Inherited wealth over the path of development: Sweden, 1810–2010*

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Abstract

In this article we estimate the long-run evolution of inheritance flows in Sweden and try to explain its main characteristics. We find that the annual flow of inherited wealth represented about 12 percent of national income throughout the 19th century. This share decreased to about half by 1950, mainly due to the rapid income growth following industrialization. In the very recent decades, inheritances have again become more important and this increase relates to the very rapid build-up of private wealth in relation to income since the 1980s. As much of this is yet to be passed on to younger generations, the share of inheritance is likely to grow in the coming decades. We compare inheritance flows in Sweden to those in France and the U.K. All three countries display similar U-shaped patterns over the long run. The levels, however, differ, especially in the 19th century when inheritance played a much smaller role in Sweden than in France or the U.K. We show that this is primarily due to a much lower wealth-income ratio in Sweden, largely driven by a relatively low value of agricultural land in pre-industrial Sweden. Interestingly, Sweden is in this sense much more similar to the U.S. than to other countries in "Old Europe"

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1. Introduction

Every generation either accumulates new wealth or inherits old wealth accumulated in the past. Depending on the relative importance of old and new wealth, the ratio between inheritance and income is also likely to be different. It is commonly assumed that in modern societies, where human capital has become increasingly important, inheritance will have a diminishing role in determining the wealth of each generation.

However, as the seminal study of Piketty (2011) shows, this is not likely to be the case in theory, and it is certainly not empirically true for France where the annual flow of inherited wealth as a share of national income fell from around 20 percent in the 19th century to 5 percent in the 1950s, but has increased in recent decades. Inheritance flows are likely to reach levels comparable to those observed in 19th century by 2050 according to his simulations. Recent work by Atkinson (2012) shows that the level and time-series profile for inheritance flows in the U.K. are fairly similar to those in France since the late 1800s.

In this paper we estimate the ratio of annual inheritance flows to national income in Sweden during the period 1810–2010. Over these two hundred years Sweden moved from being a poor agricultural country, over a relatively late but rapid industrialization in the end of the 19th century, to becoming one of the world's richest nations by the middle of the 20th century. During this period Sweden also developed the world's most extensive welfare state in which the government provides many of the things that individuals in most other countries save for privately. Studying the case of Sweden is therefore not only important in its own right but also for understanding the dynamics of private capital accumulation and the role of inherited wealth in a small and late-industrializing economy.

Some of the issues we address are: What has been the role of inheritance in Sweden over this development path? Was Sweden different or similar to France and the U.K. in the 19th century or was past wealth relatively less important in pre-industrial Sweden? Has it developed differently over the 20th century along with the expansion of the welfare state? Are inheritance flows today increasing in Sweden or is inheritance less important as government involvement is more extensive?

We find that the share of inheritance to national income in Sweden was relatively stable at

around 12 percent throughout the 19th century. As economic growth accelerated, starting in the end of the 19th century, inheritance flows decreased in importance to levels around 6 percent by 1950. Starting in the 1980s the share of inheritance has increased, largely as a consequence of a rapidly increasing ratio of private wealth to national income. These developments are presented in Figure 1.

[Figure 1 about here]

Comparing our results for Sweden to those for France in Piketty (2011) and those for the U.K. in Atkinson (2012) reveals striking differences as well as similarities. In short, Sweden displays a U-shaped pattern over time similar to those in France and the U.K., with relatively a high ratio of inheritance to national income in the 19th century, a falling ratio in the first half of the 20th century, and an increase from the 1980s until today. The levels, however, differ, especially in the 19th century. Whereas the inheritance flow in relation to national income was above 20 percent in France until around 1900 (and at that time also was about 20 percent in the U.K.) the corresponding figure in our main series for Sweden is about 12 percent throughout the 19th century.

The most important contributor to this difference is the low private wealth-national income ratio in Sweden. The wealth-income ratio stood around 600–700 percent in 19th century France and the U.K., while it varied between 300 and 500 percent in Sweden, making Sweden look more like the U.S. in this respect.[1] Even if Sweden was sparsely populated it is, however, unlikely that the low wealth-income ratio was due to a "land-abundance effect" as in the new world. Rather the relatively small Swedish private wealth reflects lower levels of accumulated investments in relation to economic and population growth. Consequently, 19th century Sweden became a country where old wealth was relatively less important in relation to the possibilities to create new wealth as compared to France and the U.K.

During the beginning of the 20th century, by contrast, similarities start dominating the differences between the countries. Sweden – like France and the U.K. – experiences a decrease in the importance of inheritance. By 1950–1960 the inheritance-income ratio had almost con-

[1] Piketty and Zucman (2013) have calculated private wealth/national income ratios for France, Germany, U.K., and the U.S. for the period 1700–2010 and find that in Europe pre-1900 the ratio was 600–700 percent while it in the more land abundant U.S. was around 400 percent.

verged across France, the U.K. and Sweden at levels around 5–6 percent. Given the much lower initial Swedish level, the decrease was less dramatic than in the two other countries. The main contributor to this development in the case of Sweden was the high economic growth rate in this period. The average annual growth rate during the period 1820–1870 was below 1 percent, while it during the period 1870–1970 was well above 2 percent (and close to 3 percent 1920–1975).

