Is Most Wealth Inherited or Created? England, 1858-2012

Gregory Clark, University of California, Davis
Neil Cummins, LSE[1]

This paper considers the claim of Piketty, 2014, that in the steady state of the capitalist economy wealth is inherited, not created: more than 80-90% of wealth at death will be inherited. This claim also implies that wealth is unmerited privilege, and that by disrupting the flow of inheritances, wealth inequalities can be substantially reduced. Using English data on wealth at death we find instead that in the steady state the share of wealth derived from inheritance is instead somewhere in the range 18-48%. We also find that wealth correlates strongly across generations mainly because of the inheritance of educational and occupational status, and not because of wealth transfers themselves. Wealth may largely derive from abilities, and taxing inheritances would thus prove ineffective in reducing wealth inequalities.

Introduction

Tomas Piketty's recent work, largely based in terms of the magnitude and character of inherited wealth, on the excellent French notarial sources, presents a bleak picture of capitalist society and its possibilities.[2] Thus Piketty summarizes his message in the introduction to his book, as

> *When the rate of return on capital significantly exceeds the growth rate of the economy (as it did through much of history until the nineteenth century and as*

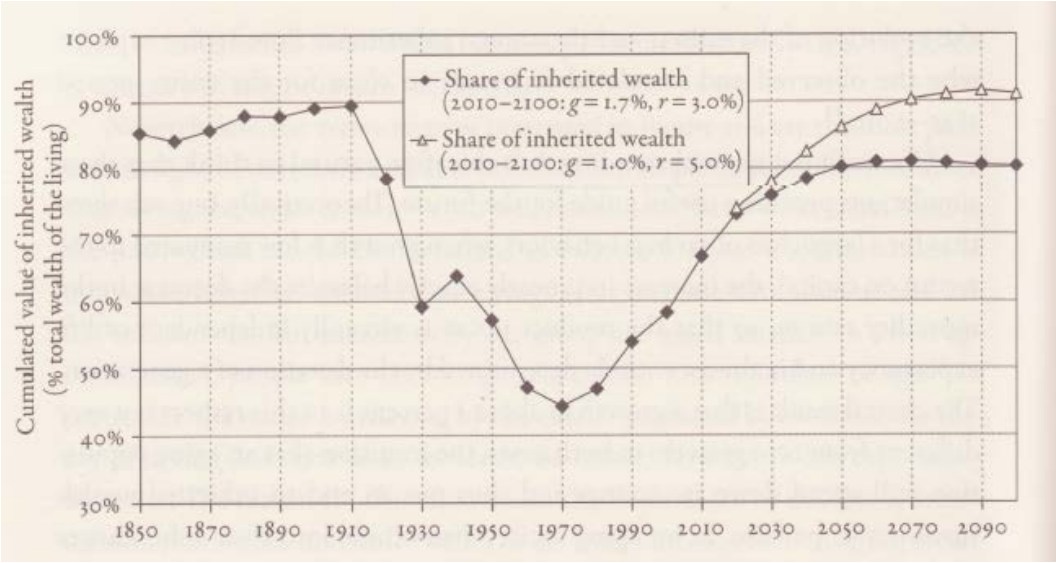
[1] gclark@ucdavis.edu, n.j.cummins@lse.ac.uk
[2] Piketty, 2014.

> *likely to be the case again in the twenty-first century), then it logically follows that inherited wealth grows faster than output and income….Under such conditions, it is almost inevitable that inherited wealth will dominate wealth amassed from a lifetime's labor by a wide margin, and the concentration of capital will attain extremely high levels (Piketty, 2014, 26).*

In particular for Piketty the natural state of the economy is one where the vast majority of wealth is inherited. The accumulations of wealth by those such as Bill Gates, Warren Buffett, and Steve Jobs are more than counterbalanced by the inheritors of wealth such as the Walton children.

Figure 1 shows the striking picture for wealth ownership in France, 1850-2010, and the projected future pattern. Increasingly wealth will derive not from individual choice and initiative, but through the blind forces of inheritance. Faster growth and tax policies 1920-1980 reduced the share of inherited wealth to as little as 45%. But with projected slower growth and less capital taxation in the future that share is forecast to rise again to 80-90%. Those who have capital bequeath it to their descendants.

Figure 1: The Share of Inherited Wealth in Total Wealth: France, 1850-2100



Source: Piketty, 2014, figure 11.7, 402.

We explore the logic of Piketty's argument below. His basic claim, however, is that as long as the return on capital, r, significant exceeds the growth rate of the economy, g, then the vast majority of wealth will be inherited. This condition should seemingly have been found in England 1870-1910. Piketty calculates the rate of return on capital as the share of income attributed to capital divided by the capital/output ratio. Thus

$$r = a\frac{Y}{K}$$

Figure 2 shows Y/K in Britain, and figure 3 the estimated capital share of income. In 1910 the capital/income ratio was 6.75, and the share of capital in income 0.36. thus the average return to capital Piketty would calculate as 5.3%. The growth rate of the economy was a bit higher than France in these years because of faster population growth, and was around 2%. But r-g was significantly greater than 0, so that by the logic of Piketty's argument England also in these years should have been an economy where close to 90% of wealth derived from inheritance.

The underlying logic driving these predictions can be conveyed as follows. Let W_t be the overall stock of wealth in the economy at any time, and W_t^H the wealth that derives from inheritance. We see to determine the ratio

$$\frac{W_t^H}{W_t}$$

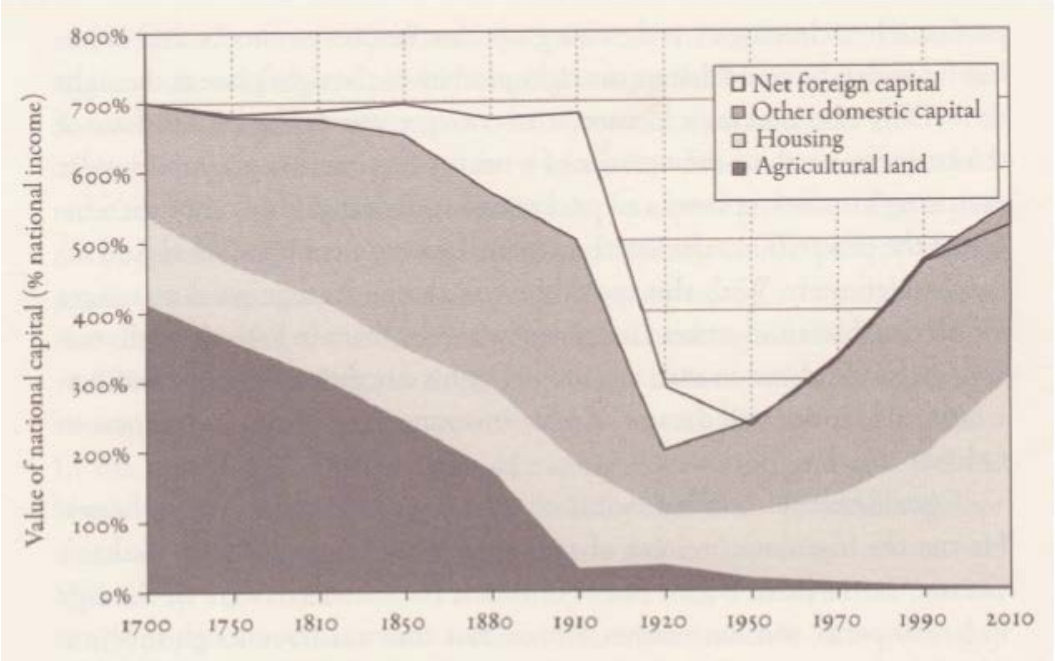
Piketty assumes that wealth overall accumulates at the same rate as overall economic growth, g, so that

$$W_T = W_t(1+g)^{T-t}$$

For simplicity assume that each generation is exactly 30 years, and that wealth flows just from parents to children. Then in each year there will be a flow of wealth B_t across generations. That inherited wealth is assumed to cumulate to a value by year T of

