: Bootstrapped standard errors in parentheses. [a]The $\hat{b}$ reported here is the estimated $\hat{b}$ multiplied by 0.94 of to reflect that the generation gap here is only 23 years, because of the truncated generation.

However, in most cases we have instead measures of the fraction of people bearing a surname who are in high or low status occupations over many generations compared to the fraction of those surnames in the general population: university graduates, doctor, attorney, member of Parliament, professor, author, or criminal.

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 6, 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.

Thus even though we cannot initially fix $\bar{y}_{z0}$ and σ^2_{z0} 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. In practice 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 in most cases. In the case of the wealth of the deceased in England figure 7 shows that for the wealthier surname probated it was actually more dispersed than for the population as a whole. But it does show the pattern premised in figure 6 of a rightward shift to the whole distribution.

Figure 6: Regression to the Mean of Elite Surnames

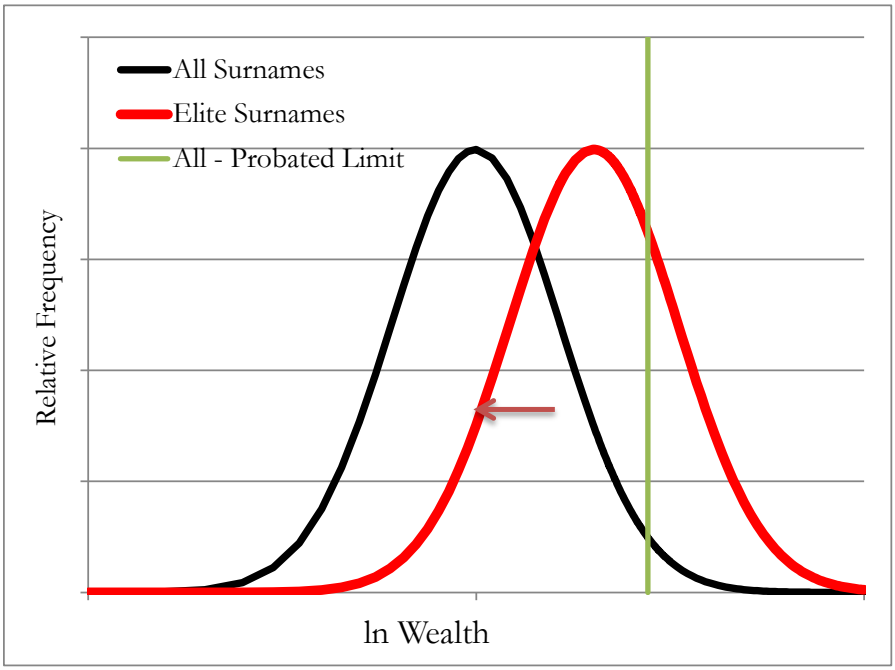


Figure 7: Wealth Distribution of Probated, Rich, Prosperous and Brown Surnames, 1918-1959

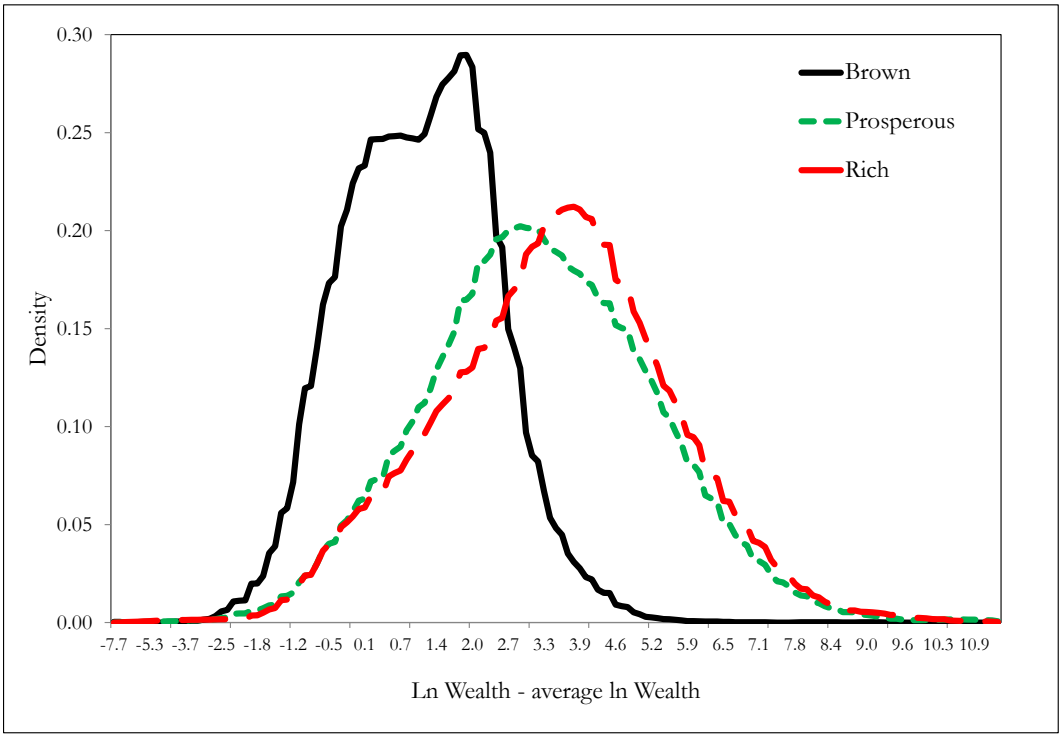


Table 7: Share Probated by Generation, England 1858-2012

Period	All Deaths 21+	Rich 1858-87	Prosperous 1858-87	Poor 1858-87
1858-87	0.15	0.84	0.57	0.00
1888-1917	0.22	0.68	0.54	0.10
1918-52	0.38	0.73	0.63	0.21
1953-89	0.46	0.70	0.65	0.34
1990-2011	0.43	0.61	0.59	0.37

For England in 1858-2012 average wealth at death is determined by the average estate value of those probated as well as the fraction of people probated. Table 7 shows this fraction for all adults (21 and over at time of death) by generation in England 1858-2012, as well as for those in the three rare surname groups of 1858-87. As can be seen the rich surnames continue to be probated at higher rates than the general population even into the last generation, 1990-2012. The poor group of surnames in 1858-87 is always probated at lower rates than the general population.

By dividing the probate rate of each group in each period by the general probate rate we can calculate the relative representation of each surname group among the probated. This is shown in table 8. Thus in 1858-87 the rich surnames were 5.5 times as likely to be probated as the average person at death. Assuming wealth variance for each surname equal to the social average we then get an implied persistence rates across generations, b, shown in table 9.[7]

[7] For the poor surnames we cannot derive this for the first period since by construction no-one in this surname group was probated in this period. With a normal distribution of wealth in each period it would not be possible to have a 0 percent of any group probated.

Table 8: Relative Representation by Generation

Period	All Deaths 21+	Rich 1858-87	Prosperous 1858-87	Poor 1858-87
1858-87	1.00	5.48	3.71	0.00
1888-1917	1.00	3.10	2.46	0.48
1918-52	1.00	1.92	1.65	0.56
1953-89	1.00	1.51	1.39	0.73
1990-2011	1.00	1.42	1.37	0.87

Table 9: Estimated b by Surname Group and Period, Probate Shares

Period	Rich 1858-87	Prosperous 1858-87	Poor 1858-87
1888-1917	0.63	0.81	0.37
1918-59	0.75	0.65	1.04
1960-93	0.59	0.70	0.80
1994-2011[a]	0.78	0.81	0.05
Average	0.69	0.75	0.57
Direct Estimate	0.69	0.76	0.61

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

The estimated intergenerational correlation of wealth from just the fractions of people in each surname group probated is very similar to that estimated directly by calculating average log wealth, as is also shown in table 9. Thus though in most cases we only observe the status of social groups by observing their relative representation in some top x% of the population, the estimates derived in this way will be completely comparable with the standard estimates.

Intergenerational Correlations by Country and Status Type

England

The tables below report the various intergenerational correlations found in the studies of the various countries. Table 9, for example, shows the various estimates of b for England, running from 1200 to 2012, and covering wealth, education, occupations, and membership in the political elite. These estimates all suggest high intergenerational correlations of status, on all measures. There is no clear sign of an increase in social mobility over time.

For wealth, for example, I have measures of probate rates from 1380 to 2012. We see above that for rare surname groups we get an estimated b of 0.74 for 1858-2012. We can follow the probate rates of these same surnames back to 1680 and get a measure of b for 1680-1858. The model posited above that underlying status is linked across generations by the formula

$$x_{t+1} = bx_t + e_t$$

also has implications about what the path of relative representation will be for surnames observed to be elite in any specific generation in the periods before that observation. The OLS estimator of b in this expression is

$$\hat{b} = \frac{\sum x_{t+1}x_t}{\sum x_t^2}$$

Suppose we were instead to posit that

$$x_t = \beta x_{t+1} + \varepsilon_{t+1}$$

The OLS estimator of β would then be

$$\hat{\beta} = \frac{\sum x_{t+1}x_t}{\sum x_{t+1}^2}$$

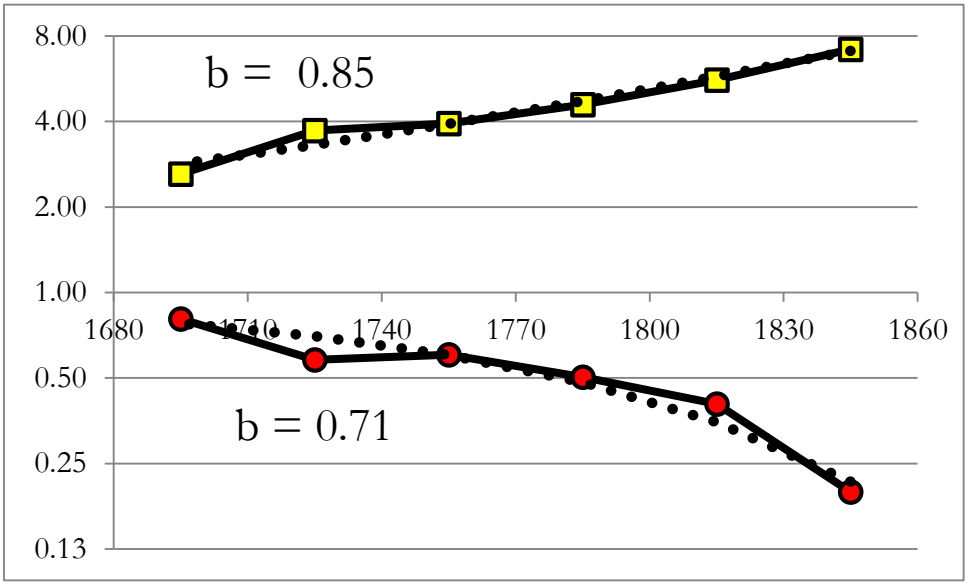
If the variance of x_t is the same as that of x_{t+1}, then it will also be the case that $E(b) = E(\beta)$. Since we have normalized variance to be the same in each generation

we have met this condition. Thus the rate of rise of surnames to be an observed elite in any generation should mirror their rate of decline back to mediocrity.

Table 9: b Estimates for England

Period	Wealth	Education	Occupations	Political Elite
1200-1400	-	0.80-0.86	-	0.91
1400-1650	0.74-0.85	0.77-0.86	-	0.91
1650-1850	0.71-0.85	0.77-0.83	-	0.91
1850-1950	0.70	0.77-0.83	-	0.81
1950-2012	0.74	0.80	0.65-1.00	-

Figure 8: The Prehistory of the Rich and Poor of 1858-87



Note: The upper curve is the rare rich surnames of 1858-87, the lower curve the rare poor surnames of 1858-87.

This is exactly what we observe in figure 8. The rare surnames of the rich in 1858-1887 rise in their status 1680-1858, those of the poor decline in status. The implied b for the rich from the rate of rise is 0.85, that of the poor from the rate of decline 0.71.

Earlier we can estimate b from the decline in relative representation among probates of 13th century elite surnames, locative surnames for example, or the rise of surnames earlier concentrated in the center of the status distribution, such as those of artisans. This produces moderately higher estimated levels of b 1380-1858, in the range 0.74-0.85. But before 1538 there is uncertainty about the population stock of surnames needed to calculate these persistence rates.

The continued high level of persistence of wealth in the modern period is surprising given the changes in the tax treatment of inheritances over the last hundred years in the UK. As figure 9 shows, before 1878 inheritance taxes were modest. Indeed for most of the period before 1800 there were no taxes on inheritances. But in the years 1946-1980 larger inheritances were taxed at rates of 75-80%. Thus we would expect that transfers of wealth between generations were correspondingly reduced substantially for richer families in some recent generations. Yet this seems to have had minimal effects on the persistence of wealth.