It is possible to interpret the observed patterns along the lines of the well-known Harrod-Domar-Solow macroeconomic growth model. It shows that the long run wealth-income ratio is equal to the net savings rate divided by the income growth rate. A doubling of the growth rate implies that the wealth-income ratio is divided by two, at an unchanged savings rate.[2] This, in turn, implies that differences in growth alone would be enough to explain the decreased inheritance flow in the first half of the 20th century in Sweden. Creation of new wealth dominated the returns to old wealth and the role of inheritance decreased. Over the past decades (since around 1980) the inheritance-income ratio has increased in all three countries. This increase, however, appears to have been less dramatic in Sweden, at least when comparing to France. Most, but not all, of this comes from a difference in wealth-income ratios.

The rest of the paper is structured as follows. In Section 2 we discuss the available data in Sweden and show how these are used to arrive at different estimates of inheritance flows over time. In Section 3 we try to understand the results by way of decomposing them according to the relative impact of changes in mortality, wealth-income ratio, and the ratio between the average wealth of the deceased and average wealth of the living. Given the nature of the data and the assumptions needed to arrive at our series we also run a number of robustness checks reported in Section 4. In Section 5 we compare our findings for Sweden with those of the other countries for which we have data and also make a decomposition of the difference according to how much can be explained by differences in mortality, wealth-income ratios, and the ratio of average wealth of the deceased to the average wealth of the living, respectively. We also try to interpret these differences in light of what is known about Sweden's economic development over the period. Section 6 concludes.

[2] See Piketty and Zucman (2013) for a thorough discussion.

2. Data, methodology, and basic results

The main statistic that we wish to estimate is the annual flow of aggregate inheritances in relation to total income. By "inheritance" we mean the annual total market value of all real and financial tangible assets less financial debt that is passed on at death or transferred as *inter vivos* gifts. Our preferred measure of "total income" is national income.[3] The ratio of inheritance to income for a given year captures the relation between old wealth passed on from previous generations to the income base for accumulating new wealth generated in the economy the same year.

In principle, there are two ways in which the inheritance-income ratio can be estimated. One is to use the relationship between total private wealth and national income, the average wealth of those who pass away in a given year in relation to the average wealth held by the living, and the mortality rate. This relationship will be called the "economic inheritance flow". The other is based on observing how much is actually passed on as inheritance using data on estates. This will be called the "fiscal inheritance flow".

Our main series, calculated annually for the period 1810–2010, is based on the economic flow approach, and is presented in the following subsection. The fiscal flow estimates, presented in subsection 2.2, rely on less frequent data but we will nonetheless present our best estimate of this flow. Given that the available data never corresponds to the theoretical ideal we will extensively discuss the various adjustments made.

2.1 Economic inheritance flow

When estimating the "economic flow" of aggregate inheritance in Sweden, we follow the same basic accounting framework as that developed in Piketty (2011). The exact empirical strategy, however, differs somewhat from Piketty's approach for France because of the different nature of the Swedish data. Broadly speaking the main difference lies in that data on estate tax returns is much less frequent in the case of Sweden. We instead have to rely more on

[3] An alternative income concept would be disposable income, i.e., national income net of taxes and transfers. Using national income or disposable income is of some quantitative importance given the rise of government involvement over the 20th century (we show this in more detail in the appendix), but, as pointed out by Piketty (2010, p. 2) which one is to be preferred ultimately depends on perspective. We are concerned with the ratio of "old" to "new" wealth amongst individuals and one could therefore argue that disposable income is best. However, this would be assuming that government expenditures are useless to individuals. If one views government spending as mostly a substitute for things that individuals would otherwise have had to save and pay at least the same for on the market, then national income seems the better choice.

wealth tax returns (i.e., wealth among the living) and use data on estates as more of a supplement.

If all intergenerational wealth transmission occurred at death (i.e., if there were no *inter vivos* gifts) then we would not need estate data at all to calculate the inheritance flow since we could get this by applying the following formula:

$$\frac{B}{Y} = m \cdot \mu \cdot \frac{W}{Y} = m \cdot \mu \cdot \beta \ . \quad (1)$$