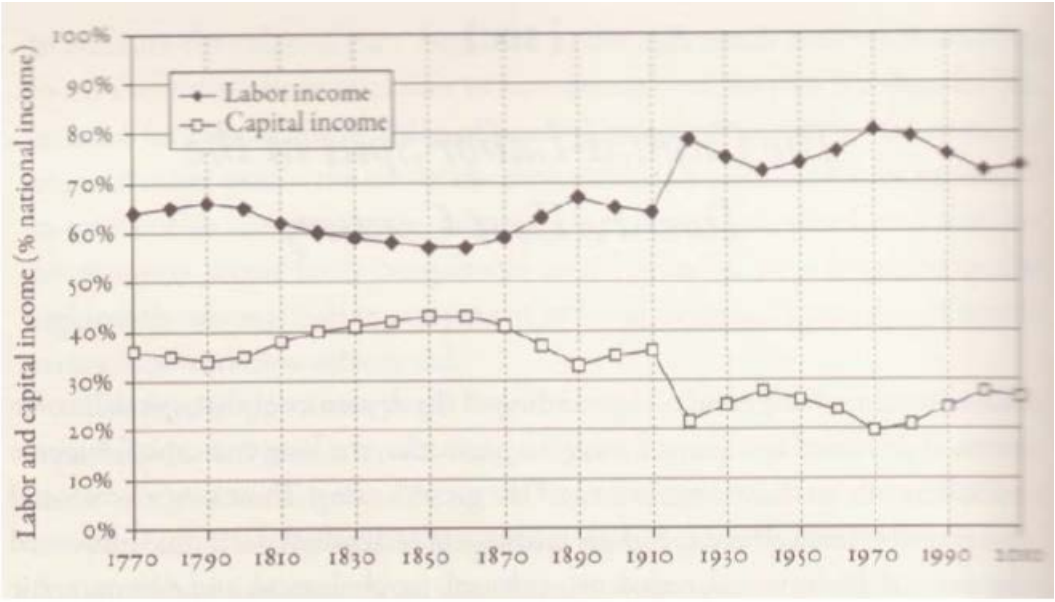
$$B_t(1+rs_K)^{T-t}$$

Figure 2: The Wealth/Income Ratio, Britain, 1700-2010



Source: Piketty, 2014, figure 3.1, 116.

Figure 3: The Share of Income from Capital, Britain, 1770-2010



Source: Piketty, 2014, figure 6.1, 200.

where r is the return on wealth, s_K the savings rate from such wealth income. Piketty assumes thus that on average such inherited wealth tends to grow, with a rate of growth determined by the rate of return (assumed to average 5%), and the savings rate from wealth income, assumed to be around 0.25. This means that at time T the total stock of inherited wealth will be

$$W_t^H = \sum_{t=T-29}^{t=T} B_t (1 + rs_K)^{T-t}$$

Thus

$$\frac{W_T^H}{W_T} = \sum_{t=T-29}^{t=T} \frac{B_t}{W_T}(1 + rs_K)^{T-t} = \sum_{t=T-29}^{t=T} \frac{B_t}{W_t}\frac{(1 + rs_K)^{T-t}}{(1 + g)^{T-t}}$$

But with a constant growth rate of population, and a thirty year generation,

$$\frac{B_t}{W_t} = \frac{1}{30}$$

So

$$\frac{W_T^H}{W_T} = \frac{1}{30} \sum_{t=T-29}^{t=T} \frac{(1+rs_K)^{T-t}}{(1+g)^{T-t}} \qquad (1)$$

For small values of rs_K and *g*, this approximates to

$$\frac{W_T^H}{W_T} = \frac{1}{30} \sum_{t=T-29}^{t=T} (1 + rs_K - g)^{T-t}$$

If $rs_K > g$ then the stock of inherited wealth will grow faster than the rate of economic growth, and all wealth will be inherited. If $rs_K < g$ then some wealth will be newly created.

For England, 1870-1910 where r = .053, and g = .002, then assuming $s_K = 0.25$, then based on equation (1) inherited wealth would be 91% of all wealth in England 1870-1910.

Below we estimate the share of wealth that was inherited in England by two different methods and show that with both estimates the share of inherited wealth is much lower, close to 50%.

Does Wealth Derive Mainly From Inheritance? England, 1858-2012

To study the importance of inheritance of wealth over time within families in different epochs we employ a sample of English families with rare surnames observed at death over the period 1858-2012. In all we observe 57,000 people dying or born in this interval. These surnames we can divide into those which were on average very wealthy 1858-1887 (23,000 people), and those that were average or poor (34,000 people). As will be explained below by looking at the total wealth of the rare surname families by generation we can estimate an upper bound of the share of inherited wealth relative to all wealth.

England does not have sources as rich as those for France on the patterns of wealth inheritance. The French notarial archives allow Piketty and his fellow researchers Jean-Laurent Rosenthal and Gilles Postel Vinay, to trace the exact transmission of wealth from one generation to the next for comprehensive samples of the population back to 1807.[3]

In England from 1858-2014 we do have comprehensive estimates of wealth at death, through the records of the Principal Probate Registry. This shows the amounts bequeathed, and an estimate for tax purposes of the value of the deceased estate. In earlier years this estimate referred just to personalty, and excluded real estate. After 1894 it is a comprehensive estimate of wealth at death. These estate valuations have been the source of most modern estimates of personal wealth in the UK (Atkinson, 2013, Karagiannaki, 2011a, 2011b, 2011c). However, we have no records of the amounts inherited by individuals over their lifetimes, and consequently, at the individual level, on the sources of their wealth at death.

[3] Piketty, Postel Vinay and Rosenthal, 2011.

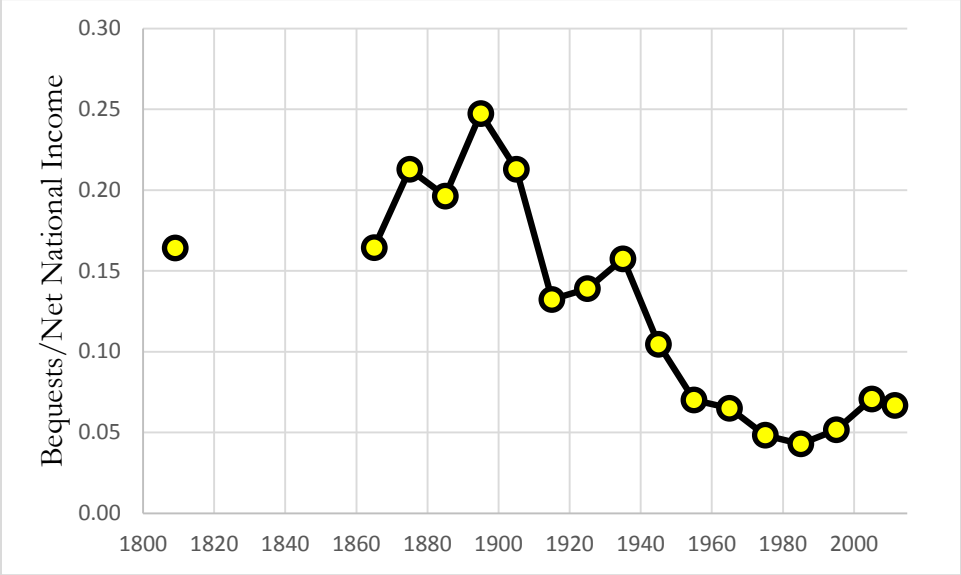
Estimates of the total value of all bequests suggest that the English economy had a similar evolution compared to France for the flows of bequests as a share of income 1820-2010. Figure 4 shows estimated annual bequests relative to net national income for England 1809-2013. Figure 5 shows Piketty's comparable estimates for France. For the years before 1896 the total value of bequests in each period was estimated by from the number of probates recorded each year at the Principal Probate Registry, with a sample of probates used to estimate the average estate value. For 1896 and later the data derives from Atkinson (2013), Appendix, Tables 1 and 2. Atkinson makes an allowance for non-filers, exempt estates, and undervaluation. For 1809 and 1858-1895 a similar proportionate adjustment as for 1896-99 is made.