For education we can similarly estimate b over many generations in England using the relative representation of surnames in Oxford and Cambridge, the only two English universities up until the 1830s. Figure 10, for example shows the relative representation at Oxford and Cambridge, representing a 0.7% elite of educational achievement in England all the way from 1500-2012, of two sets of rare surnames: rare surnames of men born 1780-1809 dying wealthy 1858-87, and rare surnames of someone attending Oxford or Cambridge 1800-29. For these surnames we calculate the *relative representation* at the universities for the succeeding generations, 1830-59,…2010-2. We can also calculate their *relative representation* in the preceding generations, going all the way back to 1530-59.

The patterns in figure 10 are striking. Surnames associated with the rich are always more overrepresented at Oxford and Cambridge than those associated with people who happened to attend the universities 1800-29, in all subsequent or prior

generations. In 1830-59, for example, the rich surnames were 54 times as frequent in Oxford and Cambridge as in the general population, and the earlier Oxbridge

Figure 9: Maximum Inheritance Tax Rates, UK, 1825-2012

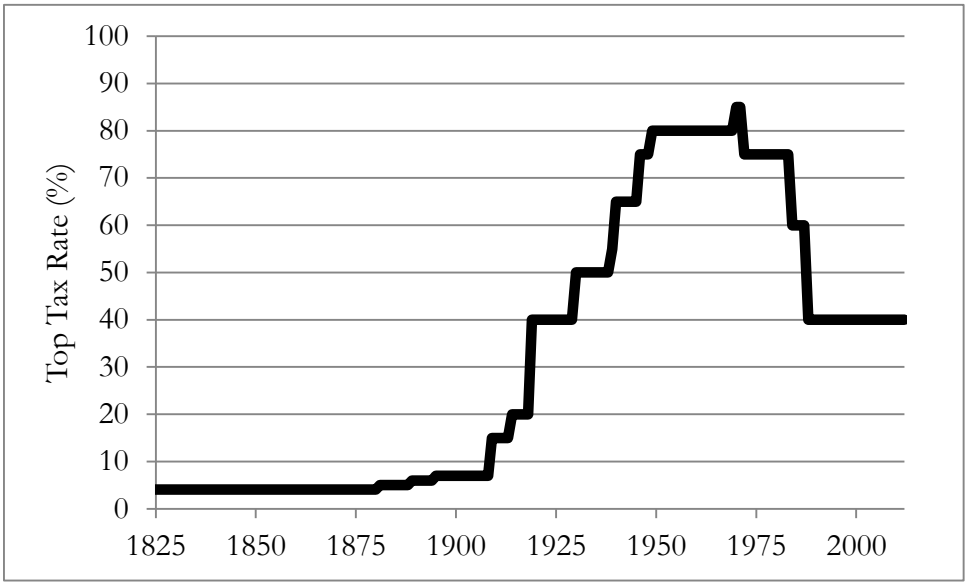
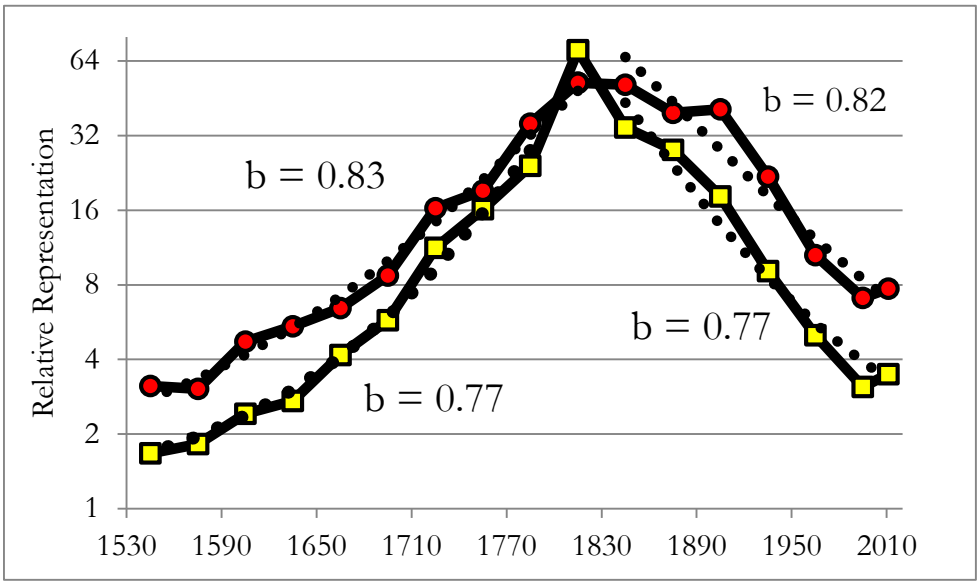


Figure 10: Relative Representation and Implied bs at Oxbridge, 1530-2012



Note: The circles indicate the observations for the wealthy surnames, the squares those for the rare surnames appearing at Oxford and Cambridge 1800-29.

surnames 34 times as frequent. But the rate of decline of the overrepresentation of these surnames at the universities is similarly slow. It is so slow that even now in 2010-2, just knowing that a rare surname was on average wealthy at death 1858-87 tells us that it will be 6 times more likely to show up on the Oxbridge rolls than the average English surname. Just knowing that a rare surname had at least one enrollee at Oxbridge 1800-29 allows us to predict that it will still be 3 times as likely to appear at the universities now as the average surname.

But the rate of decline for each group is constant. One b fits all generations. The implied b measure of persistence for the rich surnames 1830-2012 is 0.82, while for the 1800-29 universities cohort it is 0.77. The rise of these surnames is symmetrical as predicted. The estimated b underlying that rise 1530-1799 is 0.83 for the rich surnames, and 0.77 for the one that happen to appear at Oxford and Cambridge 1800-29. This data thus strongly supports the assumption that the process of social mobility is indeed Markov. One underlying equation of mobility

$$x_{t+1} = bx_t + e_t$$

describes mobility over multiple generations.

Sweden

Table 10 summarizes the surname estimates of social mobility rates for Sweden 1700-2012 from Clark (2012). These estimates are based on occupation and education, using attorneys, doctors, university students and Academicians as representatives of elite surname groups. Three features are notable. First these mobility rates are very similar to those reported for England 1300-2012. Second the rates do not seem to show any clear downwards trend in the modern era. Third, the mobility rates for education and occupation seem similarly slow.

Figure 11 shows the details of relative representation of surnames in some of the Swedish Royal Academies, the most elite fraction of the academic establishment. Comprehensive membership lists are available for the Swedish Academy of Sciences (founded 1739), the Swedish Academy of Music (1771), and the Royal Academy (1786). Together these three academies have had 2,834 domestic members.

Figure 11 shows the relative representation of the surnames of the eighteenth century elite – Latinized surname and the surnames of nobles - in these three academies by 30 year generations starting in 1739-1769, and ending in 1980-2012. In the earliest period such surnames made up half of the members of the academy. By 1980-2012 this had declined 4.1% of the Academies. But these surnames in 2011 were only 0.71% of the Swedish population, so they were still strongly overrepresented in the Academies.

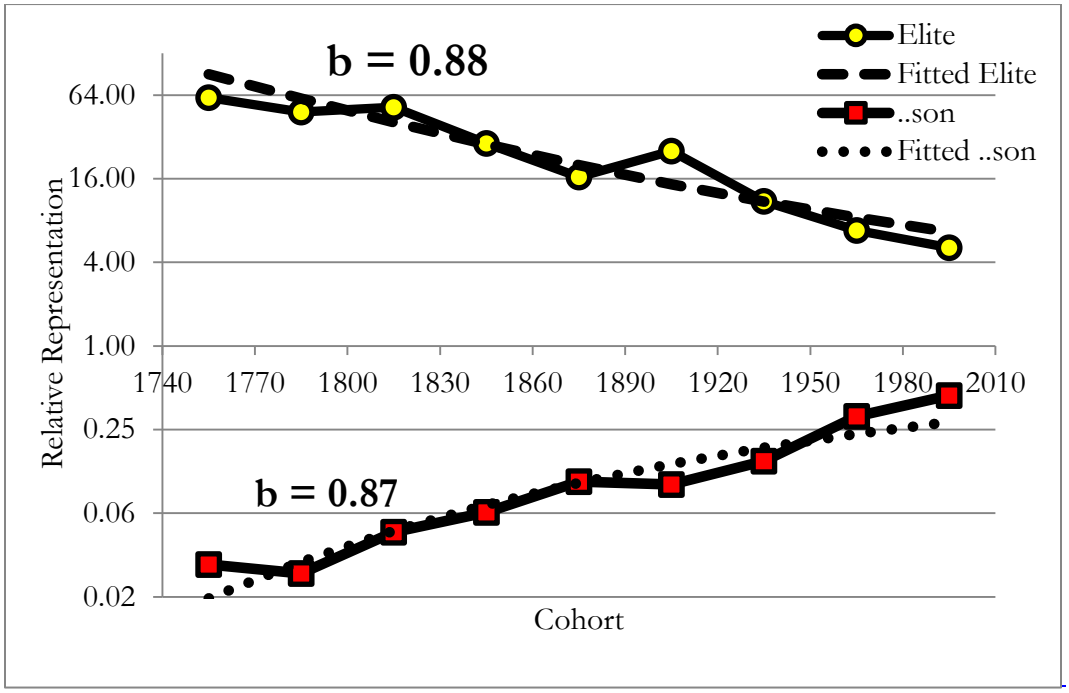
The small number of members compared to other groups we have looked at means that in the latter years there is a lot of sampling error in terms of the frequency of elite surnames. Taking these academies to represent the top 0.1% of Swedish society the implied persistence b over these 273 years is 0.88. There is also little sign of an increased rate of regression to the mean for the entrants to the academies 1980-2012 compared to 1950-79. The estimated b for elite surnames is still 0.84.

Figure 11 also shows the relative representation of Patronyms, lower class Swedish surnames, in the Academies. Such surnames are of course still strongly underrepresented, but they have shown a slow but steady convergence towards proportional representation. However, the implied b is 0.87, close to that for the elite surnames. Again we see the predicted symmetry in terms of rates of upwards

Table 10: Summary b Estimates by Period, Sweden

Group	1700-1900	1890-1979	1950-2012
Attorneys	-	-	0.71
Physicians	-	0.67	0.88
University Students	0.78	0.85	0.66
Academicians	0.89	0.75	0.84

Figure 11: Elite and Lower Class Surnames in the Swedish Royal Academies



and downwards mobility. However, there is a caveat that many people in Sweden whose father had a patronym did not take their father's name as an adult, and this switching was likely selective. This would reduce the rate of measured upward mobility.

USA, 1920-2012

To measure mobility in the USA we use five groups of surnames – Ashkenazi Jewish (e.g. *Katz),* Black (e.g. *Washington*), New France (e.g. *Gagnon*), Rich Rare Surnames of the 1920s (*e.g. Roosevelt*), and rare surnames appearing as students in the Ivy League 1850 and earlier.[8] Only Black surnames of English origin were used, to identify the domestic Black population. Figure 12 shows the relative representation of these surnames among doctors registered by the AMA 1920-49, 1950-79, and 1980-2011. Jewish, Rich 1920s and Ivy League pre-1850 surnames are overrepresented. Black and New France surnames underrepresented. We can thus calculate implied persistence rates for each group by generation.

For all five surname groupings there is a general convergence towards a relative representation among physicians of 1 between the last two generations observed. But, as can be seen in the graph, and will be confirmed by the estimates of the underlying b for each group, this is a slow process that will not be complete for many generations for most of these surname groupings.