In equation (1), B is the annual inheritance flow, Y is the national income, W is the aggregate net personal wealth, m is the annual population mortality rate, μ is the ratio between average wealth of the deceased and average wealth of the living, and β is the aggregate wealth-income ratio. Since we wish to include all intergenerational wealth transfers each year, also including *inter vivos* gifts transferred during the donor's lifetime, we will use a gift-corrected μ ratio denoted μ^*. The gift-corrected inheritance flow thus becomes:

$$\frac{B}{Y} = m \cdot \mu^* \cdot \beta \ . \quad (2)$$

As a measure of Y we use *national income*, defined as the gross domestic product less capital depreciation plus net foreign income. Data on GDP by activity and capital depreciation rates come from Edvinsson (2005, 2014) and data on net foreign income come from Statistics Sweden's statistical yearbooks and estimates for the earlier historical period (see the appendix for a detailed description of the sources). An alternative income concept to use is *disposable income*, i.e., national income net of taxes and transfers. Using national income or disposable income is of some quantitative importance given the rise of government involvement over the 20th century (we show this in more detail in the appendix), but which one is to be preferred ultimately depends on perspective. We are concerned with the ratio of "old" to "new" wealth amongst individuals and one could therefore argue that disposable income is best. However, this would be assuming that government expenditures are useless to individuals. If one views government spending as mostly a substitute for things that individuals would otherwise have had to save and pay at least the same for on the market, then national income seems the better choice.

Data on population mortality m are available for all years during 1810–2010 in the Human Mortality Database (see Appendix Mortality for details about data and calculations).[4] Specifically, for each age a we observe the number of adult deaths M_a and the number of living adults N_a.[5] Age-specific mortality rates is then computed as $m_a = M_a/N_a$ and the population mortality rate equals $m = \sum_a M_a/N_a$.

Personal sector net wealth, W, comes from Waldenström and Ohlsson (2013), which presents a newly constructed annual database over the aggregate market-valued balance sheet of the Swedish household sector in the period 1810–2010. These data follow the main principles of the System of Historical Accounts, with a few minor adjustments so as to follow the historical wealth aggregates recently generated by Piketty and Zucman (2013). Specifically, non-financial assets contain of two main components: produced assets (buildings and constructions, inventories) and non-produced assets (agricultural land including timber tracts, other land). Consumer durables are not included in non-financial assets since the expenditures on them are counted as consumption and not investment in the national accounts.[6] Financial assets contain currency, bank deposits, equity in incorporated and unincorporated businesses, bonds, interpersonal claims, and insurance savings. Liabilities consist of loans taken from different sectors and actors. Informal borrowing (from local merchants or other households) was dominant in the 19th century whereas formal credit market loans became the rule relatively soon into the 20th century. Household liabilities are predominantly associated with financial sector lending, but since the mid-20th century there is also quite some state lending going to higher education and private housing. In Section 5 below we present some evidence on the role of the composition of Swedish household wealth stock and compare this with some other Western countries.

The parameter μ^* is defined as the gift-corrected ratio of average wealth of the deceased $\bar{W}_d$ to the average wealth of the living $\bar{W}_l$. It is arguably the most difficult parameter to attain in equation (2). Unlike the case of France where wealth of the deceased is observed directly

[4] The HMD database (www.mortality.com) is constructed by demography researchers from different countries and made freely available to other researchers.
[5] Throughout we are for obvious reasons concerned only with the adult population.
[6] Historically, excluding consumer durable goods is highly questionable as they were important parts of household economies in broad layers of the population. Waldenström (2013) presents a series for the stock of consumer durables which shows that they have represented between 10 and 20 percent of total non-financial assets.

through large samples of estates alongside reported stream of taxable gifts, the Swedish μ is constructed using historical evidence on age-wealth profiles in the living population combined with age-specific mortality rates (adjusted for differences across social classes) as follows:

$$\mu = \frac{\bar{W}_d}{\bar{W}_l} = \sum_a \frac{M_a}{M} \left(\frac{\bar{W}_{l,a}}{\bar{W}_l} \right) . \quad (3)$$

Key in equation (3) is that we can compute the trickiest parameter, the average wealth of the deceased $\bar{W}_d$, by combining observed information about the average wealth of living individuals at age a, $\bar{W}_{l,a}$, and information about death rates both at specific ages, M_a and for the whole population M. Altogether we get an age-specific average wealth of the deceased equal to $\bar{W}_{d,a} = (M_a \cdot \bar{W}_{l,a})/M$, which yields the population μ when summed over a. We call this approach the *inverse mortality multiplier method* (IMMM), with reference to the common mortality multiplier method; instead of multiplying the wealth of the deceased by inverse mortality rates we multiply the wealth of the living by the morality rates.

Since the wealthy live longer than the poor, we need to adjust the observed death rates for the different mortality rates across social classes. If we do not do this adjustment, we will ascribe too high death rates to the wealthy individuals and this would generate too large inheritances. To remedy this, we use a similar approach as Piketty (2011) in which we separate between two broad groups in the population: "the rich" (i.e., the ones owning most of private wealth and having markedly lower mortality rates than the rest of the population) and "the rest" (i.e., those owning a small share of all private wealth and having higher mortality rates than the rich). This correction results in a differential mortality-adjusted estimate of the average wealth of the deceased. Data on historical social mortality differentials in Sweden are scarce, but some evidence does exist. Among the earliest reports are those for the early 1900's presented in Flodström (1910) whereas Bengtsson and Dribe (2011) present evidence covering almost the full time span of our analysis (for details about our methodology, sources and references, see the Appendix "Mortality").