As in France bequests constitute a large proportion of income circa 1870-1909, 20-24%, declining dramatically in the years 1920-1960. Yet in the earlier years of the nineteenth century the estate value measured just the personalty of the probated, the value of assets other than real estate, and we see above in figure 4 that real estate would be a substantial share of assets in the nineteenth century. So the ratio of annual bequests to current income was likely even higher in England 1870-1914 than in France, and on Piketty's argument England should be largely a rentier society in this period.

At their low point in 1980-9 bequests represent just over 4% of net national income in England. This data shows that if all bequests are consumed they would constitute now about 7% of resources. However, this data is biased in terms of the magnitude of intergenerational wealth in two important, though offsetting ways. First it does not include inter vivos transfers from one generation to the next. But second, many bequests will be from one spouse to another, or from one sibling to another, or bequests to charitable institutions. Thus intergenerational bequests will be only a portion of the totals reported in figure 4. A detailed examination by HMRC of bequests 2000-1 found that of £38.8 b. in total, 37% were to spouses or charity, 42% were to children or grandchildren, and 21% were to relatives or others who may or may not have been in the next generation.[4] So only 42-63% of bequests were across generations. Thus the flow of income deriving from bequests since 1950 has likely been only in the range of 2-4% of net national income.

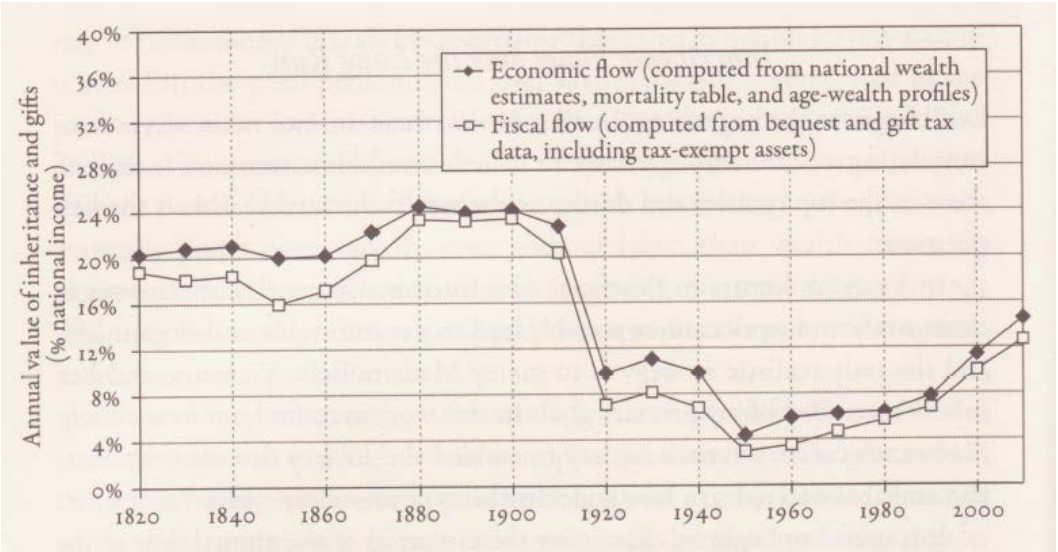
[4] HMRC, 2004, table 12.9.

Figure 4: Bequests as a Fraction of Annual Income, England, 1809-2013.



Notes: The total flow of bequests each year from 1996 on is from Atkinson, 2013. The flow 1858-1895 is estimated from a sample of probates at 5 yearly intervals from *England and Wales, Index to Wills and Administrations.* The flow 1809 is derived from the *Probate Act Books* from the Prerogative Court of Canterbury. Net national income is from Clark (2010).

Figure 5: Inheritance Flows as a Fraction of National Income, France, 1820-2010



Source: Piketty, 2014, figure 11.1, 380.

For the families in our rare surname panel we know the individual family linkages, so we can estimate intergenerational wealth correlations at the individual level. But we can also group families by surname into those on average wealthy and on average poor in the initial period, and derive an alternative measure of intergenerational wealth inheritance based on the average wealth of the surname groups. This is shown in table 1 for death periods designed to correspond to generations. As can be seen while the individual correlation is not high, at the group level there is a strong intergeneration correlation of wealth. In the case of wealth this could reflect inheritance of wealth across multiple generations, and from collateral relatives. But importantly the data we are using here shows strong inheritance of wealth across generations, in line with other results showing that persistence of status across generations is stronger than conventionally believed (Clark et al., 2014, Clark and Cummins, 2014).

Table 1: Individual and Group Level Correlations of Wealth across Generations, England, 1858-2012.

Period of child death	N	Father-Son Wealth Correlation	Correlation - Surname Groupings
1888-1917	902	0.49	0.71
		(0.028)	(0.026)
1918-59	2,109	0.39	0.68
		(0.017)	(0.028)
1960-87	1,126	0.38	0.72
		(0.023)	(0.032)
1999-2012	449	0.42	0.83
		(0.055)	(.077)

Note: Robust standard errors in parentheses.
Source: Clark and Cummins, 2015, table 6.

To investigate the share of wealth inherited we utilize the above-mentioned panel of people with rare surnames where the average person dying with the surname in England 1858-1887 was wealthy. The rare names used are those held by 40 or fewer people in 1881: names such as Bulteel, Bazalgette, and Bigge, the complete list given in the Appendix, and the data set described in Clark and Cummins, 2015. There were 1,864 deaths among these rare rich surnames in 1858-1887, with an average estate of £21,578. This was more than fifty times the estimated average wealth at death for these years, so these are very wealthy families on average.

While we cannot observe the individual transfers of wealth across this group, we can assume that on average the wealth of generation t+1 will have been acquired by a combination of transfers from generation t, and from some new wealth creation. Figure 6 portrays the situation. While the English data do not reveal who left what to whom, by following wealth at the surname level we can expect to capture the intergenerational flows of wealth within the economy. Bequests are overwhelmingly made to those who are related by marriage or genetics, and the rare surnames allow us to track one half of this genetic line of descent of bequests and wealth. Wills in the early nineteenth century show bequests to those not related in this way to the decedent to be less than 1% on average. The HMRC study above for 2000-1 finds bequests to unrelated individuals to be 7% in value of bequests, still a very small minority.

We do not capture all inheritors of the original rich surname families when we look at wealth by rare surnames. Married daughters will not carry the surname, and their wealth at death will not be counted. So we will miss transfers to the families of married daughters (and also to the families of married sisters in the case of within-generation bequests). However, included in the surname wealth counts are the estates of daughters-in-law, some of which will have been inherited from the daughter-in-laws' parents, siblings, uncles and aunts. For a surname of average status, these omissions and inclusions will typically cancel out. The flows out and in of the surname lineage of bequests will be equal.