In the previous generation, from 1920-49 to 1950-79, both the Jewish and Black surname groups move away from the mean. The cause of this in the case of the Jewish surnames was the explicit policy of many US medical schools between 1918 and the 1950s to limit the number of Jewish students admitted. These quotas led to a decline in the number of Jewish students in AMA approved medical schools declining from 794 in the class of 1937 to 477 in the class of 1940.[9]

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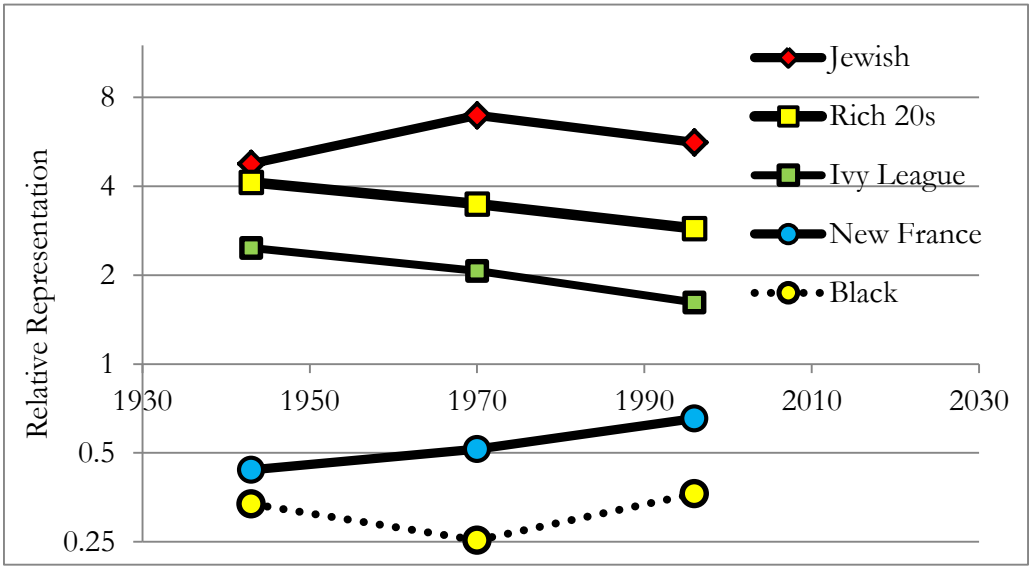
[8] Black surnames were those for which at least 89% of holders of the surname in 2000 declared their race as Black in the census.

[9] Borst, 2002, 210. These quotas were progressively tightened across the 1920s and 1930s. Thus, in one of the most dramatic cases Boston University Medical School cut Jewish enrollment in 1929 from 48 percent, to 13 percent by 1934 (p. 208).

Figure 12: Relative Representation by Surname Type by Generation



Only in the 1950s were these anti-Jewish quotas lifted. These policy shifts show up in the AMA directory data. There is a substantial decline in Jewish surname overrepresentation for doctors completing medical school between the 1930s and the 1940s. In figure 3.9 below which looks at relative representation by decade from the 1940s on we see a rise in Jewish relative representation among those graduating from medical school from the 1950s to the 1970s.

For the Black surnames there was a decline in relative representation between the 1940s and 1950s, though the numbers of Black physicians in these decades is so small that this may just be a random fluctuation. However, the AMA in these years recognized only two Black Medical Schools, Howard and Meharry. Its reluctance to charter more Black Medical Schools in an age where many white establishments discriminated against Black students could explain the fact that in the 1950s and 1960s Black surnames do not show any rise in AMA membership.

Table 11 shows the calculated b for 1950-79 to 1980-2011, and also for 1920-49 to 1950-79 for the three cases where this could be calculated. The rates of persistence of occupational status are remarkably high compared to conventional

estimates. Thus in the most recent generation the rate of persistence of the five groups averaged 0.74, though this ranged from 0.65 for the New French and Ivy League pre 1850 groups, to 0.88 for Ashkenazi Jewish surnames. For the earlier generation in the three cases less affected by racial quotas for medical schools, the average rate of persistence is even higher at 0.80.

Table 11 also shows calculations of the average b for a generation of 30 years calculated just as the average across the periods 1970-9, 1980-9, 1990-9, and 2000-11. This is done because social mobility rates for Jews were clearly still being influenced by medical school quotas even as late as the 1950s and 1960s. Also there was clearly a shock to Black social mobility in the 1970s from the Civil Rights era of the 1960s.

Figure 13 thus shows the relative representation of each of our five surname groups for the periods 1940-9 to 2000-11. The peak showing of Jewish surnames at 7.6 times the expected among physicians qualifying from domestic medical schools occurs only in the 1970s. In the 1970s Blacks graduated from medical rates at a rate nearly three times higher than in the 1950s or 1960s, in part as a result of affirmative action policies that have continued to this day.

Figure 13 immediately suggests that the relatively high black mobility rates across the generations 1950-79 to 1980-2011 was likely partly a product of the dramatic institutional changes of the Civil Rights era of the 1960s, and has not been sustained in more recent decades. Similarly the regression to the mean of the Jewish population is underestimated because the numbers of Jewish doctors in 1950-79 was still being limited by racial quotas even in the 1950s, and perhaps also the 1960s.

Table 11 records the estimated persistence rates for the modern era, 1970-2011. The estimate social mobility of the Ashkenazi Jewish group does as expected increase. Now the b for this group is estimated at 0.75 for a generation of 30 years. But this implies remarkably slow mobility compared to conventional measures. For example, at this rate of mobility the descendants of the Ashkenazi Jewish population of the US will be no longer overrepresented among doctors in 2316, 300 years from now, or 10 generations.[10]

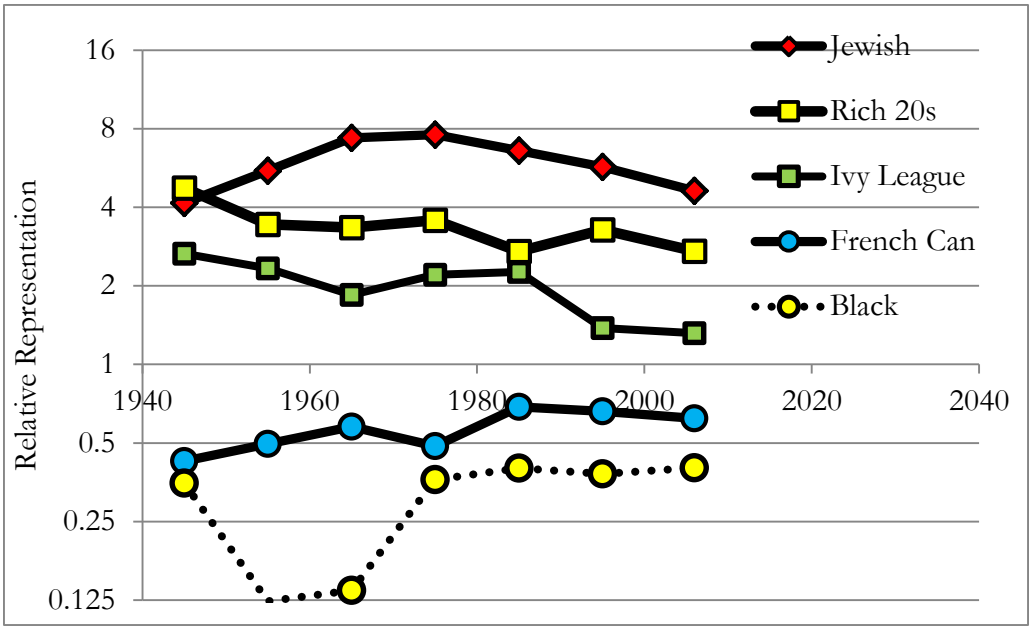
[10] Taking convergence as being less than 10 percent overrepresented.

Table 11: Calculated Persistence from Physicians

Group	1920-49 to 1950-79	1950-79 to 1980-2011	1970 to 2011
Ashkenazi Jewish	-	0.88	0.75
1920s Rich	0.78	0.84	0.94
Ivy League pre 1850	0.80	0.65	0.23
New France	0.81	0.65	0.78
Black	-	0.69	0.96
Average All	0.80	0.74	0.73

Figure 13: Relative Representation by Surname Type, by Decade, Doctors, 1940-2011

Note: The last period is 2000-11.



For the Black population convergence on the mean is estimated as being even slower, as is evident from figure 13. The b in this case for a generation is 0.96. This implies that even by 2243 the Black population will be represented at only half the rate of the general population among physicians. And note that the current convergence of Black rates of representation among doctors is still being significantly influenced by affirmative action policies at US medical schools.

The descendants of the New French are also converging slowly on full representation among physicians. Their b is 0.78, again implying generations before full convergence. The two elite white groups – the descendants of the rich of 1923-4, and the descendants of Ivy League attenders pre 1850 – show very different rates of social mobility. The descendants of the rich show incredible persistence, with no convergence on the average even by 2316. But the Ivy League descendants exhibit rapid social mobility with a b of 0.23. However, with the method being used here random error will have a big effect for groups that deviate only by small amounts, as do the Ivy League descendants, from the social average.

But overall, as table 11 shows, even taking into account sampling errors, the overall rate of social mobility implied by surname persistence among physicians is very low. The persistence parameter b averages 0.73 on a simple average across these five groups from 1970 to 2011. But if we were to take an average weighted for likely sampling errors then the implied b would be even higher than this.

Though we observe marked status differences, and slow intergenerational social mobility using physicians as a marker, the pattern observed is indicative of a general one that will be found across all high and low status occupations. This we confirm by carrying out the same procedure with attorneys.

Surnames are more difficult to track among attorneys because attorneys are licensed at the state level, so that the records of surname distributions among attorneys are contained in 50 different places. To make this check feasible we have thus checked surname frequencies in only a sample of states, we use a smaller set of surnames for each group, and we take the surnames *Olson/Olsen* as indicating the average frequency of the domestic population among attorneys by decade.[11]

[11] *Olson/Olsen* shows an average representation among physicians.

Figure 14: Relative Representation by Generation among Attorneys

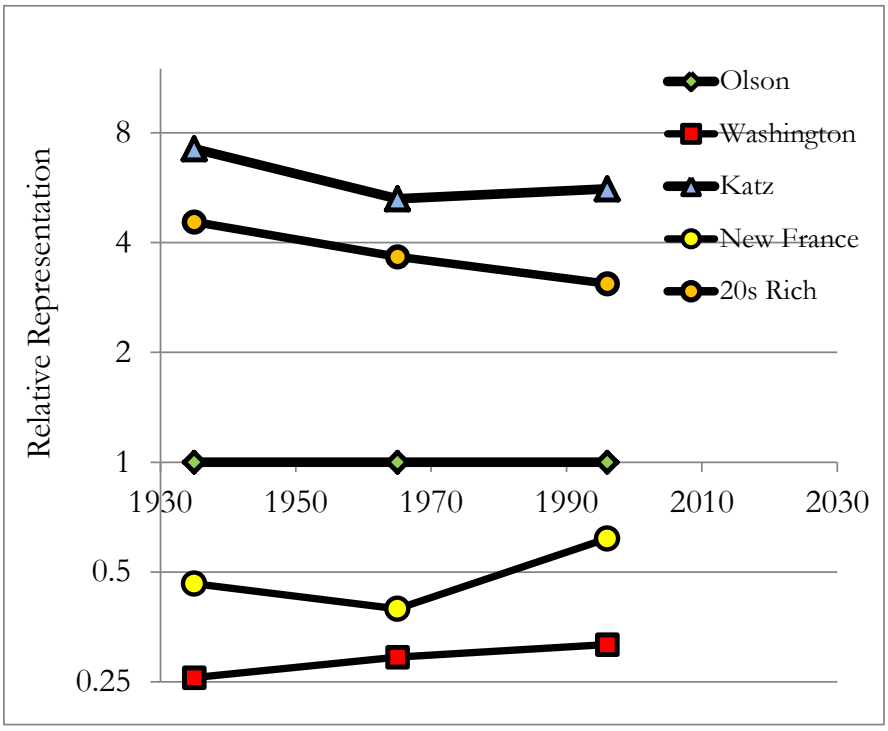


Table 12: Calculated Persistence from Attorneys

Group	1920-49 to 1950-79	1950-79 to 1980-2011	1970 to 2012
Katz	0.82	1.04	0.95
1920s Rich	0.84	0.86	0.95
New France	1.20	0.53	0.58
Washington	0.91	0.94	0.84
Average All	0.94	0.84	0.83

To measure social mobility rates we first calculate these measures of relative representation for three generations, as with doctors: 1920-49, 1950-79, and 1980-2012. For each period we know from the 25 state licensing records the number of attorneys in each surname group. To calculate their relative representation we just need to calculate for each group their population of 25 year olds in these earlier periods relative to *Olson/Olsen.* The share of *Olson/Olsen* in each decade is calculated from the Social Security Death Index.

We again see a pattern of persistent regression to the mean for all groups, but at very slow rates. Figure 14 shows relative representation over three generations of admissions to the bar, 1920-1949, 1950-1979, and 1980-2012 for the four surname groups used. All four surnames regress to the mean rate of representation, assumed to be that of *Olson/Olsen*, but at slow rates in most cases.

Table 12 shows the b implied for each surname type and period by figure 14.[12] For 1950-79 to 1980-2012 the average implied b is even higher that for the doctors, and averages 0.84. For 1920-49 to 1950-79 the average implied b is even higher at 0.94. But these earlier estimates are subject to substantial margins of error because of the small numbers of observations. Moving to the most recent measurement, which compares the cohort 1990-12 to 1970-89, we see little sign of any improvement in mobility rates. The average persistence rate in this period is still 0.83.