Furthermore, historical evidence on actual age-wealth distributions in Sweden is used. We assemble all information know to us from Censuses and previous scholarly work about the average wealth of Swedes at different age classes, $\bar{W}_{l,a}$, yielding a database with age-wealth

distributions in nine different periods between the 1840s and the mid-1960s and annually since 1968 in administrative tax records.[7] These observations are described in detail in Appendix "Age-Wealth".[8] Our aim is to compute regular, and ideally yearly, observations of μ^* over the period 1810–2010, as opposed to the few points in time for which we observe the age-wealth profiles. Recall that the historical demographical data gives us annual observations of M_a/M, and from equation (3) we thus only require a yearly $\bar{W}_{l,a}/\bar{W}$ to get a yearly series of μ. Our solution is to simulate the historical age-wealth profiles by using fitted values from linear regressions where the ratio $\bar{W}_{l,a}/\bar{W}$ is regressed on a set of age and year polynomials:

$$\left(\frac{\bar{W}_{l,a}}{\bar{W}_l}\right)_t = b_0 + b_j \sum_{j=1}^{4} Age_{a,t}^{j} + c_j Year_t + d(Age_a * Year_t) \quad (4)$$

The fitted values from the regressions of equation (4) are inserted into equation (3), yielding the parameter of interest, $\hat{\mu} = \sum_a \left[(M_a/M)/(\widehat{\bar{W}_{l,a}/\bar{W}_l})\right]$. In addition to this main approach, we also present a robustness calculation of μ^* for the dozen of years when we directly observe the wealth distribution over age, i.e., where we do not use the fitted values for the age-specific ratio of the average wealth of the deceased to the average wealth of the living but instead the ratio calculated for the specific year. The result of this calculation is shown in the sensitivity analysis in section 4 below.

Gift correction, finally, allows us to go from μ to the parameter of interest, μ^*. This means that we correct for the unobserved flow of *inter vivos* gifts from the deceased to their heirs made before the time of death. This is done by scaling up the estimated inheritance flow by a gift correction-factor. This factor computed using data of Ohlsson (2011), which reports about annual tax revenue from inheritances and estates 1884–2004, and about annual gift tax revenues 1915–2004. The relationship between gift tax revenue and inheritance/estate tax revenue tells us something about the order of magnitude of gifts in relation to other inheritances. We observe fiscal inheritance flows in a number of years during 1873–1967, for which gift cor-

[7] Note that this yields comparable wealth concepts in $\bar{W}_d$ and $\bar{W}_l$. Specifically, we cannot use the aggregate private wealth W divided by the adult population for estimating $\bar{W}_l$ since the aggregate private wealth is both market-valued and consists of items not always included in the tax-based wealth concepts used in the age-wealth distributions reported by the Censuses or estate tax return-based 19th century estimates.

[8] Specifically, the historical sources (before 1968) report the wealth of people divided into between four and 13 age classes. All sources are based on the entire Swedish adult population except for our data from the 19th century which is based on a rich estate sample of deceased in a Southern parish (Perlinge, 2003). See the appendix for a detailed description of all historical age-wealth distributions.

rections are in the order of 4–14 percent. For the most recent years, 2002–2004, data on the total taxable gift amounts are close to 20 percent of the aggregate estate values (see further the Appendix "Fiscal flow").[9] This figure is supported by survey evidence reported in Nordblom and Ohlsson (2011). The 1998 wave of the "Household market and nonmarket activities" survey (HUS) has answers from close to 3,000 individuals about *inter vivos* gifts and inheritances received. These suggest that gifts are about 20 percent of the inheritance amount. In addition to the gift correction there are considerable amounts transferred from decedents to heirs via insurance arrangements that, for the most part, do not show up in estate inventory reports. A new Swedish administrative inheritance tax register database (Belinda) provides us with a lower bound for how important insurance was for wealth transfers from decedents to heirs in 2002–2005. Taxable insurance benefits to heirs motivate a correction in the order of 2 percent for these years.

2.2 Fiscal flow estimates

As a contrast to our findings on the transmission of wealth from decedents to heirs based on the economic flow we look at evidence from the fiscal flow measured as the direct transfers from decedents to heirs. As data on direct estates are more scattered than those needed to calculate the economic flow estimates we view this mainly as a robustness-check of the previous findings. Appendix "Fiscal flow" contains more details about Swedish estate tax data and exactly how we deal with each source of information.

Even if it has been compulsory to file estate inventory reports (or probate records) in Sweden since 1734 there are very few statistical compilations of these.[10] In our search for previous aggregations of the estate and inheritance we have found the following: In an early publication by the Finance ministry (Ministry of Finance, 1879) aggregate values of estates 1873–1877 are reported; as part of a series of empirical studies of economic variables in the beginning of the 1900s (*Finansstatistiska utredningar*) the Finance ministry published a detailed

[9] The background for the Belinda databases is as follows: Statistics Sweden was commissioned to organize data on intergenerational transfers (estates, inheritances, taxable gifts during the previous ten years, and insurance payments) using the *Inheritance Tax Register* of the Swedish Tax Agency as a starting point. Three data sets have been produced: The first dataset has basic data on assets, debts, and net wealth for all deceased during the period 2002–2004. The second dataset has data on all taxable gifts during the period 2002–2004. Finally, the third dataset has detailed balance sheets at death in 2004 and 2005 for representative samples.