Figure 6: The Inheritance of Wealth within Surname Lineages

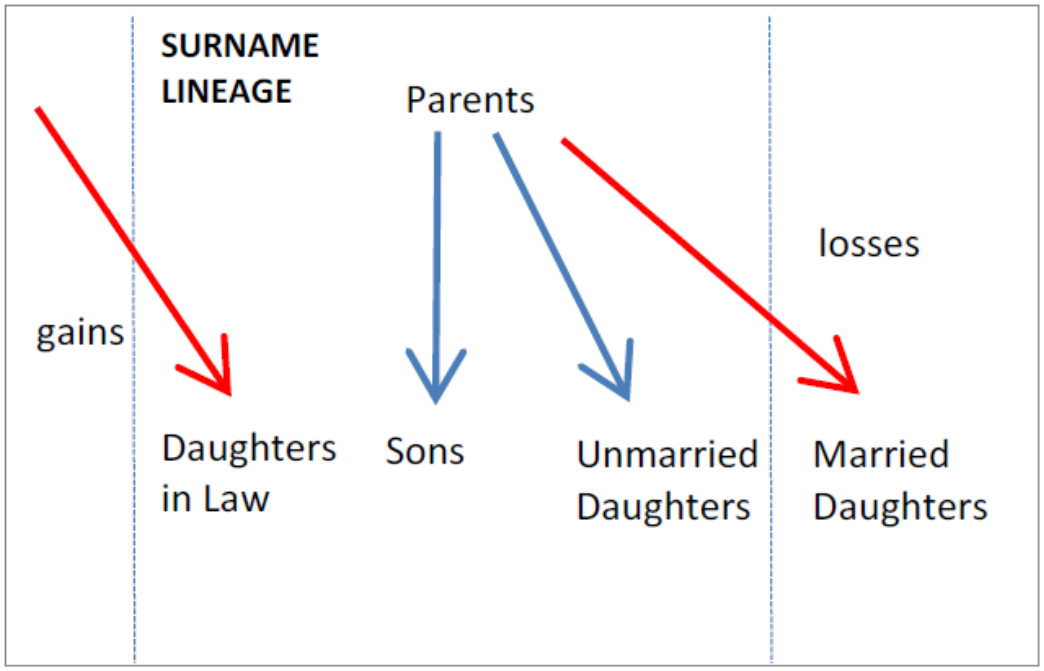


Table 2: Estates of daughters versus daughter-in-laws, deaths 1860-1949

	Married Daughters N	Married Daughters Ave Value	Daughters in Law N	Daughters in Law Average Value
Average Estate, 1860-89	168	£6,063 (1,056)	444	£9,452 (1,633)
Average Estate, 1890-1919	268	£6,909 (743)	499	£12,026 (3,131)
Average Estate, 1920-49	321	£11,010 (1,201)	587	£11,993 (2,451)

Note: Standard errors in parentheses. These estimates come from tracking the marriages of daughters in the surname lineages, and then their wealth at death, using Ancestry.com.

For a rare surname of high average wealth, however, potentially the married daughters take away more wealth from the surname holders than the daughters-in-law bring in. However, this effect will be modest where mating is highly assortative, so that the source families of daughters-in-law tend to be as rich as the surname families. The empirical test about whether rich surname lineages lost substantial amounts of wealth through the married daughters will be measures of the relative wealth of daughters-in-law compared to married daughters.

Table 3 shows by death cohort the numbers and average wealth of identified married daughters and daughters-in-law. As can be seen there is not much difference in the average wealth at death of married daughters and daughters in law. Also daughters in law if anything tend to be wealthier. Thus there is no sign of any net outflow of wealth from these lineages. The wealth held by those with the rare surnames in succeeding generations will reflect the family transfer of wealth across generations.

One thing that emerges is that wealth in this period descended mainly through sons. Sons' average wealth at death was respectively £34,861, £26,368, £28,323 in 1860-89, 1890-1919 and 1920-49. So however we treat the potential omissions of wealth transferred to married daughters, the effects will be small. The net effect, even for this wealth group will be close to zero.

To get an upper bound estimate of the share of wealth inherited in England across each generation we adopt the following procedure.

- Estimate for England as a whole total bequests in each generation, B_t
- Estimate for the wealthy rare surname families total bequests in each generation, B_{tR}
- Assuming, as an upper bound, that all bequests in the rich family sample stemmed from inheritance, estimate the amount of bequests derived from inheritance nationally in each generation as H_t, where

$$H_t = B_{t-1}\frac{B_{tR}}{B_{t-1R}}$$

The share of all wealth derived from inheritance will thus be estimated as

$$\frac{W_T^H}{W_T} = \frac{H_t}{B_t} = \frac{B_{t-1}}{B_t}\frac{B_{tR}}{B_{t-1R}}$$

If all wealth is inherited then the bequests of the rich rare surname group have to increase as rapidly as all bequests.

Table 3 shows the details of this calculation of the share of wealth inherited. The table shows all the deaths aged 21+ with the rare rich surnames, and the total estimated value of these estates for each period (B_{tR}). Also shown is the total value of bequests in the same years for England and Wales as a whole.

Though the aggregate value of the rare surname estates increased over time, the increase was less than for the aggregate value of bequests, implying that only a proportion of wealth was inherited. Thus the ratio of the rare surname bequests to all bequests fell steadily across generations. Figure 7 shows the ratio of the wealth at death of these surnames compared to all wealth at death for the periods 1858-89, 1890-1919, 1920-1949, 1950-1979, and 1980-2012, with 1858-89 set at 100.[5] As can be seen the wealth of this group is regressing towards the mean, though this regression is at a slow rate. By 1980-2012 their average wealth was still nearly 5 times as great as decedents in general, as shown in the last column of table 3.

Table 3 also shows the unusual demography of this rich surname group. The growth of population in this group has been much less than for the domestic population of England as a whole. In contrast a group of rare poor surnames was about 2.6 times as large in terms of adult deaths 1980-2012 compared to adult deaths 1858-1889. For this reason though the overall flow of bequests from this rare rich group declined substantially relative to all bequests, relative to the average person wealth at death remained substantial even in 1980-2012. In terms of the average wealth at death of adults in England this group went from being 55 times as wealth as the average to being 4.6 times as wealthy. This implies quite strong persistence of wealth across generations, to make this group four generations later still significantly wealthier than average. Figure 8 shows the path of wealth per death compared to the population average.

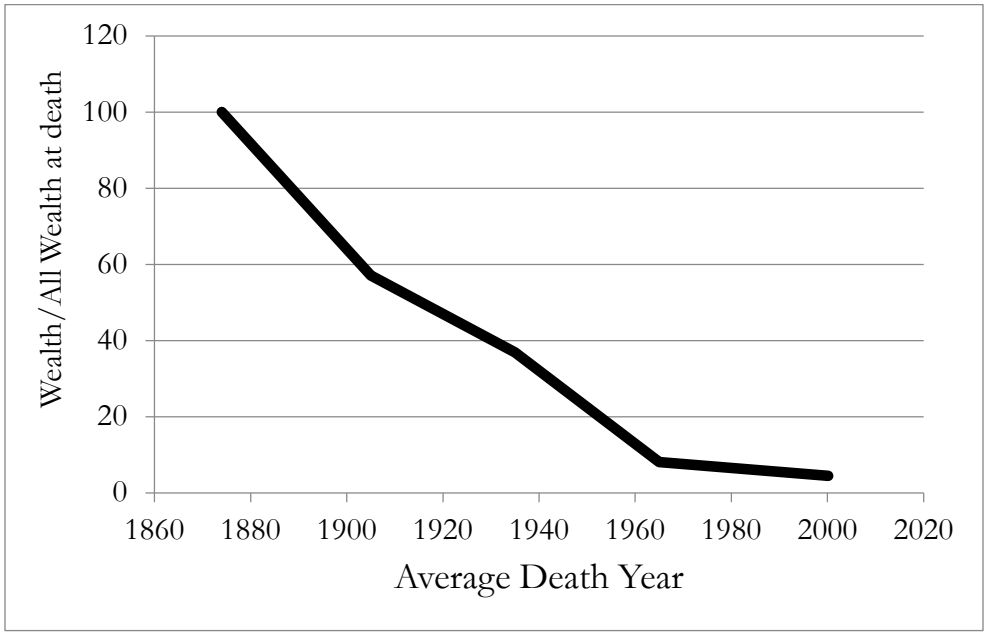
[5] In 1984-1998 the probate records return uninformative valuation bands for most estates, so this period uses just the data 1980-83, and 1999-2012.

Table 3: Wealth at Death of Rare Surname Holders, 1858-2012

Period	Rare Surname Deaths 21+	Total Wealth at Death (£ m.)	All Wealth at Death (£ m.)	Rare Surname Wealth relative to all Estate Wealth (1858-89 = 100)	Rare Surname Average Estate compared to all deaths 21+
1858-89	2,008	42.5	3,923	100.0	55.2
1890-1919	2,116	38.4	6,984	57.1	31.7
1920-49	2,406	44.7	15,298	36.9	20.3
1950-79	2,112	42.7	52,826	8.1	6.2
1980-2012	947	316.2	795,554	4.5	4.6

Note: 1980-2012 is the years 1980-3 and 1999-2012.