Thus the attorney evidence is largely consistent with that from physicians, though suggesting even lower rates of social mobility. The sampling here contains more possibilities for error and misrepresentation. So the main thing is that the attorneys confirm that the social mobility rates found for physicians indicate a general slow rate of social mobility, and are not just an artifact of physicians.

There is not room here to even outline the results for Japan, India and China. Suffice to say that they are very similar in character to the above. This naturally leads to the question "What is driving these high and seemingly similar rates of persistence across these disparate societies?"

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[12] This assumes that attorneys represent the top 1 percent of the occupational status distribution, whereas doctors were assumed to represent the top 0.5 percent of the distribution.

A Theory of Social Mobility

We have seen above why intergenerational mobility is always lower than traditionally measured. But why is intergenerational mobility also seemingly constant across vastly different social regimes?

Economic theories about the rate of social mobility typically assume there are two channels by which social status is inherited. First there is a genetic/cultural connection between the attributes of the parent and child, independent of any actions of the parents. Second the parents invest time and resources in rearing children and in increasing their "human capital," and can directly transfer to them non-human capital. Such are the mechanisms in Becker and Tomes, 1979, 1986, Mulligan, 1999, 2001, and Solon, 2004, 2013. However, the empirical implications of such models are hard to adduce, because there are many unobserved parameters and choices of functional form, as Goldberger, 1989, observed.

If we assume, for example, complete capital markets, or institutions that finance education socially, then for each child there will be human capital investment to the point where the return equals the rate of return on physical capital. The correlation in education, occupational status and earnings between parents and children will be driven only by the genetic/cultural connection between parents and children. However, the correlation between parents and children in wealth will be higher, since wealth is directly inheritable, and wealthy parents will seek to spread out their consumption advantages across future generations, as long as they have some degree of altruism.

Alternately, we can assume that all human capital is financed by parents, with their investment capacity limited by imperfect capital markets to their own resources. In this case higher status parents have greater resources, and thus transfer more to their children as human capital, ensuring a greater persistence of status than would come from the purely biological connection. Solon, 2012, for example, is a simplified adaptation of the model of such transmission developed by Gary Becker and Nigel Tomes (Becker and Tomes, 1979). This concludes that the intergenerational elasticity of income will be

$$b_y = \frac{(\gamma + \tau)}{(1 + \gamma\tau)}$$

where τ is the correlation of abilities between parents and children, independent of any investments in children by parents, and γ is the elasticity of income with respect to human capital investment.[13] If human capital investments have no effect on income, then γ = 0, parents don't invest in human capital, and $b_y = \tau$, from the biological correlation between the attributes of parents and children. But if γ > 0, then parents invest proportional to their own incomes, and $b_y > \tau$.

In this model a key parameter in influencing status transmission is γ, the elasticity of income with respect to human capital investment. It is assumed that income spent on children always boosts their human capital, and thereby raises their earnings as adults. This assumption has become a key, almost theological, doctrine of modern economics in accounts of modern economic growth. One problem has been that the parameters τ and γ are unobserved

However, if we assume that income can be influential in the production of human capital in children, we would expect the strength of the effect of parental human capital investment on child incomes to vary substantially across social regimes. In the pre-industrial world where education was largely privately financed all the way from elementary to university, we would expect that γ would be large, and so persistence great.

Also, in modern societies such as Sweden and the UK, a lot of human capital investment is publicly financed. Elementary, secondary and even university education is provided free of charge. Often even the living costs of university students are covered.

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[13] This model assumes only parents, and not grandparents, contribute resources to children. It also does not allow for the possibility that parents could simply choose to endow their children with wealth, rather than investing this in their children's human capital. The key result is that the parental investment in children's human capital is given by

$$I_{i,t-1} = \left[\frac{\alpha\gamma}{1-\alpha(1-\gamma)}\right] y_{i,t-1}$$

where y is income, and α is the measure of parental altruism.

Sweden represents one extreme in terms of state support for education. From age six through tertiary education tuition is free (and for younger ages includes meals). All students in post-secondary education are eligible to receive student aid in the form of grants and loans to finance up to five years of study. The statement of the Swedish National Agency for Higher Education is that

> The Swedish system of student finance is designed so that higher education is accessible to all those who can benefit from it regardless of socio-economic background…As tuition at higher education institutions in Sweden is free-of-charge….student finance is intended to cover living expenses and the cost of study material. Everyone below the age of fifty-four has the right to apply for student finance for a maximum of 240 weeks. Student finance comprises a grant and a loan.

Even those attending higher secondary schools, aged 16-20 can get student aid for living expenses. For children aged 1-5 municipal governments are responsible for providing pre-school places at a modest maximum price set by each municipality, with meals always included. In 2009 the tuition cost for pre-school in Sweden was at maximum $200 per month, a trivial amount for parents above the very lowest income levels.

In a society such as modern Sweden what is the contribution parental spending can make to the human capital of children? There are private schools and private school corporations which have strong academic results such as *Internationella Engelska Skolan (IES)*. But the overwhelming majority of these private schools emerged after the government in 1992 started to pay an equivalent to the state tuition cost to private schools, which in return have to admit students tuition free and on a "first come, first served" basis. They are thus popularly designated "free schools", and now enroll 10 percent of students.

So what can a highly resourced Swedish family do to increase the human capital of their offspring? They could hire private tutors to supplement the public school system, but if children are attending well organized schools this will have little effect. In terms of the equation above γ will be very close to 0. That is why, if human capital investments are an important contributor to status persistence, Sweden should be the society with the highest social mobility rates.

England has less extensive public support for education than Sweden, and so potentially more room for private investments adding productive human capital. Education is free in pre-school (3+), elementary school, and secondary school in the state system. In England from 1962 to 1998 students did not pay tuition fees at institutions of higher education. Maintenance grants were available to families with lower incomes. From 1998-2012 students have to pay tuition fees, but are able to borrow to finance these fees, which recently were raised by many universities to £9,000 ($15,000) annually. Students can also get grants and loans to cover their living costs.

A private elementary and secondary school system, paid for individually by parents, is much more extensive in England than in Sweden, and 7 percent overall of elementary and secondary students attend such schools, though this rises to 18 percent of students aged 16 and above. Fees for such schools range from £2,500 to £30,000 ($4,000-$48,000) annually, the highest fees being for boarding schools.

Such private schools on average have much better academic results than state supported schools. For example, their graduates are three times as likely as state school graduates to be admitted to Oxford or Cambridge. So in England there is possibly more room for parents to transform their resources into enhanced human capital for their children.[14] But even the private sector grants much scholarship aid for poorer students who pass the qualifying exams for these schools, so the gains from income will again be limited.

And certainly England post 1962, on this human capital argument, should display much less status persistence than England before 1870. For before 1870 schooling was entirely a private matter in England, with parents paying for all schooling themselves or relying on charity schools.

In comparison to Sweden and England, the USA has many more children in privately financed education at primary, secondary and tertiary levels. At the first

[14] Recent evidence suggests that while attending private school will increase the A level results of a student of a given ability beyond those of the equivalent student at a state school. This evidence is, however, that fact that students from state school with the same A-level scores as those from private schools once admitted to university. Thus private students gain some advantage in admissions, but see this eroded in terms of degree results.

two levels 15 percent of children are privately educated, at fee paying schools. These schools in areas like the north East can be very expensive, as much as $43,000 for day students.[15] Thus it is easily possible to spend as much as $600,000 educating one student to the age of 18 in the US.

At the tertiary level, the US again has a much larger fee paying sector, with 27 percent of students attending private institutions, and state institutions charging fees for students. Net of discounts and grants 19 million tertiary education students in 2009 paid $53 billion in tuition in the USA.[16] In addition they had to cover their living costs while attending college. Unlike in Sweden and England, for a student of a given educational attainment at the point of college entrance, the ability to attend the more selective colleges depends on the financial resources of parents. Since in terms of the economic model of human capital, the USA would be the society where parental resources can do the most work. It should thus be the society with the greatest persistence of status.

Even the empirical evidence for the proposition that parents can significantly boost their children's human capital and economic outcomes through expenditures of money and time on the children is weak.[17]

There is evidence in the work reported by James Heckman and others that early brain development can be substantially influenced by childhood environment.[18] But this work concentrates on harsh childhood environments characteristic of the bottom of the status distribution, as for example the effects of Romanian orphanages on child development. There is a large part of the distribution of social status for which we have little evidence that parents can significantly boost their children's outcomes by investments of time or money.

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[15] In 2012-13 the most expensive school in the US was The Lawrenceville School, New Jersey, with fees of $43,314.

[16] Geiger and Heller, 2011, 3, 9.

[17] Caplan, 2011, recently emphasized this.

[18] Heckman, 2012. However, the two studies cited by Heckman in support of the significant later effects of early childhood enrichment, the Perry Pre-School Program, and the Abecedarian Program, enrolled respectively 58 and 57 treated children and 65 and 54 controls. There is some concern that this constitutes a very modest evidential basis for the effects of early interventions. And recent studies, using randomized controls, find no lasting effects of the Head Start Program on student achievement by the third grade.

Some recent studies of the outcomes for adopted children in the USA and Sweden, for example, suggest that the characteristics of the adoptive parents has modest influence on outcomes such as earnings or educational attainment compared to those of the biological parents. Bjorklund et al., 2007, find that the education of the biological parents is about twice as influential as that of adoptive parents in predicting years of education for children. This accords with the adoption study of Plug and Vijverberg, 2003, which concludes that comparing adopted to biological children, genetics explains 60-100 of educational outcomes, with some of the uncertainty here being because we do not know the degree to which birth and adoptive families are correlated in socio-economic status. Bruce Sacerdote, is able to exclude such confounding effects, and compare outcomes for Korean adoptees in the US randomly assigned to families with greater or lesser educational and economic resources (Sacerdote, 2007). The adoptive families did not include those at the lower end of the income distribution. US Law required the adoptive families to be earning at least 125 percent of the poverty level. But the adoptive families included those across a wide range of income and education.

Figure 15 shows the average family income of adoptees as a function of the income of the parents at the time of adoption. There is no connection. Absent a genetic connection between parent and child high income parents are unable to transmit any income advantage to their children. For non-adoptive children parental income was positively predictive of child income. But this must be mainly because of genetic connections between parents and children.

For education there is evidence in the Sacerdote study that parents can have some effect independent of genetics. Adoptees with adoptive mothers having very low levels of schooling do show fewer years of school completed, as we see in figure 16. But this effect only exists for mothers at the lower end of the education distribution. Once we get to mothers with 15 or more years of schooling, which would include even some without Bachelor's Degrees, there is no further effect of more maternal education on adoptive child outcomes.

Overall in the Sacerdote study genetics explained three times as much (or more) of the variance in years of education, college graduation, and income, as did shared family environment. The decomposition of variance, however, in all these studies measures only the additive contribution of genes, and not their contribution through

Figure 15: Korean Adoptees USA, Child Income versus Parents' Income

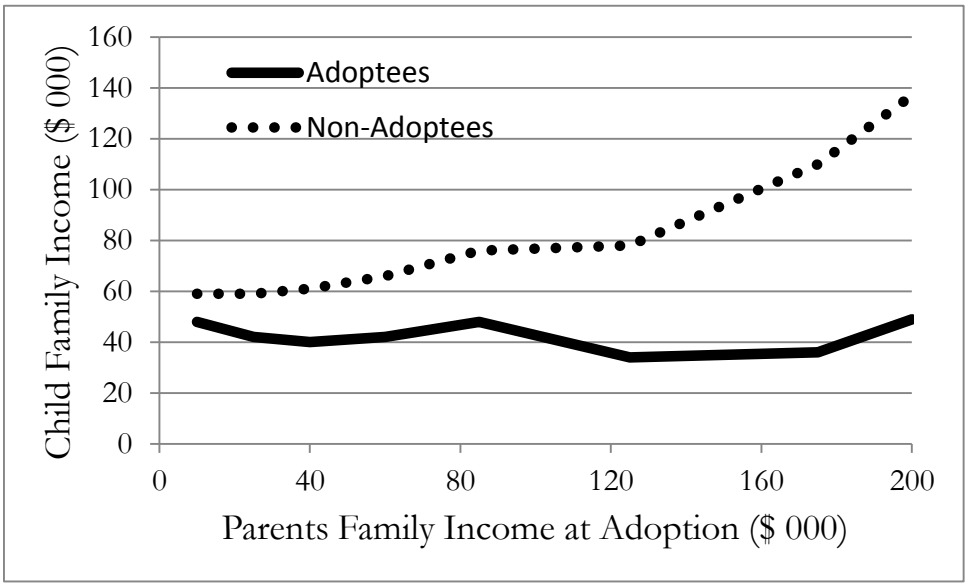
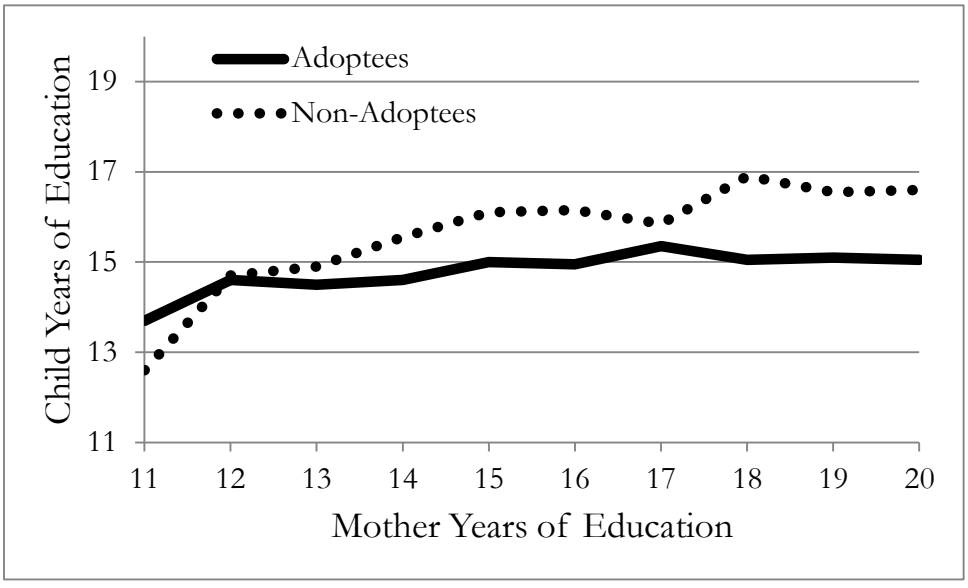