[10] The historical reports are kept by local courts and in regional archives. In 2001 the responsibility was moved to the Swedish Tax Agency, which now registers all estate reports in the Inheritance Tax Register but as the inheritance tax has been abolished this database is, unfortunately, incomplete with respect to economic variables after 2005.

account of estate reports for the years 1906–1908 (Ministry of Finance, 1910b) and one on inheritances for the same years (Ministry of Finance, 1910a); an official government commission on taxation, SOU 1946:79, *Statsskatteberedningen*, contains aggregate data on estate inventory reports for the years 1943–1944; the official government commission on inheritance tax, SOU 1957:48, *Arvsskattesakkunniga,* published similar data for the year 1954/55, and yet another official government commission on capital taxes, SOU 1969:54, *Kapitalskatteberedningen*, did a very ambitious study of estate inventory reports registered in 1967; and finally there is the recent Belinda database which gives detailed information on bequests and taxable gifts for the years 2002–2005. Taken together this allows us to estimate direct inheritance flows for these years.

Like for the economic flow it is important to add gifts to the direct inheritance to capture the full intergenerational transfer of real and financial assets. We use the same gift correction procedure as explained above, increasing the total by between 4 and 20 percent.

Figure 2 shows the resulting result for our measure of the fiscal flow. It is clear from the figure that the fiscal flow was close to the economic flow during the 1870s and the 1900s. The fiscal flow became considerably smaller than the economic flow during the 1940s, the 1950s, and the 1960s. Our latest observations suggest that the fiscal flow has increased the last decades. The fiscal flow is, however, still much smaller than the economic flow.

[Figure 2 about here]

What can explain the large discrepancy between the two from 1940s and on? Broadly speaking the gap can be interpreted as a measure of tax avoidance and evasion, and other measurement errors. The tax non-compliance interpretation is supported by the fact that the early observations (1873–1877, and 1906–1908) are similar for the economic flow and fiscal flow estimates, while the later observations in the 1940s to 1960s, when taxes were much higher, show larger differences. That tax planning was an issue already in the 1940s is clearly visible in a massive spike in gifts in 1947 when increased inheritance tax was about to be implemented in the following year (see Ohlsson, 2011 and Appendix "Fiscal Flow" for details). The most recent estate based observations 2002–2005 also show large differences. This could also be due to tax reasons even if 2005 was the year when inheritance tax was repealed. Non-taxable gifts and non-taxable insurance benefits may also be part of the difference, in particu-

lar in the most recent years when private insurance has grown in importance.

3. What drives the development of inheritance flows in Sweden

Having explained how we arrive at our basic series we now move towards understanding what lies behind the development of inheritance flows over time. One simple way of doing so is to decompose the economic inheritance flow according to the relative impact of changes in wealth-income ratio, mortality, and the ratio between the average wealth of the deceased and average wealth of the living. The section ends with a decomposition table showing the relative contribution of each component to the observed inheritance flow.

3.1 Development of private wealth to national income

Figure 3 shows the development of the wealth-income ratio, β, in Sweden during the two hundred year-period 1810–2010. The ratio hovers around 300–400 percent in the pre-industrialization period. Economic growth in this period was slow, below one percent. This was also a period with relatively low levels of investment and international capital market integration played a small role. The period from 1870 onwards is often described as the beginning of the industrial revolution in Sweden. In terms of the wealth-income ratio, this is also a period when the capital stock expands faster than the economy grows; average compounded annual GDP growth was around 2.8 percent 1850–1900 whereas average compounded annual growth in private net wealth was 3.2 percent in the same period. As a result, β grew to about 500–550 percent in the beginning of the 20th century.

[Figure 3 about here]

Which wealth components can account for the rise in W and β? Waldenström and Ohlsson (2013) shows that the rise in β between 1850 and 1880 was primarily due to increased values of dwellings (in towns and the country side) and agricultural land, but that later increases were mainly due to a secular increase in financial assets, particularly bank savings and the emergence of corporate equity. This development thus reflects the monetization of the Swedish economy, when salaries were increasingly paid in money terms and the financial system became large enough to also serve normal households (see Schön, 2012).