Figure 7: Wealth, Rare Rich Surnames, relative to all bequests, 1858-2012



Note: Wealth at death of rare surname group relative to all wealth set at 100 in 1858-1889.

Figure 8: Wealth per Death, Rich Rare Surnames, Relative to Average Wealth per Death, 1858-2012

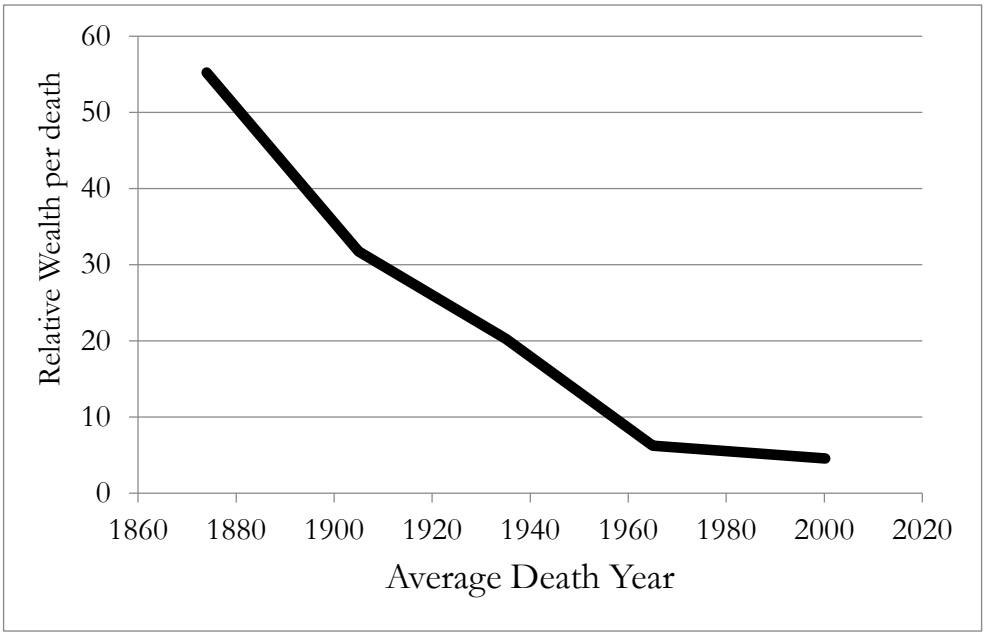


Table 4 shows the calculated share of inherited wealth based on the data in table 3. As can be seen, for those dying 1890-1919 where Piketty would predict 91% of wealth to be inherited, the data here suggests instead only 53% (which is still substantial). Even in the late nineteenth century, supposedly a golden age for wealth accumulation, with little taxation of wealth, the process is one of dissipation, not accumulation. Wealth is being consumed by the children of these families, not created.

However, as can be seen from the next column, the lengthening of the life span means that the generations here are not all of 30 years. The fourth column thus shows the estimated inheritance share of wealth for a standardized 30 year generational interval. The last column of the table shows the implied share of inherited wealth if each cohort was standardized to a 30 year interval, assuming that the rare rich wealth stock relative to overall wealth changes at a constant yearly rate between each cohort. Except for 1950-79 the estimated share of wealth inherited is in the range 52-57%.

Table 4: Share of Wealth Inherited

Period	Share Wealth Inherited	Ave Birth Date	Age Gap	Share Wealth Inherited (30 year generation)
1858-89	-	1814	-	-
1890-1919	0.53	1843	29.1	0.52
1920-49	0.65	1867	23.6	0.57
1950-79	0.22	1888	21.7	0.12
1980-2012	0.55	1920	31.7	0.57

Table 5: Concentration of Wealth of Rare Surname Holders, 1858-2012

Period	**Total Wealth at Death (£ m.)**	**Wealth of top 1% of sample (£ m.)**	**Percent of Wealth held by top 1%**	**Implied Wealth if bottom 99% share is 0.57 (£ m.)**	**Rare Surname Wealth relative to all Estate Wealth**
1858-89	42.5	16.7	39	45.3	100
1890-1919	38.4	16.6	43	38.2	53.3
1920-49	44.7	20.2	45	43.1	33.4
1950-79	42.7	8.9	21	59.3	10.5
1980-2012	316.2	128.2	41	329.8	4.4

Note: 1980-2012 is 1980-3, and 1999-2012.

There is, however, possibly another imperfection in the data in tables 3 and 4. Table 5 shows the wealth held by the top 1% of the rare surname sample, and the share of this wealth in all wealth held by this group of families. This averaged close to 43% in all periods except 1950-79 when it was only 21%. In 1950-79 there may just have been an accident thus that no deaths occurred among very wealth surname holders. If we calculate wealth in this period on the assumption that the bottom 99% of decedents held 57% of all wealth then the decline in the bequest share in this period is less dramatic, though still faster than in any other period. Table 6 shows these calculations.

Table 6: Share of Wealth Inherited – Adjusted Rare Surname Wealth Estimates

Period	Share Wealth Inherited	Ave Birth Date	Age Gap	Share Wealth Inherited (30 year generation)
1858-89	-	1814	-	-
1890-1919	0.48	1843	29.1	0.48
1920-49	0.63	1867	23.6	0.55
1950-79	0.32	1888	21.7	0.20
1980-2012	0.41	1920	31.7	0.43

The overall conclusion here is clear. While inheritance is an important source of wealth, and might indeed explain half of all wealth holdings at any time, it is not as important as Piketty assumes based on his data for France. Given the similarity in bequest trends seen above from these two societies, this implies that their may be something suspect also in the conclusions drawn from the notarial sources for France also.

For the descendants of the wealthy, on average, all their wealth at death does indeed derive from inheritance. But this process for the wealthy implies a decline of wealth holdings in general, and a decline of wealth inequality, unless there is another class of families which are generating wealth *de novo.* Thus the maintenance of wealth inequality over the long run depends in England on the constant creation of new wealth, not the inheritance and accumulation of old wealth.

As noted above, the estimates here are likely an upper bound of the share of wealth inherited. Some members of these lineages will be creating new wealth above anything they inherited. Richard Frederick Colvile, for example, died leaving an estate of £12.2 million in 2004. But his father Kenneth who died in 1956 left an estate of only £34,520, and his mother Kathleen, dying in 1982, left an estate of only £91,118. He had three adult siblings who would have shared any inheritance, so his inheritance from his parents likely was £32,000 or less. Compounding his inheritance at the rate of return on long term government bonds, this would have accumulated to £1.6 million by 2004.[6] Likely most of his wealth at death was newly created.

Offsetting this effect to some degree is that fact that some wealth will leak out of these surname lineages from the emigration of members to other countries: the USA, Canada, Australia, Ireland, and NZ principally. But this would be only a few percent of wealth per generation based on the evidence of these lineages. So the likely bias in these estimates is that they overstate the importance of inherited wealth Thus the estimates in table 6 are very much an upper bound estimate of how much of wealth at death in England in each generation stemmed from inherited wealth.

It is unclear why the estimated importance of inheritance in wealth at death is so different for England as compared to France. Interestingly Piketty's key chapter *Merit and Inheritance in the Long Run* is based only on French data, and indeed only Parisian data, insofar as it concerns the proportion of wealth that is inherited.[7] Thus the projections of the book for the return of the rentier society in the 21st century rests only on French experience, so that the English counter example is potentially important in terms of what generalizations can be made from French experience.

---

[6] The government bond returns are from Mitchell, 1988, and Janssen et al., 2002.
[7] Piketty, 2014, 377-429.

One issue that arises is that we have looked here at only relatively wealthy families. Could this give a misleading impression of the importance of inherited wealth compared to the population as a whole? However, there is no reason to expect that parents high in the wealth distribution will tend systematically to have children who are more likely to create their own wealth. The general feature for wealth inheritance is of a constant rate of regression to the mean. For any parents of above average wealth their children tend to have less wealth. Thus to maintain the variance of the wealth distribution there has to be a constant creation of new wealth. Below we formally simulate this process.