Figure 16: Korean Adoptees, Child's Education versus Mothers'



dominance and genic interactions which are not additive. In general if V_P is the variance of outcomes,

$$V_P = V_A + V_D + V_E + V_U ,$$

where V_A is variance from additive genetic effects, V_D is variance from dominance and genic interaction effects, V_E is variance from the shared environment, and V_U is variance from random effects and non-shared environment. Since in these families (V_A + V_E) typically accounted for less than 15 percent of the variance of outcomes, there is plenty of room for genetics to play an even more important relative role in explaining outcomes.

Further there is every reason to expect that the family environment is itself in part a product of the parents' genetic endowment, so again magnifying the potential contribution of genetic transmission of social status. So the question arises about whether we are largely seeing a genetic process at work in the intergenerational persistence of social status? The experience of similar slow rates of social mobility in modern Sweden, pre-industrial Sweden, the modern USA, medieval England and modern England, very different institutional environments, is at variance with the human capital account of intergenerational mobility. Instead it seems that social status is transmitted within families independently of the resources available to parents. This raises the possibility that nature, much more than nurture, is what propagates social status so persistently across the generations.

Genes Versus Culture/Human Capital

While nature may triumph nurture, the question is to what extent is this because the transmission of status is genetic, as opposed to stemming from some family culture that passes down the generations? How could we test if genes were the most important carriers of social competence?

One argument for the importance of genetic transmission is that with genetics we know there will be the regression to the mean that we observe for underlying status. If instead what is being transmitted is a cultural formation then why would there be such a consistent tendency for regression to the mean? Even if family

culture were transmitted with some error between generations, as long as positive errors were as likely as negative this would just increase dispersion of outcomes for an elite group, not produce consistent regression to the social mean.[19] Genetic processes have built into them an inherent tendency for characteristics to regress to the mean, in a way that other inheritance processes do not.

A second argument in favor of the transmission being importantly genetic is the following. The important thing we know about genetic transmission is that all the information that generates the characteristics of the next generation is contained in the genes of the parents. The past only matters insofar as it is encoded in the genes of the parents. Thus genetic regression to the mean is inherently Markov in nature. It proceeds at the same pace from generation to generation. This is something we observe for underlying social competence in all the cases above. For underlying competence grandparents and great-grandparents do not add any information to the process in the current generation. But on a many cultural transmission models grandparents would play important roles in the process.

One implication of genetic as opposed to cultural transmission of status would be the following. With genetic transmission of social competence the process of regression to the mean would be halted for an elite or underclass group if they had complete marital endogamy. For in this case the regression would be to the group mean of social competence, and not to the social mean.

For even if marriage is perfectly assortative, those in an elite group who choose marriage partners from the general population will be matching with someone who has deviated more by lucky chance from the genetic average of their population, and the offspring will thus be subject to greater regression downwards.

If in contrast we think that the advantage of elite families is some kind of cultural trait, then endogamous marriage would not lead to any more faithful transmission of that trait than marriage exogamously to someone with the same observed characteristics as the elite group. We show below that endogamy is associated with a complete absence or a slowing of the process of regression to the mean for elite groups.

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[19] The one way that such error could produce mean reversion would be if there was an upper bound on "family competence" so that errors at the extremes effectively had to lead towards the mean.

Another prediction if genes are important carriers of social competence will concern how elites get formed. For individual families this will just be a process of a series of random accidents, and we can test below if that prediction is borne out in terms of the trajectories through the generations of such families. But for large social groups, if the world is characterized by persistent regression to the mean, balanced only by random shocks to maintain status dispersion, how do they end up systematically above or below the mean in the first place? If the differences between groups are genetic as opposed to cultural one process that could produce such differences would be selective affiliation to a social group by people at the top or the bottom of the status distribution. We shall ask below if there is any evidence historically of such processes at work.

Thus there are a number of tests we can do below to see how plausible it is that genetics is playing an important role in the creation and maintenance of social status. In particular, the tests will be:

(1) Does social mobility exactly mimic processes which we know to be largely genetically driven, such as the intergenerational transmission of height? That is does social status show a constant rate of regression to the mean wherever a family is in the status distribution?
(2) Do groups that marry endogamously escape the Law of Regression to the mean for social status?
(3) Is regression to the mean Markov in nature over multiple generations?
(4) Are elite and underclass groups typically formed as a selection from the upper or lower tails of a larger population? Or can a group retain all its members and move from elite to underclass status or vice versa?

Does social mobility meet these tests? There are some characteristics of the history of social mobility that seem to defy the simple quasi-biological Law of Motion described above. The quasi biological account of social mobility can explain why individual families become elite or underclass. We see above the dynamics of that process. But can it explain how large social, religious and ethnic groups attain high social status or are condemned to low status? And can it explain the persistence of such groups over millennia? Such an outcome seems not compatible with the basic Law of Motion enunciated above.

How, thus, did Jews emerge as a social elite in Eastern Europe and the Middle East in the middle ages or earlier? How did the Gypsy or Traveler population of England emerge at the bottom of the social ladder in the sixteenth century and seventeenth centuries? Why are Christian minorities typically economic elites within the Muslim world 1,300 years after the Muslim conquest of these societies?

The emergence of elite social groups has often been linked to their embrace of religious ideologies that themselves privilege and foster the aptitudes and aspirations favorable to social success. Thus Maristella Botticini and Zvi Eckstein stress the rise of the Jews as an educated elite in the Middle East 70-700 AD was driven by the emergence within Judaism circa 70 AD of a religious ideology which emphasized that each male should learn to read the Torah, the book of laws.[20] Adherence to this emerging religious precept molded the history of the Jewish people in the pre-industrial world, transforming them from farmers to traders, scholars, and bankers.

The similar religious precept of Protestantism in Reformation Europe that each person should be able to read the bible for themselves, rather than have their religious knowledge mediated for them by a priestly caste, has been given an equivalent causal role in modern Europe in explaining the higher economic status of Protestants compared to Catholics in various countries of Europe. If religious or ethnic affiliation can play this independent causal role in the social competence of families, then the simple Law of Motion will fail to predict many outcomes.

The second thing the simple Law of Motion cannot explain is the persistence of status over centuries by groups with no sign of regression to the mean. Why are Jews still a social elite in most societies, after an existence as a separate group for more than 2,000 years? Why are Brahmins in Bengal still an elite, and Muslims in Bengal still lower class? How did Copts and other Christians in the Middle East and North Africa maintain a social status above the social average for more than a millennium after the Muslim conquests?

We can show, however, that these outcomes do not necessarily invalidate the simple Law of Motion detailed above. That would only be the case if religious ideology itself can change the social competence of families. Another process that can explain the emergence of elites and underclasses is just that religions tend to

[20] Botticini and Eckstein, 2012, 71.

recruit selectively from the existing pool of talent in a society. And the duties that different religions impose on their followers can dictate from where in that talent pool adherents are drawn.

Thus in their discussion of Jewish history before 1492 one feature Botticini and Eckstein highlight is that by 1490 AD the Jewish population was a modest subgroup of descendants of a much larger parent population. Assuming the Jews had the same rate of natural increase as the surrounding populations, by 1490 AD only about 10% of the parent Jewish population when Judaism began to emphasize the importance of universal male literacy as a fundamental religious duty was represented in the stock at that date. The rest of the Jewish population had converted to other religions, probably mainly Christianity. But these conversions occurred in environments where forced conversion was rare.

In their book they explicit model the decision to stay with Judaism or convert to one of the many competing sects as an economic one.[21] What drives the decision is first the occupation of the family, since literacy is assumed to have an economic value only to traders and craftsmen. Also there will be some selection based on talent, though this is not explicitly modeled, and the authors are ambiguous on the importance of this feature in determining conversion.[22]

The main idea of Botticini and Eckstein is thus that a religion which emphasizes a duty of literacy will have a comparative advantage for adoption among those who engaged in the pre-industrial world in the urban occupations of trade and manufacture. But if the adoption of such urban occupations is driven for families by their underlying talent, as seems likely, then Judaism will also be adopted by the most talented subgroup of the earlier Jewish population. Much of their evidence is consistent with an interpretation where conversion from Judaism was mainly driven by the social competence of families. Thus "passages by early Christian writers and Church Fathers indicate that most Jewish converts to Christianity were illiterate and poor."[23]

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[21] Botticini and Eckstein, 2012, 80-94.

[22] "families with low-ability sons or with sons who do not like studying…will be less likely to invest in children's literacy" (Botticini and Eckstein, 2012, 93).

[23] Botticini and Eckstein, 2012, 120. However, a model of selective survival of Judaism among elite Jewish families would show a relatively uniform decline of Jewry across geographic areas. Botticini and Eckstein also emphasize that Jewish populations disappeared

Table 13: Jewish Population as a Percent of Parent Groups, 65-1492 AD

Year	Total Population	Jewish Population	% Jewish
65 AD	55	5.5	10
650 AD	51	1.2	2.4
1170 AD	70	1.5	2.1
1490 AD	88	1	1.1

Source: Botticini and Eckstein, 2012, figure 1.1, 18.

A seeming test of whether selection based on ability played an important role in shaping the Jewish population would be the economic status of Jews in the modern world. If the current Jewish population is just a random subset of descendants of an original Jewish population of 70 AD, then now that literacy is universal, and supplied by the state, Jews should quickly lose economic advantage. But we see that even 100 years after the arrival of universal literacy Jewish populations are still heavily concentrated in the upper parts of the status distribution. What could be the source of this abiding economic advantage in the modern world be, if not that Judaism has selectively recruited from its parent populations?

We do get nice evidence of the tendency of religions to selectively attract adherents from the experience of Ireland up till 1911. Ireland is a society notable for the long standing differences between the Catholic and Protestant populations. From the 17th to the 20th centuries the Protestants, a settler population largely established in the 17th century, remained an elite. Given the sharpness of the later social divisions between Catholic and Protestant, and the seeming impermeable barrier between social intercourse between the two communities, it would seem that from the time of the arrival of the largely Scottish protestant settlers in Ireland in the seventeenth century until the present these two communities developed in isolation

across much of the Middle East and North Africa by 650 AD, the surviving populations being concentrated in Mesopotamia and Persia.

of each other. Thus the Protestant population now will be the descendants of the Protestant settlers, and the Catholic population the descendants of the native Irish.

However, surname evidence suggests that there have been considerable transitions of population between the two religious groups.[24] Thus if we take a sample of surnames of exclusively Scottish origin and look at the religious affiliation of the holders in the 1911 Irish Census, we find that a full 14% of them were now Catholic.[25] And similarly if we take a sample if native Irish surnames, once exclusively Catholic, we find that again in 1911 12% of the holders were Protestants of some form.[26] There had thus been a two way movement of population across what would seem to be an impenetrable religious divide.