In section 5 we compare this development with the corresponding developments in France, the U.K. and the U.S. The main message is that the Swedish β was notably lower than those in France and the U.K. But if Sweden had a relatively low wealth-income ratio by mid-19th century, how can we explain the contemporaneous rise of capital-intensive industries and infrastructural investments? Swedish economic historians have debated the question about who financed Sweden's industrialization, some arguing that it was primarily domestic private finance and, in particular, domestic bank lending (Gårdlund, 1942), while others emphasize the role of foreign capital imports (see Schön, 1993). In particular, those arguing for the role of foreign finance claim that even though Swedish banks indeed did lend money to Swedish industrial corporations (as pointed out but the proponents for the domestic private finance channel), Swedish banks were in turn capitalized by foreign loans. Furthermore, because the Swedish government borrowed abroad to fund the crucial expansion of the country's infrastructure, primarily the establishment of a railway network, there remained some funds for the private industry to borrow which otherwise may not have been the case.

The new evidence in this paper together with the series of Waldenström and Ohlsson (2013) points at a fairly low private wealth-income ratio in 19th-century Sweden, suggesting an, at best, modest role of private finance. But in the absence of Swedish private wealth, money must have come from either public funds or foreign financiers. Public sector assets were relatively small in the large European economies at this time, ranging between +/–10 percent of national wealth according to recent estimates by Piketty and Zucman (2013). There exists unfortunately no comprehensive historical account of Sweden's public sector wealth, but we have made a tentative calculation made for the 1870s showing the amount of net assets held by the central and local governments which suggests that their share of total national wealth was well in line with the other countries, meaning around seven percent of total national wealth.[11] Looking, finally, at the foreign sector, Schön (1993) estimates a series of Swedish net capital imports from the 1820s, using a method based on comparing the net export and

[11] There exist official balance sheets for both the state and the local governments (municipalities and county councils) in the 19th century, with 1875 being the earliest relatively easily accessible year. Market-valued net assets in 1875 are estimated as follows. The total (book) value of state-owned real estate and financial assets is 270 million SEK (SOS *Statistisk årsbok* 1880), tax-assessed state agricultural and forest dominions were valued at 62 million SEK, and the state debt was 176 million SEK (Fregert and Gustavsson, 2014), making a net tax-assessed/book-value wealth of 156 million SEK. For local governments, net book-value wealth was 57 million SEK in 1875 (Statistics Sweden, 1960, table 250). Note that foreign government debt is (at least to some extent) also included in this amount. Summing state and local government book-valued net wealth makes 213 million SEK, and multiplying this amount by two to get an approximate market value makes 425 million SEK. Total net private wealth in 1875 was 5,441 million SEK. Total national wealth would then be 5,866 (= 5,441 + 425) million SEK, of which about 93 percent was private wealth and 7 percent public wealth.

changes in the foreign exchange reserves at the Swedish Riksbank. There is also a series based on Flodström (1912) on the total value of outstanding Swedish bond loans floated abroad.[12] These data indicate that foreign lending was indeed an important source of finance to Sweden. By the late 1860s, the bond loans issued abroad amounted to 30 percent of national income and in 1900 the share was 70 percent. Gauging the role of foreign capital to Swedish industrialization, however, it is more relevant to relate it to other domestic aggregates. For example, its share of domestic net financial assets was about 70 percent in the entire latter half of the 19th century (Waldenström and Ohlsson, 2013). Perhaps an even more relevant comparison is that with commercial bank lending. This shows that in the mid-19th century the stock of foreign credit was three times the stock of domestic bank loans and in 1900, after some decades of rapid banking expansion, it was one to two times as large.

The wealth-income ratio of the 20th century has a market U-shape, falling from 500 percent of national income to 250 percent of national income from the outbreak of World War I to around 1980. The ratio increases sharply during the following three decades to almost the pre-WWI level by 2010. The overall most important driver of this development was the accelerating growth of the Swedish economy. Average real GDP growth rates rose from around one percent per year in the 19th century to around three percent annually in the 20th century up the mid 1970's (Schön, 2012). The private wealth numerator also did change over the course of the century as shown by the study of Waldenström and Ohlsson (2013). There was no compositional shifty between non-financial and financial assets; they accounted for roughly one half each throughout this period. Within these asset categories, however, there were changes. The value of land, especially non-agricultural land associated with housing, increased steadily over the century whereas the stock of buildings did not increase as much. For financial assets, there were small changes up to around 1980 when there is a dramatic shift in household portfolios from bank deposits to mutual funds (mainly pension insurance savings). Also notable is the postwar public sector expansion that Sweden experienced. Most notably in terms of wealth accumulation, the new public pension system required large buffert funds to create a long-run financial stability of the system. For this reason, social security contributions

[12] Schön's (1993) estimates build upon earlier efforts by Lindahl, Dahlgren and Kock (1937), who used a so-called "indirect method" to measure the total foreign debt. This method calculates net capital imports as the difference between the net export and changes in the foreign exchange reserves of the central bank. Schön adds the costs of the imported capital, using the interest on government bonds as a proxy for the cost of capital. The foreign debt stock is the equal to the accumulated capital imports. An alternative measure is to compile the values of all outstanding bond (and bank) loans of Swedish public and private actors. Using this approach, Fahlbeck (1890) and Flodström (1912) find a series which is not all that different from the series of Schön. Altogether, there is a relatively robust basis for estimating the Swedish capital imports during industrialization.

increased drastically, from only a few percent of gross incomes in the early 1960s to almost 40 percent in the early 1980s. Much of these taxes went to capitalize public pension buffert funds ("AP-fonderna"), who increased from 5 to 30 percent of GDP between 1960 and 1970. Needless to say, this development implied a slower growth in the accumulation of private wealth, contributing to the downward secular postwar trend in the Swedish β.