Family Size and Wealth Inheritance

Piketty thinks that wealth itself, and wealth inheritance, is the great driver of wealth inequalities in society. If we could disrupt the inheritance of wealth, by taxing away more of large bequests, then we could substantially reduce wealth inequalities. Evidence on family size and wealth in the above sample of rich lineages suggests, however, that wealth at death is not largely determined by how much is inherited, but instead depends on social and occupational position. If bequests were reduced by estate taxes, families may simply respond by accumulating more wealth within their lifetimes.

The way we can get some insight into what mechanisms are actually producing the strong intergenerational correlation of wealth, especially within lineages, is by looking at the effects of family size on child wealth. For those dying in England in the interval 1858-1960 family sizes varied greatly. They could have between 0 and 18 adult siblings. Also for marriages formed before 1880 there was no correlation between family size and the wealth or education level of parents. Family size measured as children achieving age 21 or above, was independent of social status as measured by educational attainment or wealth at death.

If wealth at death is largely driven by inheritance, so that 90 percent of wealth is inherited, then family size should be a significant predictor of child wealth at death. Children who happen to be from larger families will inherit less, and will consequently see significant declines in their wealth at death.

The reasoning is as follows. Let us assume that the total bequest from the previous generation to the children of a given family is

$$(1+\tau)(W_F + W_M)$$

where W_F is the father's wealth, W_M is the mother's wealth, and $\tau > 0$ reflects wealth inherited from unmarried aunts and uncles, assumed to be correlated with parent wealth. Let us suppose that a proportion θ_i of this wealth is saved until death. Suppose also that each individual generates some random amount of new wealth of amount W_i, $W_i > 0$, where the average of this new wealth is $\bar{W}$. Thus the wealth of each child at death is on average

$$\bar{\theta}(1+\tau)\frac{(W_F + W_M)}{N} + \bar{W}$$

where N is the number of adult children, and $\bar{\theta}$ is the average of the θ_i. Wealth will thus decline substantially as N increases.

This implies the total wealth of all N children is

$$\bar{\theta}(1+\tau)(W_F + W_M) + \bar{W}N \qquad (2)$$

If 90% of wealth derives from inheritance then the $W_F + W_M$ component (inherited wealth) will dominate in the above expression over the $\bar{W}$ component for the richer families we are considering. Thus the aggregate wealth of children will be close to independent of family size, and will rise only very modestly with family size.

The above ignores wealth at death attributable to transfers from spouses. But in line with the logic of figure 6 above these will on average be 0. For each husband who benefits from a transfer from his wife, there will be a wife who loses wealth from transfers to husbands. Spousal transfers will net to zero.

Using a set of 1,101 rich fathers married before 1880 in England we can empirically estimate the relationship between total wealth of children, wealth per child, and family size. These fathers had 4,652 adult children, and average of more than 4 per father. There were 2,494 sons and only 2,158 daughters identified. This

is because daughters are harder to identify in the records because they change their names on marriage. However, the missing daughters tend to be concentrated in families with only daughters. Thus of 336 missing daughters, 55 are from one-child families with a daughter only, 68 from two child families with only daughters, 96 from three child families with only daughters. Thus for families of size 5 or less we add in estimated wealth for these missing females by assuming a .5 probability of any children being male or female.

Figure 9 shows the relationship between family size and total wealth at death. As can be seen there is a strong positive relationship, in contradiction to equation (2). Children from smaller families tend to dissipate inherited wealth, while those from larger families are more likely to accumulate wealth. What this suggests is that the strong intergenerational correlation of wealth across families and lineages is not driven mainly by bequests, but instead derives from the inheritance of educational and occupational status. Children are adjusting their wealth to their educational and occupational status. If they come from a smaller family, they consume most inherited wealth. If they come from much larger families they themselves accumulate wealth to match their educational or occupational status.

Figure 10 shows average wealth per child as a function of family size. There is a modest decline in wealth per child as we move from one child to 11 child families, but the effect is very modest relative to what would be expected if inheritance is the main driver of wealth at death. Children from larger families are unexpectedly wealthy relative to their inheritances, and children from small families are unexpectedly poor. Inheritance alone is not the main driver of the correlation of wealth in families across generations.

Figure 9: Total Wealth and Total Bequests as a function of family size

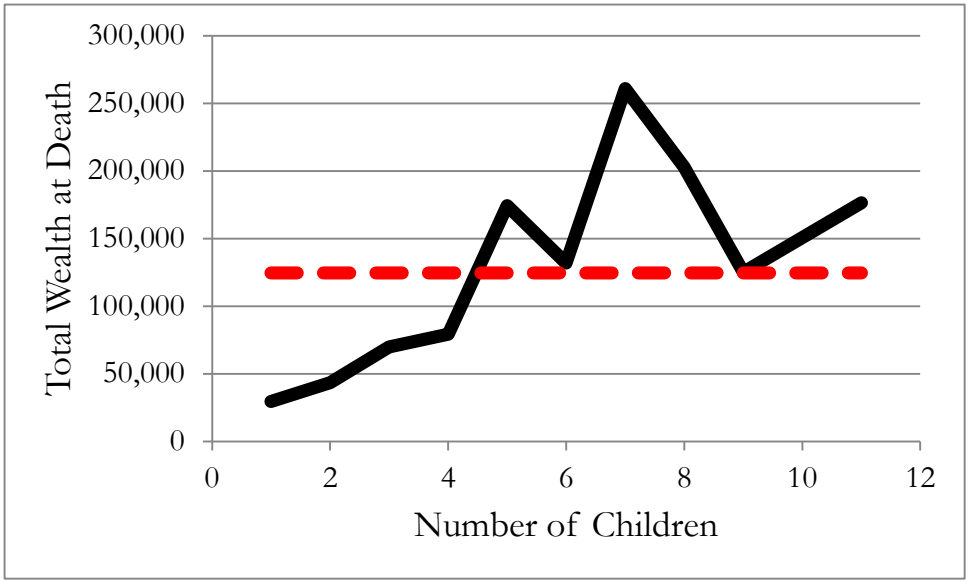
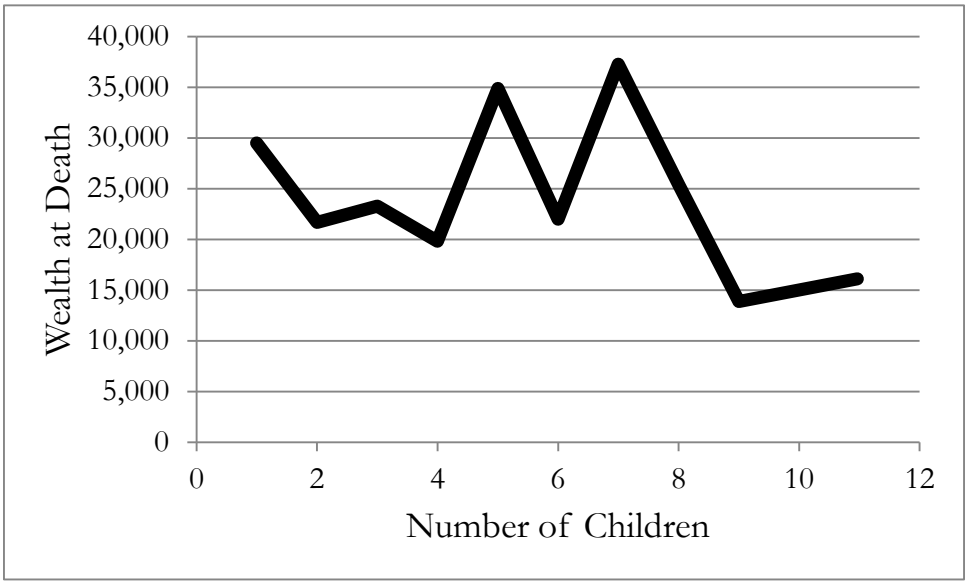


Figure 10: Average Wealth per child as a function of family size



Also shown in figure 9 as the dashed line is the estimated average wealth total wealth of children deriving from bequests, calculated as

$$(1+\tau)(W_F + W_M)(1+r)^T$$

r is taken, in line with English evidence, at only 0.03.[8] τ, the allowance for bequests from unmarried uncles and aunts is taken as 0.1. *T*, the length of time between generations, averages only 23 because in order to produce 12 adult children, for example, a father would need to be married for more than 46 years before their death. Thus the estimated average value of bequests at the time of death of children is £124,525. This is shown as the dashed line in the figure.