What drove these transitions? To look at this it is useful to divide Ireland in 1911 into the 6 counties with the greatest share of Protestants – Armagh, Antrim, Down, Fermanagh, Londonderry, and Tyrone – which became Northern Ireland, and the other 26. Figure 17 shows the location of these counties, dark shaded. Figure 18 shows the share of each surname type that were Catholic for those aged 30+ and 0-29 in each region in 1911.

Figure 19 reveals that surnames were changing to the predominant religion of each region. In the south 97% of the Irish surnames were still Catholic, while in the six northern counties only 66% of these surnames remained Catholic. In counterbalance, in the northern counties 93% of Scotch surnames remained non-Catholic, while in the south 34% of the Scotch surnames were now held by Catholics.

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[24] This is pointed out in Kennedy et al., 2012. The sections here just amplify their observations.

[25] These surnames were chosen to be exclusively Scottish in origin: *Bothwell, Buchanan, Cathcart, Fullerton, Girvan, Hamilton, Laird, McGregor, Orr, and Sproule*.

[26] These Irish surnames are: *Boyle/O'Boyle, Doherty/O'Doherty, Grady/O'Grady, Han(n)away, McBride*. Hanaway was included because it is the surname of my maternal grandfather who himself appears in the census.

Figure 17: Distribution of Protestants by county, 1911

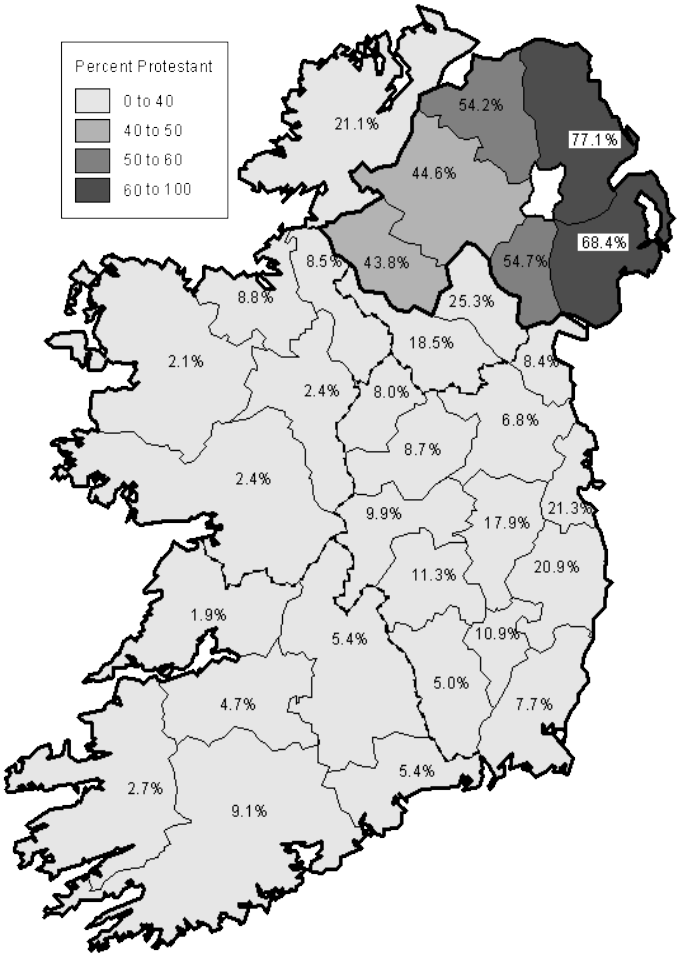


Figure 18: Share of Irish and Scotch Surnames Catholic, 1911

The census also suggests that this process had been proceeding for many generations. We can divide people in the census into those 30+, and those 0-29, on average about a generation earlier. When we do this we see while in the south the Irish surnames went from 97.0% in the older generation to 97.4% in the younger generation, in the north the share dropped from 67.5% to 65.2%. At the same time the share of Scotch names in the south with Catholic religious affiliation rose from 31.8% to 38.1%, while in the north the share rose only from 6.8% to 7.2%. Thus in each region the predominant shift was to the majority religion of the region.

The two groups, Catholics and Protestants, were socially differentiated. Thus 19% of Catholics in this sample aged 16 and above were illiterate, but only 5% of Protestants. And while for Protestant adult males there were .6 workers with skilled occupations for every one with an unskilled occupation, for Catholics the ratio was 0.2.

However, as figures 19 and 20 show, the transitions from one religion to another served to help perpetuate the religious difference in social status. Catholics with Scotch surnames had much lower social status than Protestants with the same surnames, even controlling for regional differences. They were more illiterate and held less skilled occupations. Similarly Protestants with Irish surnames were much higher status than Catholics with the same surnames. They were more literate, and held more skilled occupations.

Thus Irish history shows how even communities as mutually antagonistic as Irish Catholics and Protestants can see not just significant movement of people from one group to the other, but also a movement that solidifies the elite position of the Protestants, and the low status position of Catholics. Those at the bottom of the social scale in the Protestant surname group were much more likely to have transferred their religious affiliation, sometime in the previous 300 years, to Catholic. Those at the top of the social scale in the Irish surname group were much more likely to now identify in the 1911 Census as Protestant.[27]

[27] Though, as Kennedy et al., 2012, note, there is potentially a question of causation here. "Whether lower socio-economic status preceded or coincided with absorption into the Catholic community, or gave rise to this outcome in the form of downward social mobility, opens a further intriguing set of possibilities."

Figure 19: Share of Irish and Scotch Surnames Illiterate, Males 16+, 1911

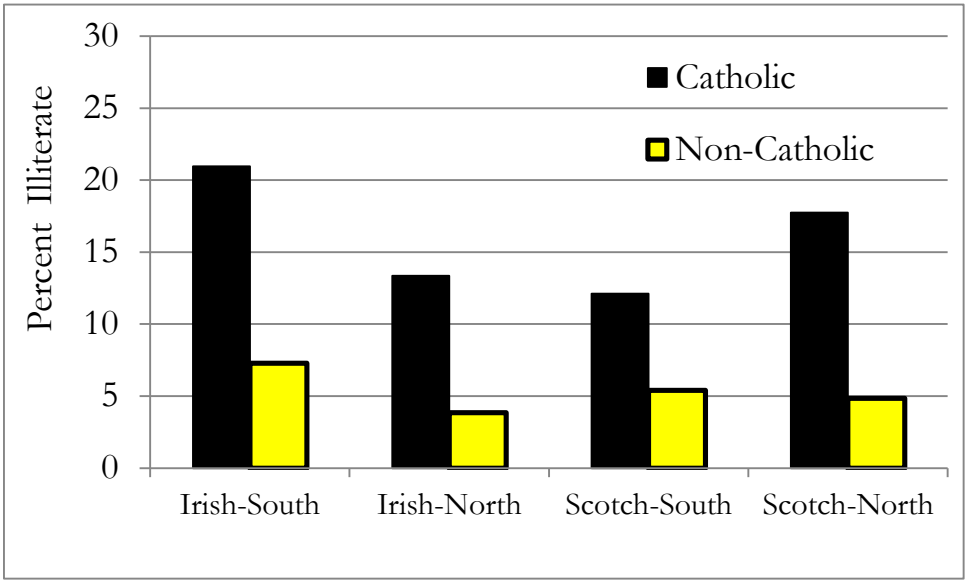
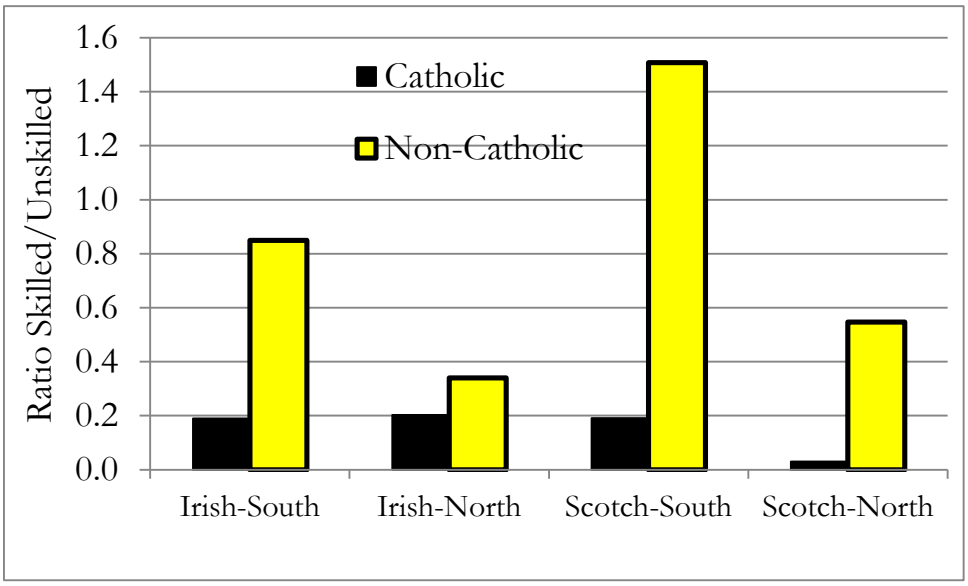


Figure 20: Ratio of Skilled to Unskilled, Males 18+, 1911, by Surname and Religion



If Jewish populations interacted with the surrounding populations in Europe, North Africa and the Middle East in the same way as the Protestant minority in Ireland with the majority Catholic population then its economic advantages later might just be explained by selective flows between the local and Jewish populations.

The modern Jewish population itself derives from what was originally a very modest offshoot of the Sephardic Jews of the Middle East, North Africa and Southern Europe. Despite the Holocaust, which disproportionately hit the Ashkenazi population, about 80 percent of the modern world Jewish population is Ashkenazi. Yet Botticini and Eckstein estimated that in 1170, all of Europe contained only 110,000 Jews, and those in Italy and the Iberian Peninsula would be Sephardic. So in 1170 the Ashkenazi Jewish population would be 4% or less of all Jews.[28]

There is uncertainty about what generated the great demographic expansion of Ashkenazi communities in Poland and Russia between the twelve and nineteenth centuries. Examination of the genetics of this community has produced conflicting results. One type of analysis, looking the Y chromosome, suggest that the genes of Ashkenazi Jews contain mutations common in the Middle East but uncommon in Europe. There is little sign that these communities absorbed men from the surrounding Eastern European populations.[29] However, a more recent study of the Y chromosome found that while the haplogroup R-M17 was at a frequency of 3-4% in Sephardic Jews, it was at a frequency of 11.5% among the Ashkenazi. In comparison in Eastern Europe it is found at a frequency of 35-60%.[30] This would imply that 20-30% of Ashkenazi Y chromosomes could be Eastern European in origin. However, this study also found suggestion that all of R-M17 haplogroup in the Ashkenazi stemmed from the contribution of one male founder.

However, if the Ashkenazim were the result of a very selective migration of Sephardic Jews from southern Europe and Byzantium first to the cities of Germany, and then under persecution to Eastern Europe, then they could easily be a very selective component of the original Sephardic Jewish population, itself a selective remnant of an original Jewish population around 70 AD. Thus the social

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[28] Botticini and Eckstein, 2012, 40.
[29] Hammer et al., 2000.
[30] Neber et al., 2005.

achievements of Ashkenazi Jews could just be the result of strong selecting for innate abilities from an ancestral population that was average in its characteristics.

Evidence for the role just of selective affinity with minority populations can also potentially explain the emergence of Christians, Jews, and Parsis as elites within many Muslim societies. This mechanism is laid out for Egypt in an interesting study of Coptic Christians by Mohammed Saleh.[31] All Muslim societies had two characteristics. First, subject populations were not typically forced to convert to Islam. Muslim societies were, from their inception, tolerant of religious minorities.[32] But non-Muslim minorities, under Islamic law, were subject to a head tax (on adult males) called the *Jizya(h)*, which was a fee for permission to practice another religion, and designed as an inducement for them to convert.

The head tax was sometimes levied at variable rates. Thus Abu Yusuf, the chief justice of Baghdad in the eighth century, in his treatise on Tazation and Public Finance, *Kitab al-Kharaj,* noted that the *Jizya* should be 48 dirhams for the richest men, 24 for those of moderate wealth, and 12 for craftsmen and laborers. But this would still imply that the tax was much more burdensome on the poorest, laborers, than on wealthier members of religious minorities.[33]

Saleh shows how in Egypt, Coptic Christians who formed the vast majority of Egyptian society on the eve of the Arab Muslim conquest, selectively converted to Islam in the centuries following the Arab conquest of 641 AD. He finds evidence that under the pressure of the poll tax on non-Muslims, the poorest of the Copts were much more likely to convert. Saleh is able to show that the conversion rate was greater in areas where heavier taxes were imposed. Also in areas where the conversions were the greatest, the remaining Coptic population was more elite by the nineteenth century. From being a group under the Byzantine Empire which had the lowest status in the society, after the Jews and upper class Greek speaking Greek Orthodox Christians, the Copts joined these two other minorities as the elites of the new Muslim Egypt. In the nineteenth century both in urban and rural areas Copts had higher occupational status than Muslims, despite being a political minority.