3.2 Swedish mortality 1810-2010

The second component used to compute aggregate inheritance flows is population mortality. The conventional view of a demographic transition when a country goes from being agrarian to industrialized and later post-industrialized fits the Swedish data fairly well (Bengtsson and Ohlsson, 1993).

As shown by Figure 4, mortality fell from about 30 deaths per thousand inhabitants in 1810 to 20 deaths per thousand a century later and to 10 deaths per thousand in 2010. Annual mortality varied considerably during the 19th century. The mortality spike around 1920 reflects the impact of the Spanish Flu. One notable feature is how the annual variability in mortality has decreased during the 20th century.

Population growth was relatively high during the 19th century, around 0.7 and 0.8 percent annually, as a consequence of the decrease in mortality while fertility rates remained stable throughout the century. The Swedish population size increased from 2.5 million in 1810 to 5 million in the year 1900. By the early 20th century, fertility also started falling and population growth declined markedly.

[Figure 4 about here]

3.3 Average wealth at death in relation to average wealth of the living

Figure 5 shows the ratio of average wealth of the deceased to average wealth of the living. As explained in Section 2, this ratio is the most difficult to estimate given the type of data available to us. Consequently the series, especially for the 19th century, are difficult to interpret. In terms of level and development during the 1800s, we note that the Swedish series are in line

with what Piketty (2011) finds for France.[13] We also note that, like in the French data, in terms of cross-sectional age-wealth profiles these are rising for all observations until the late 1960s. This could, at least in some cases, be an artifact of only observing broad top age groups. Overall, however, clear life-cycle decumulation does not seem to be present until the late 1960s when profiles become hump-shaped.

The decline in the early 1900s, up until the 1930s, is consistent with what Roine and Waldenström (2009) have found in previous research on Swedish wealth concentration. This is a period when tabulations of wealth by income class allow us to differentiate between those with high incomes based on high wealth and high earnings, and to look at the development of their wealth shares over time.[14] The basic pattern that emerges is that the wealth share of high-income individuals increases over this period, in particular in the 1910s and 1930s.[15] In terms of wealth over age profiles relatively younger cohorts are accumulating new wealth while the share of older "rentiers" is declining. Note that in terms of aggregate wealth-income ratios this is a period of decline as growth of new wealth is dominated by income growth.

The upward trend that we observe from the 1930s until the 1980s suggests a break with the earlier period in terms of the relative wealth held by those who pass away compared to the living population. As the aggregate wealth-income ratio continues to decline this suggests that Sweden in this period was an environment where incentives to accumulate private wealth were weak. This was most likely a consequence of anti-capitalist policies (like in France), high taxes on wealth and inheritance, but also due to the build-up of a system where private wealth accumulation for precautionary reasons became seen as less and less important as welfare state programs and the public pension system expanded.

The sharp up-turn around 1980 indicates yet another break in the trend. Over the past 30 years the wealth of the living population has grown faster than the wealth of those who pass away (that is, μ^* decreasing) at the same time as the wealth-income ratio has increased. This is in line with asset values increasing more rapidly than income and these increases largely being

[13] It should be noted that the similarity is referring to the final series used. The trend for France changes when taking gifts into account. For Sweden we simply do not have data to capture any differences in gifts over the 19th century so the correction is basically the same factor throughout this early period based on late 19th century data.

[14] These tabulations are due to income taxes being raised on earned income plus a fraction of wealth held be a household, together forming what was called "taxable income", see Roine and Waldenström (2008).

[15] A pattern that is also in line with Glete (1994) who describes the rise of new corporate owners in the 1910s and the successes of corporate executives in the 1930s.

captured by relatively younger generations (see Roine and Waldenström, 2012). In terms of the impact this has on inheritance flows it seems likely that there is a lagged impact in the sense that values in the living population are still to be passed on to the next generation. Consequently inheritance flows are likely to increase in the future.

[Figure 5 about here]

A somewhat more systematic decomposition of the changes in inheritance flows is shown in Table 1. Specifically, the table presents average annual changes in the inheritance flow and its components across a set of selected historically significant periods. Between 1810s and 1870s (decennial averages are used), the inheritance-income ratio decreased by 0.3 percent annually with this decrease primarily being driven by a drastic mortality drop (–0.5 percent) offset by an increase in the wealth income ratio by 0.4 percent annually. In the end of the 19th century, the inheritance flow leveled and the same appears to have been true for the components which all changed quite little.