Children in one child families consume most of the wealth they inherit. However, for family sizes of five or above the children have an aggregate wealth at death that exceeds the capitalized value of bequests. They are creating new wealth. For the sample of 1,101 families used here, the total estimated value of all wealth at death of the children is £180.9. Of this £21.8 million is estimated to be newly created by the children in families of size 5 or greater who on average inherited less than they bequeathed themselves. Thus consideration just of the effects of family size on bequeathed wealth suggests that significant new wealth is being created within these surname lineages, so that an upper bound estimate for the share of inherited wealth in all wealth in the late nineteenth century would be 48% rather than 55%. But 48% is still an upper bound since there will be individual children at any family size who create new wealth in their lifetimes.

[8] In England in this period this was the return on such safe assets as government debt, railway company bonds and equity, and farmland and housing. See Clark, 2007, 299 for the return on railway company bonds.

Individual Simulation of the Role of Inheritance

The above estimate looks at groups of families. It is also possible to estimate the role of inheritance in wealth in the years 1858-1914 in an entirely different way by simulating the connection between the wealth of fathers, the wealth of sons, as well as the numbers of siblings and the time in years between the deaths of father and sons, using individual data.

In general we find the best functional predictor of son's wealth is

$$lnW_s = a + blnW_f - clnN + u$$

where W_s is the wealth of sons at death, W_f is the wealth of fathers at death, N the number of siblings, and u a random component. This implies that

$$Var(lnW_s) = b^2Var(lnW_f) + c^2Var(lnN) + \sigma_u^2$$

The best fit of this relationship for sons dying 1858-1914 is

$$lnW_s = 4.94 + 0.41lnW_f - 0.31lnN \qquad (3)$$

This implies that in order to maintain wealth variance over time there must be a large random component in wealth at death σ_u^2. For $b^2 = 0.17$, $c^2 = 0.10$, and $Var(lnN) = 0.38$ while $Var(lnW_f) = 3.16$. Only about 18% of the variance of sons' wealth is explained by the wealth of fathers and the number of siblings. The other 82% is random.

The amount of wealth that each son inherits can be estimated as

$$\min(W_s, \frac{2W_f}{N}(1+r)^T)$$

This is assuming each father divides up wealth bequeaths equal amounts to all children, and that mating is perfectly assortative so that sons receive an equal bequest from their fathers-in-law through their wives. This assumption is made to ensure that the total of bequests by fathers equals the total of bequests received by sons.

It is also assuming that the son receives no bequests from unmarried uncles, aunts or cousins. Thus this sets a lower bound estimate of the role of bequests in wealth, as opposed to the upper bound in the previous estimate.[9]

T is the gap in years between the death of fathers and sons, in which time the bequest, if all saved, would accumulate at the rate rate of return on capital, r.[10] In this sample *T* averages just 23 years, while from the timing of male marriages we would expect this value to be 30 years on average. However, fathers who have children are a select group that die at later ages on average than men in general of their generation, since to get married implies living to 27 typically. Also a man who has 12 surviving children would typically have to live to age 51 or greater. This implies that the share of wealth inherited will be

$$\min(1, \frac{2W_f}{NW_s}(1+r)^T)$$

Thus the estimated share of wealth inherited will depend on the wealth of fathers and sons, as well as the numbers of siblings and the time interval between the death of fathers and sons.

Piketty would have the return on capital be of the order of 5%, but as noted above there are strong arguments that such a return is too high for England in 1858-1914. This return for Piketty is calculated by counting all rents paid to capital as a return only on capital ownership. But many such rents will instead reflect payments for the entrepreneurial and managerial abilities of capital owners. For passive investors the return on capital was much less. Thus in England in these years the real rate of return on safe assets such as long term government debt was only around 3%. So in the exercise here we assume only a 3% return on capital. But we also consider what the implied importance of inheritance would be if we accepted the Piketty assumption of a constant 5% return on capital.

[9] In refinements we will try and model these flows also, since whatever assumption is made about their distribution, they will increase the role of inheritance in wealth.

[10] This assumes that the bequest through the wife is received at the same time as that from the father. Since we do not have evidence on the date of death of wives' fathers we make this assumption for convenience.

To simulate this process we first construct a large sample of wealth from the probate registry for deaths 1858-1914.[11] This serves as the sample of fathers' wealth. We assign randomly to fathers a number of children N, which has the same mean and variance of actual child numbers for our rare surname sample, and a time between death of father and death of son, which again matches the characteristics of the observed rare surname sample.[12]

The above allows us to simulate, using equation (3), the wealth characteristics of sons who had fathers who were probated. For each father we generate a hypothetical son with wealth

$$lnW_s = 4.94 + 0.41lnW_f - 0.31lnN + u$$

where u is a normally distributed random variable with a variance chosen to make the variance of sons' log wealth equal to that of fathers'.

Table 7 shows some examples of the simulated data. From this simulation we can calculate the total bequeathed wealth of the son generation, as well as the total implied wealth.

There are also sons probated, however, whose father was not probated. For fathers and sons both dying in the interval 1858-1914, 10% of sons of fathers without a probate were probated, with an average probate value of £1,035. In 1858-1914 13.5% of adults were probated. Based on poorer families for 1858-1914 58.2% of probates were male, so the male rate of probate would be 15.7%. So sons probated without their father being probated would constitute 8.43% of adult males, or 0.537 of probated males. All their wealth would be fresh wealth. The range in values for the 17 cases where we observe a son probated without the father being probated was £43-£5,996. So we use a sample of probates of £6,000 or less, 1858-1914, to simulate this set of son probates.[13]

[11] This sample would ideally be for men only, but is currently for both men and women.
[12] There is no correlation for marriages commenced before 1880 between family wealth and numbers of surviving children.
[13] Since all this wealth is assumed new, we do not have to simulate the numbers of children in these families, or the time interval between father and son deaths.

Table 7: Example of Simulated Wealth Inheritance

Wealth Father (£)	N children	Gap in Years	Wealth Son	Potential Inherited Wealth	Actual Inherited Wealth	Share Inherited
19,856	1	22	13,185	76,834	13,185	1.00
19,797	2	36	292	58,296	292	1.00
19,521	2	14	18,741	29,710	18,741	1.00
19,453	8	-3	1,533	4,445	1,533	1.00
19,429	8	11	9,825	6,756	6,756	0.69
19,414	9	31	27,102	10,934	10,934	0.40
19,346	10	-3	4,279	3,536	3,536	0.83
19,236	9	4	21,800	4,820	4,820	0.22
19,234	10	-5	14,836	3,311	3,311	0.22
19,226	10	-5	3,229	3,310	3,229	1.00

From this simulation what is the average share of inherited wealth, 1858-1914? The answer is very low. If we assume a 3% rate of return on capital then only 18% of wealth at death was inherited. Even if we assume a 5% rate of return on capital the share of wealth inherited is estimated at only 28%. This, however, is very much a lower bound estimate, since unexpectedly wealthy sons could have acquired that wealth from collateral inheritance, or from their wife's inheritance. But it is offered here to show that there is nothing in the actual data on wealth at death that contradicts the contention above that less than half of wealth at death is inherited.

Why is the share inherited so low? The crucial thing here is the randomness of father and son wealth. Many sons get large bequests but spend them so that this flow of inherited wealth dissipates. We saw above that this is systematically the case for sons from smaller families. And many sons have estimated bequests, even when

capitalized at 5%, well below their wealth at death. Again we saw above that this is common for sons from larger families. The dissipaters have to be counterbalanced by fresh accumulators of wealth to maintain the variance of wealth.