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[31] Saleh, 2012.

[32] Though once someone converted, or was born Muslim, conversion to another religion was forbidden, and punishable by death.

[33] Muslims had their own taxes to pay under Islamic Law, though these were generally, by design, less burdensome than the Jizya.

But the situation in Egypt is echoed in other Muslim societies. In Iran, for example, an analysis of the 1966 census found that the high income capital Tehran, with about 10 percent of the country's population contained 65% of Jews, 47% of Zoroastrians, 67% of Armenian Christians, and 50% of Assyrian Christians. The explanation was that

> Many of the early physicians, engineers, mechanics and teachers of foreign languages with Western training, were from among minorities. Tehran was in the vanguard of modernization and presented a high demand for such professionals. Thus, minorities were attracted to it (Firoozi, 1974, 65).

However, minorities in Iran even in 1966 were only 1.2% of the population, large numbers of Jews, Zoroastrians, and Christians having previously emigrated because of the intolerance towards minorities of Shia Islam.

In Lebanon, Syria, Jordan and Iraq Christian minorities all constituted elites after the Muslim conquests, presumably because of a differential pattern of conversion to Islam under the poll tax system.

Once created minorities in Islamic societies seem to have maintained their high status position through more than a millennium because of the high rates of marital endogamy in these societies. Thus a genetic study of the ABO blood groups of Iran concluded that the Jewish, Armenian, Assyrian and Zoroastrian minorities had been in genetic isolation from the rest of the Iranian population for long periods.[34] These groups are such a small share of the population, however, that while it can be concluded they gained few members from Muslim population groups, it cannot be ruled out that they lost members to assimilation with Muslim groups.

All these experiences of the creation of elite sub-groups, and the persistence of elites, are consistent with the simple model of social mobility outlined in chapter 6. Elites are formed by the selective affiliation to a religious identity of some upper or lower share of the distribution of abilities within the population. Islamic societies, through the operation of policies of initial tolerance of religious minorities, but head taxes on these groups, tended to recruit to Islam the lowest socio-economic strata of

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[34] Walter et al., 1991.

conquered societies.[35] Elites and underclasses maintain themselves over periods of as much as 1,300 years because of very high rates of endogamy, which preserves the initial advantage of elites from regression to the mean through intermarriage with less advantaged populations.

Will such explanations also work for the major English underclass for the last 400 years, the Gypsy or Traveler community? This community has long been at the bottom of the socioeconomic ladder in England. The UK Equality and Human Rights Commission notes that

> they are one of the most deprived groups in the Britain. Life expectancy for Gypsy and Traveller men and women is 10 years lower than the national average. Gypsy and Traveller mothers are 20 times more likely than the rest of the population to have experienced the death of a child. In 2003, less than a quarter of Gypsy and Traveller children obtained five GCSEs and A*-C grades, compared to a national average of over half.[36]

Table 14, for example, reports the result of a survey of 293 adult British and Irish gypsies/travelers in 2006. About half the people surveyed no longer traveled, and about a quarter traveled only in the summer. Only two thirds of the travelers had ever attended school, and their average age at completing school was 12.6. 58% of them smoked. 49% reported a chronic cough, and 28% anxiety or depression. Women on average had given birth to 4.3 children, though some would not yet have completed their fertility.

A comparison group was surveyed, which was composed, somewhat mysteriously, of poor English Whites (60%), Muslim Pakistanis (20%) and Blacks of Caribbean origin (20%). The outcomes for the comparison group were systematically significantly better than for the Traveler population. The comparison group had more schooling and better health. They also notably had much lower fertility rates.

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[35] It is not clear if this mechanism will account for the low socio-economic status of Muslims in India by the time of the arrival of the British Raj. See Eaton, 1993.

[36] http://www.equalityhumanrights.com/key-projects/good-relations/gypsies-and-travellers-simple-solutions-for-living-together/

Table 14: Characteristics of Travelers, England,

Status	Travelers	Comparison Poor Group
Average Age	38.1	38.4
Ever attended school (%)	66	88
Average Age of Completing Education	12.6	16.4
Current Smoker (%)	58	22
Average Children Born (women)	4.3	1.8
Reports Anxiety/Depression (%)	28	16
Chronic Cough	49	17

Source: Parry et al., 2007, table 2.

Figure 21: Dale Farm. "Young travellers look on as bailiffs enter to evict residents."

Source: *Daily Telegraph*, Oct 19, 2011

The mythology of the Gypsy/Traveler community is that they are the descendants of Romany, with their origins in India. However, there is plenty of evidence to suggest that the community is almost entirely of native British origin. Consider, for example, figure 21 which shows two Traveller children at the 2011 eviction of Travelers from an illegally occupied site at Dale Farm, Essex. These do not look like people of Indian origin.

Evidence from the surnames of Gypsies and Travelers in England suggests that they are indeed of domestic origin. When we observe an immigrant group to England, such as the Jewish population which emigrated to England in the seventeenth century and later, we will see an unusual distribution of surnames by frequency. Figure 22 shows this for people with characteristically Jewish first names such as Solomon and Golda, born in England 1910-4. The most common surnames in the native population in 1881 were very infrequent among Jews. Instead half the Jewish population had surnames held by less than 200 people in 1881.

When we look at surnames identified with people in the 1891 census labelled with such terms as suggest Gypsy or Traveler families ("Canvas tent" "in caravan" "on the common" "travelling hawker" "showman") we find that apart from one peculiarity, they echo the surname frequency distribution of the general population. That peculiarity is the unusually high frequency of the surname *Smith* among English Gypsies and Travelers. *Smith* is the most common surname in England. But in 1891 this appeared at a frequency of 7.7% among travelers, compared to 1.4% in the general population in 1881. But other than this, travelers do not seem to have had unusual surnames imported from outside England. Their surnames are a representative sample of rare, intermediate and common English surnames.

What this suggests is that the Gypsy and Traveller population of England was not created by some exotic band of imported Romany, an underclass many generations old, but is almost entirely indigenous and more recent in origin. It is likely that among the indigenous English population, at random some families ended up at the margins of society as traveling harvest workers, hawkers, basket makers, and showmen. But this marginal group, perhaps even drawing inspiration from the

Figure 22: Distribution of All Surnames 1881, and Jewish Surnames 1910-4

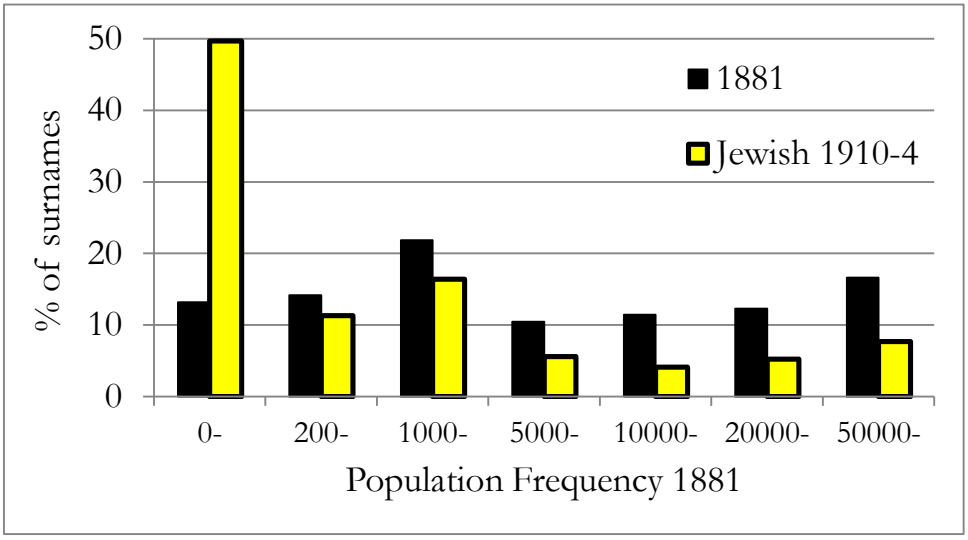
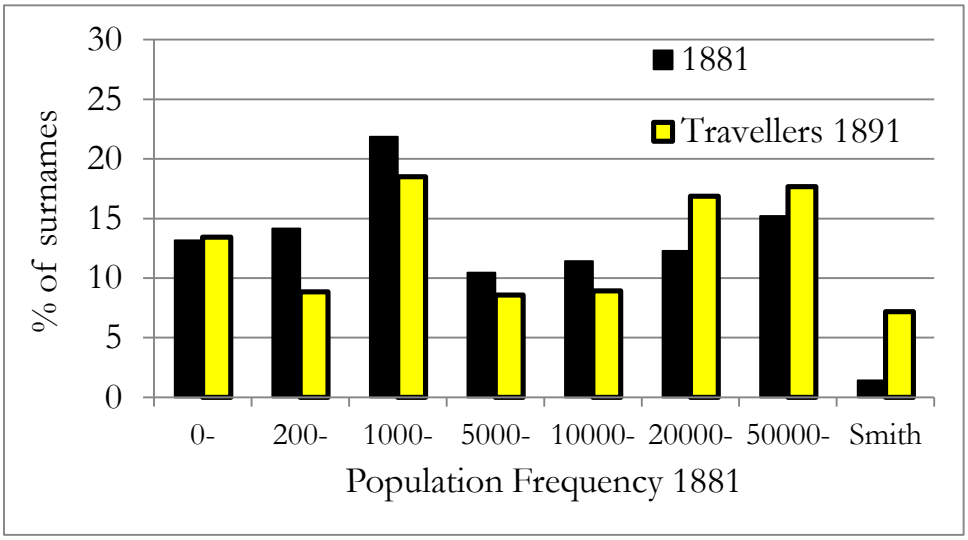


Figure 23: Gypsy and Traveler Surnames, England, 1891 Census



Source: Keet-Black, 2002.

few genuine Romany they encountered, adopted a romanticized version of the Gypsy lifestyle and a creation myth of their own.[37]

Thus by the nineteenth century the first names of Gypsy and Traveller children were sometimes colorful. For boys favored names allegedly included such as Goliath, Belcher, Dangerfield, Gilderoy, Nelson, Neptune, and Vandlo. For girls we get Britannia, Cinderella, Dotia, Gentilia, Fairnette, Freedom, Mizelli, Ocean, Reservoir, Sinfai, and Vancy.[38] Are these timeless Gypsy names, passed down by Romany forefathers?

Not likely. For if we look at the extensive records of baptisms in England 1538-1837 we find that almost all these supposed Gypsy and Traveller surnames appear for the first time only in the late eighteenth and nineteenth centuries. Thus the first recorded Cinderella baptism was in 1798, the first Goliath 1817, the first Ocean 1797, the first Freedom 1803, and the first Gilderoy 1785. This is not too surprising for Cinderella, for example, since the French tale that is the basis of the English version of the Cinderella story was first published in English in 1729.

The hypothesis here would thus be that the Gypsies and Travelers of England now are mainly not descended from those of 1600, 1700 or 1800. For the normal process of social mobility should bring those descendants closer to the social mean. Instead there is a steady flow of people into and out of Gypsy and Traveler communities. The more economically successful members of these communities acquire permanent homes, and occupations more associated with the majority population. Because they are in no way racially distinct from the rest of the indigenous English population, and because their surnames mainly do not reveal anything of their background, they can at any time blend into the larger society. But at the same time as there is a flow of people out from this group, there will be a flow in from people on the margins of society. These entrants adopt the lifestyle and mores of the Gypsies and Travelers.

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[37] In line with this genetic testing suggests that the Irish Traveller community is of entirely Irish origin. See North et al., 2000. Further this article concludes that " these data support that the origin of the Travellers was not a sudden event; rather a gradual formation of populations." There are not equivalent genetic studies of the origins of English Gypsies and Travellers.

[38] These first names are from the Romany and Traveller Family History Society. Most are in later periods associated with surnames known to themselves contain many traveler families. http://website.lineone.net/~rtfhs/gypsy.html

The recent addition to the travelling community, the New Age Travelers who took to the road in the last generation, for example, because of the similarities of their lifestyles with those of the traditional Gypsies and Travellers will likely eventually merge into future generations of Gypsies and Travellers.

This hypothesis of an open Gypsy and Traveller community would predict, that surnames which had concentrations in the traveler community in 1891 or earlier, surnames such as *Boswell, Penfold, Loveridge, Brazil* or *Beeney,* would from then on regress upwards towards the mean in social status. Each generation, some of the Travelers with these surnames would move up, and be incorporated into the settled society, so that the average surname status would rise. But only those who did not experience this upward mobility would remain identifying as Travelers. Thus those identifying as Travelers would seem a minority not subject to social mobility.

However, when we test this hypothesis by looking at the social status of a Traveler surname such as *Loveridge* from 1858 to the present, we do not get the expected result. Figure 24 shows a measure of the social status of the surname *Loveridge* from 1858 to 2012, by decade. The status is measured by the fraction of people called *Loveridge* who were probated at death, compared to the fraction of all deaths probated. For a surname of average status this will be one. For above average, greater than 1, and for below average less than 1. Interestingly up till 1900-9 *Loveridge* is a relatively high status surname. But from then the average status of *Loveridge's* has declined steadily, so that by 2000 the probate rate of *Loveridge*s was only about 60% of the average.[39]

What is happening here? While rare surnames can move away from the social mean of status through random forces, *Loveridge* is so common that such a random movement is wildly improbable. By 2002 there were 5,163 *Loveridges* in England and Wales. Does this show that the Law of Motion enunciated above sometimes does not predict social outcomes? Can social groups systematically move downward in status?

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[39] There are other signs of the low social status of the Loveridges in recent years. A search on the internet for recent arrests and convictions in England and Wales showed 8 times as many *Loveridges* as *Barclays*, even though the name *Barclay* has about 20% more holders than *Loveridge*.

Figure 24: Social Status of *Loveridge* by decade, England, 1858-2012

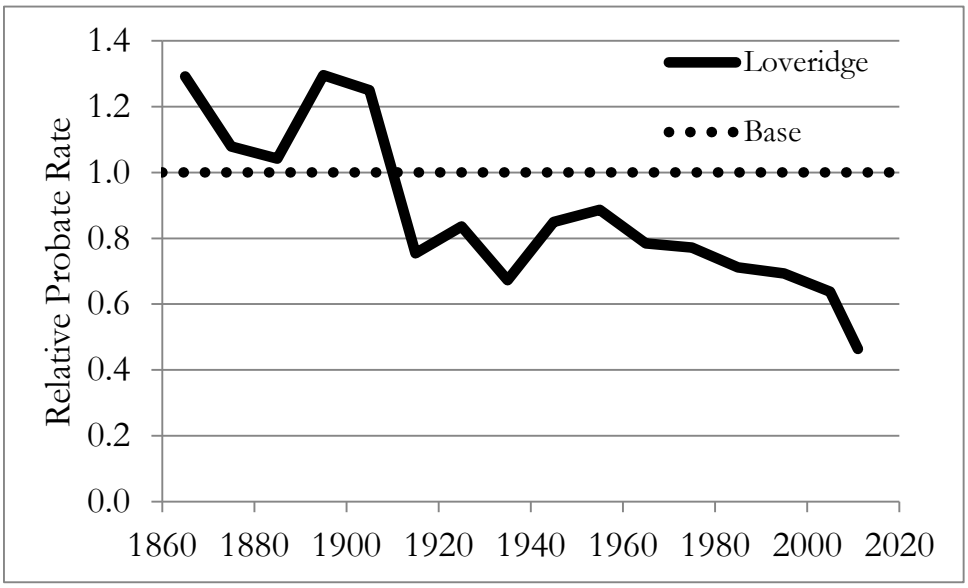
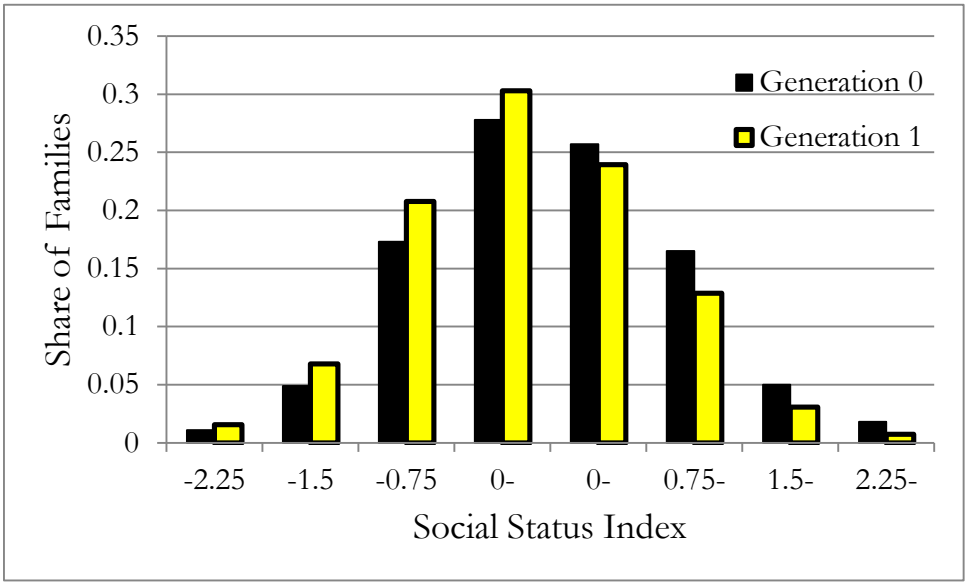


Figure 25: Simulated Downward Movement of Surname Social Status from Fertility Effects



The likely resolution to this puzzle, which does not violate the Law of Motion, is the following. *Loveridge* has had a very unusual growth in frequency for a common surname in England in the years 1881-2002. In that interval the stock of the average indigenous surname grew by only 90%. Yet in the same interval *Loveridge*s increased by 382%. This is presumably the result of the very high fertility rates among Gypsy and Traveler families in modern times illustrated in table 14 above. Such fertility rates would double the population of travelers in each generation, and could explainwhy even though a substantial fraction of *Loveridges* are not Travelers, the stock of the name could increase so much over time. If fertility is much higher for low status families with a surname, then we can have every family obey the Law of Motion, but yet have the average social status of the surname move downwards from the mean over time.

The implication here is that the children of the low status *Loveridges* are indeed regressing to the mean across the generations, but they have so many more children than the high status families, that the bottom end of the status distribution is growing as a share of the surname. Figure 25 simulates this effect for a population that starts in the first generation with the average social status of the group being at the social mean, and where status regresses to the mean with persistence b = 0.7. Fertility, however, is at twice the average rate at the bottom of the distribution and half the average rate at the top. In this case mean status moves downwards from the mean, despite every family regressing to the mean.

The downward mobility in the example above will continue until the average population status reaches an equilibrium where the population mean is sufficiently low that regression to the mean can balance the excess fertility at the bottom end of the status distribution. Thus another way you could get long lasting underclasses in a society even with intermarriage between the underclass and the rest of the population would be when that underclass had much higher fertility rates than the society as a whole. The effects of marital exogamy in pulling the group towards the mean would be offset by the higher fertility of poorer members of the group. However, in pre-industrial society poor groups typically had lower fertility rates than richer groups, so this effect could only operate in the modern world, meaning the world since 1880 in this case.

Thus it seems that cases that seem to violate the quasi-biological Law of Motion where every elite or underclass family should regress towards the mean can typically by explained as the result of selection effects or differential fertility. Even now institutions such as US immigration law can be powerful forces in creating upper and underclass groups, through selection from the originating populations.

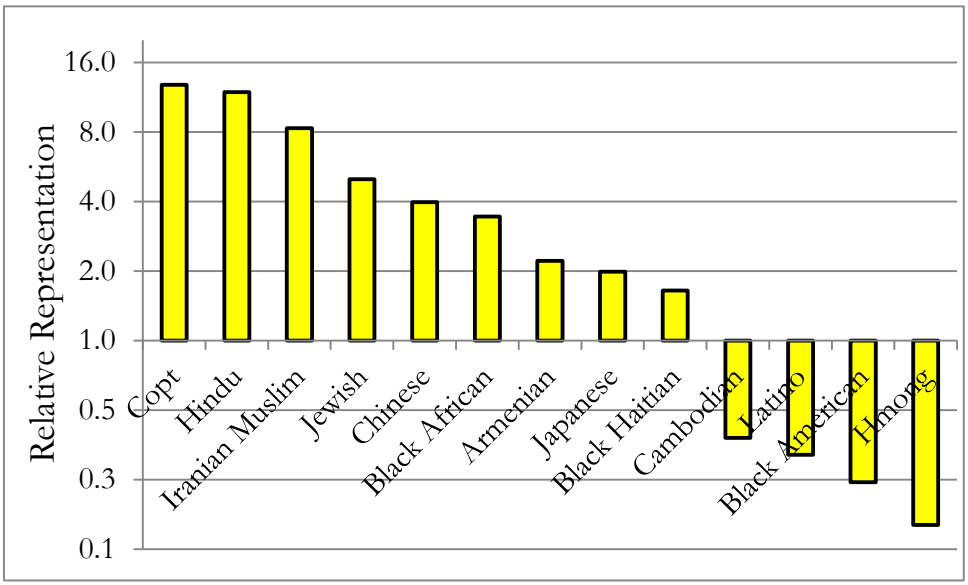
There is evidence that for many other immigrant groups coming to the US, strong positive and negative selection is still at work. A simple measure of the likely average status of immigrant groups compared to some domestic populations is the number of doctors per person of that surname group in the US. This is shown in figure 26, measured again just using surnames characteristic of each group. The measure is the doctor rate per head of population in 2000 for each group, including those trained abroad, relative to the domestic average. To show these differences the vertical scale has to be logarithmic, the range is so great between the highest and lowest rates. There are 80 times as many doctors per capita among Hindu Indian surnames such as *Banerjee* or *Ganguly* than there are among Hmong surnames such as *Her, Lor*, or *Vang.*

On this measure the most elite group in the USA, far eclipsing the Ashkenazi Jewish population, are Copts and Hindu Indians, with sixteen times as many doctors per capita in the USA than the average of the domestic population. This reflects just that immigration to the US from Egypt and India is heavily biased towards those with skills. Other groups that appear by this measure to be being selected from the upper end of their domestic populations are Iranian Muslims, Chinese, Black Africans, Japanese, Armenians, and Black Haitians.[40]

The high rate of doctors among Black Africans and Black Haitian surnames in the US is notable, given the great poverty and low educational attainment in the general population in Haiti, and in most of Sub-Saharan Africa.

[40] For these immigrant groups, population growth in the US 2000 to 2012 has been faster than average, so the doctor rate will be upward biased. But correcting that bias would leave all these groups looking as though they are elite populations.

Figure 26: Frequency of Doctors across Immigrant and Domestic Surname Groups, USA, 2012



Note: The vertical scale measures the numbers of doctors per capita in these groups relative to the population of the USA as a whole.

In contrast on this measure is the experience of the large Latino community in the US, 17 percent of the population, with its origin mainly in various countries of Central America and the Caribbean. A substantial fraction of this population came originally to the US illegally. Thus of the current population of 32 million in the US of Mexican descent, an estimated 6 million are currently illegally in the US, while another substantial fraction will be the children and grandchildren of original illegal immigrants. Living illegally in the US is much less attractive to people with greater skills and education than to the unskilled, in terms of employment limitations and the other disadvantages of illegal status. Thus the US Latino community is, on all measures, one of low educational attainment and social status.

The Hmong also register as a group with very few doctors per head of the population with characteristic Hmong surnames.[41] Again the general level of

[41] These were identified as surnames whose greatest concentration was in the six centers of Hmong settlement, Fresno, Merced and Sacramento in California, Saint Paul and Minneapolis in Minnesota, and Milwaukie, Wisconsin.

educational attainment is low. This community was engaged mainly is subsistence farming in the hills of Laos before coming to the US. It seems to represent a broad cross section of the Hmong population of Laos, entire communities having moved to refugee camps in Thailand in fear of the Communist Laotian Government, and then being admitted en masse to the US. Thus what started as a disadvantaged community in Laos has been transplanted en masse to the US.

Conclusion

The experience of long persistent social groups at high and low status in various societies would seem to be a contradiction to the simple quasi-biological Law of Motion for social status laid out above. However, we see that in the anomalous cases discussed above there are factors at play that can make even extreme persistence consistent with the universal pull of the mean on families across time. Elites and underclasses seem to be created by mechanisms that select them from the top or bottom of the established status distribution. They can also be created, as we see in modern England and the Gypsy/Traveller community, by differential fertility of the poorer members of a community.

The maintenance of these differences in social status, once established, can be by complete marital endogamy by social groups, as seems to have happened with Christian and Jewish minorities in the Muslim world. Or they can be maintained by selective movement between social groups, as we observe in the case of Catholics and Protestants in Ireland. Thus there seems to be no obvious contradiction between the simple quasi-biological Law of Motion observed for social mobility, and the observed pattern of elites and underclasses.

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