So while Piketty, Postel Vinay and Rosenthal present a picture of a society where wealth is determined largely by inheritance in the years before 1914, for England we have clear evidence that even among the wealthy, father's wealth and family size alone explain less than a quarter of the variance in wealth across the next generation. Shocks, in the form of how much of inheritances children choose to consume, and how much wealth is created *de novo,* are the main determinants of wealth at death as opposed to blind, mechanical forces of inheritance. Now some of what looks like shocks may be inheritances from family members other than fathers, so this simulation will be very much a lower bound estimate of the importance of inherited wealth. But we see above that even for late nineteenth century England, where Piketty would expect 80-90% of wealth to be inherited, the share is instead somewhere between 18% and 48%.

Conclusions

We estimate from surname lineages that as an upper bound for England that on average 1890-2012 at maximum only 43% of the capital stock in any generation derived from inheritance, with 57% created de novo. This result is observed in a sample of families where there is stronger than expected multigenerational persistence of wealth, so it is not a product of an unusually wealth-mobile set of families.

Since there is no economic theory of this wealth creation process, its future dynamics are inherently unpredictable. Will it, for example, be more important in societies with rapid economic growth, so that the growth rate will be a predictor of the importance of wealth in a society? Will it be more important under some institutional structures, which allow innovators to capture more of the rents of their innovations, than under more open market conditions? Capitalism in the 21st century may have many surprises in store for us, or it may look very much like capitalism of the nineteenth and twentieth centuries.

But there is nothing in English history 1858-2012 to suggest that wealth inheritance itself explains most of current wealth. In all periods wealth creation *de novo* accounts for most wealth. Yet this is consistent with the tendency to create wealth to also be inherited within family lineages.

Sources:

Atkinson, A. B. 2013. "Wealth and Inheritance in Britain from 1896 to the Present." Centre for Analysis of Social Exclusion, London School of Economics.

Clark, Gregory. 2010. "The Macroeconomic Aggregates for England, 1209-2008." *Research in Economic History*, *27*: 51-140.

Clark, Gregory. 2007. *A Farewell to Alms: A Brief Economic History of the World.* Princeton: Princeton University Press.

Clark, Gregory. 1998. "Land Hunger: Land as a Commodity and as a Status Good in England, 1500-1910," *Explorations in Economic History, 35*(1): 59-82.

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

Clark, Gregory and Neil Cummins. 2014. "Inequality and Social Mobility, 1700-1870." In *The Cambridge Economic History of Modern England*, Vol 1. eds. Roderick Floud and Jane Humphries. Cambridge: Cambridge University Press.

Clark, Gregory, Neil Cummins et al.. 2014. *The Son Also Rises: Surnames and the History of Social Mobility*. Princeton: Princeton University Press.

England and Wales, Index to Wills and Administrations, 1858-2012. Principal Probate Registry, London (available online 1858-1966 at Ancestry.co.uk).

HMRC, 2004. "Inheritance tax: Distribution of the value of bequests by sex and marital status of deceased and relationship to beneficiary, deaths 2000-01." http://webarchive.nationalarchives.gov.uk/20060213225216/http:/hmrc.gov.uk/stats/inheritance_tax/table12_9.pdf

Janssen, N, Nolan, C and Thomas, R. 2002. 'Money, debt and prices in the United Kingdom', *Economica*, 69(275): 461-79.

Karagiannaki, Eleni. 2011a. "Recent trends in the size and the distribution of inherited wealth in the UK", CASE paper 146, London School of Economics.

Karagiannaki, Eleni. 2011b. "The impact of inheritance on the distribution of wealth: Evidence from the UK", CASE paper 148, London School of Economics.

Karagiannaki, Eleni. 2011c. "The magnitude and correlates of inter-vivos transfers in the UK", CASE paper 151, London School of Economics.

Mitchell, Brian R. 1988. *British Historical Statistics*. Cambridge: Cambridge University Press.

Piketty, Thomas. 2014. *Capital in the 21st Century*. Harvard: Harvard University Press.

Piketty, Thomas, Gilles Postel-Vinay, and Jean-Laurent Rosenthal. 2006. "Wealth Concentration in a Developing Economy: Paris and France, 1807-1994." *American Economic Review,* 96 (1): 236-56.

Piketty, Thomas, Gilles Postel-Vinay, and Jean-Laurent Rosenthal. 2007. "The increased concentration of wealth in Paris 1807-1912; of Revolution and Demography."

Piketty, Thomas, Gilles Postel-Vinay, and Jean-Laurent Rosenthal. 2011. "Inherited vs Self-Made Wealth: Theory & Evidence from a Rentier Society." Paris School of Economics, working paper.

Prerogative Court of Canterbury and Related Probate Jurisdictions: Probate Act Books. The National Archives, Kew, London.

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

Appendix

Construction of the Rich Surname Sample

Rare surname samples were created from surnames held by 40 or fewer people in 1881, where there was at least one adult death in 1858-1887. Surnames were designated as rich based on average wealth at death, estimated as personalty in these years, of all those 21 and above with a surname dying in these 30 years. Personalty is all property other than real estate. In this period on average only 15 percent of adults in England had their estates probated after death. The value of the other 85 percent mostly fell below the minimum estate value of £10 at which probate was required.

We identified candidate rare surnames in a number of ways. For the rich and prosperous samples we checked the probate records in 1858-61 looking for rare surnames with high probate values. We also checked rare surnames from Rubinstein's list of the very rich dying 1810-1839 (Rubinstein (2009)).

The list of these surnames is: Agace, Agar-Ellis, Aglen,, Ahmuty, Allecock, Aloof, Alsager, Angerstein, Appold, Auriol, Bagnold, Bailward, Basevi, Bazalgette, Beague, Benthall, Berens, Beridge, Berners, Berthon, Bigge, Blegborough, Blicke, Boger, Bouwens, Braikenridge, Brandram, Brettingham, Brideoake, Brightwen, Broadmead, Broderip, Brouncker, Brudenell-Bruce, Brune, Brunel, Bulteel, Burmester, Burrard, Buttanshaw, Calrow, Cankrien, Carbonell, Cazalet, Cazenove, Champernowne, Champion-De Crespigny, Chaplyn, Chatteris, Clagett, Claypon, Cleoburey, Cludde, Coape, Colfox, Colvile, Conduitt, Conyngham, Cookney, Cornwallis, Coryton, Cotesworth, Cothay, Courtauld, Creyke, Croasdaile, Crokat, Cruso, Cruttwell, Daukes, Daubuz, D'aubuz, De Gatacre, De Grey, De Lousada, Dilke, Du Boulay, Du Cane, Elmsall, Faulconer, Favre, Fector, Filder, Fludyer, Garle, Gatacre, Gaussen, Goodford, Goodhart, Grazebrook, Greame, Grimshawe, Haldimand, Haselfoot, Hecker, Heneage, Hetley, Hilhouse, Holbech, Hollwey, Hugonin, Jeakes, Jervoise, Knowlys, Labouchere, Lamotte, Lane-Fox, Lechmere, Legrew, Leir, Leschallas, Leveson-Gower, Leycester, Lillingston, Linzee, Loddiges, Lombe, Lousada, Lucena, Lutyens, Magenis, Manners-Sutton, Marryat, Merceron, Merewether, Methold, Meux, Micklethwait, Mildmay, Minet, Monins, Montefiore, Morier, Musters, Nedham, Nottidge, Novelli, Oliverson, Oglander, Orred, Papillon, Penoyre, Penrhyn, Pepys, Perigal, Perryn, Pickmere, Pigou, Poulett, Proby, Puget,

Pulteney, Reynardson, Rothschild, Roupell, Rusbridger, Rushout, Sapte, Senhouse, Severne, Sich, Skipwith, Sotheby, Strangways, Streatfeild, Taddy, Teissier, Thellusson, Thoroton, Thoyts, Trebeck, Trelawny, Tunno, Tyssen, Uppleby, Usticke, Uthwatt, Vansittart, Villebois, Watlington, Weguelin, Weyland, Willoughby De Broke, Willyams.