Between the 1910s and 1950s, inheritance flows dropped by 1.6 percent each year, and the table shows that this drop was primarily driven by falling mortality and a falling β (which in turn was driven by strong income growth while wealth was stagnating). During early postwar era, inheritance flows changed little, but this reflects the outcome of a falling β being offset by increasing mortality rate and μ^*. Finally, since 1980 the inheritance-income ratio has increased by 1.2 percent annually, and this increase is entirely driven by a soaring wealth-income ratio (increased 2.1 percent each year) while both mortality and the μ^* worked to dampen the overall increase.

[Table 1 about here]

4. Robustness of our results

Measuring aggregate inheritance flows over two centuries raises a number of problems and challenges. In this section we check how sensitive our results are for changes in various data selections or simulation methods used in the computations (further details about these alternative simulations and calculations can be found in the Appendix "Age-Wealth").

The first set of sensitivity analyses concerns the μ^* parameter. Underlying is a concern that the μ^* estimates generated by the simulation approach are systematically biased due to the assumptions about age and year polynomials used in the linear simulation regressions. Figure 6 reports inheritance flows resulting from four alternatives of μ^*. Two of these are based on different simulations, one called "Linear" where no polynomials at all in age or year were used and one called "No trend" where polynomials in age but no time trend were used. Third, we replaced the simulated μ^* by the long-run level of μ^* as reported for France by Piketty (2011).[16] Fourth, we calculated the actual μ^* based on the few historical data points for which we observe age-wealth distributions.

As the figure shows, changing the μ^* does not change the overall time series pattern of Swedish inheritance flows. Our main series is consistently in the middle or at the lower-end among these alternative estimates, suggesting that if anything it may be downward biased. The deviation is large in the 19th century, when the other estimates are 20–50 percent higher, while the 20th century series are closes to each other. The few years of actual observations of μ^* in the end of the 20th century and beginning of the 21st century are notably higher, which suggests that we indeed do underestimate current inheritance flows.

[Figure 6 about here]

Another important robustness check concerns the choice of national income denominator. There exist to date several versions of a Swedish historical national product. This variety is mainly due to a gradual development of the research in Swedish historical national accounts, but also to frequent revisions of the modern national accounts by Statistics Sweden (since 2000 the Swedish official GDP has been revised over 50 times!). Our main inheritance flow series uses an estimate of national income, based on the historical GDP *by activity* of Edvinsson (2012, 2014). To get national income we subtract capital depreciation and add net foreign incomes to obtain the net national product (NNP).[17] As Edvinsson explains, this is his

[16] There is some variation over time in the French case: μ^* was roughly 1.6 during the 19th century up to World War I, then it fell to levels only marginally above unity only to increase sharply in the last three decades to levels around 2.2.

[17] Capital depreciation is reported annually since 1800 in Edvinssson (2005). We use that series when using the Edvinsson (2005) GDP by activity, or its share of GDP when using the other series. Net foreign income, or net current transfers from abroad, is reported annually in Statistics Sweden's Statistical Yearbook back to 1964. For years before that, we assume that its share of GDP was the same as it was in the period 1964–1971 (0.19 percent). There is a break in the series in 1993, with values being about three times higher in the latter period.

most reliable historical GDP, derived from the production side, summing the gross value added in all sectors and subtracting the cost of intermediate inputs. However, GDP is sometimes measured *by expenditure* approach, i.e., as the sum of all expenditures on private and public consumption, investment and net exports. Edvinsson (2005, 2014) presents several series for national income by expenditure using different adjustments with respect to the various generations of System of National Accounts. Furthermore, Krantz and Schön (2007, 2012) have produced several generations of Swedish historical national accounts, largely similar to the ones used by Edvinsson but still different in some important respects.[18] One could also argue that disposable household income is a more appropriate metric than national income is when assessing the relative importance of inheritance. There exists no official series over Swedish disposable household income prior to the 1950s. We therefore compiled a preliminary series for the full historical era, using the official series from the national accounts since 1950 and for the earlier era a constant share, 91 percent, of national income (based on the average level in 1950–1955).

The results from varying the income denominator on the inheritance flow are shown in Figure 7. Like the case with the alternative μ^* estimations, our preferred series is at the low end in the 19th century, being 10–20 percent lower than the alternative series. For the 20th century, however, the relation is the reversed, with our main series being somewhat higher than the other series. Most notably, however, the series based on disposable household income increases sharply in the postwar era, reaching in the early 2000s levels of inheritance flows similar to those in the 19th century. As discussed in section 2, whether to use disposable or national income is a matter of perspective. Many services have become overtaken by the public sector, funded by tax payments and then provided costless. If one thinks that these services would be purchased privately if not provided by the public sector, then the disposable income concept need to be extended so as to also account for the tax payments going to these services today, which would increase the disposable income and thus reduce the share of inheritance flows.

[Figure 7 about here]

Finally, we present a robustness check of the real rates of return to the capital stock and of

[18] The differences between Edvinsson and Krantz and Schön lies mainly in how they treat various subsectors, e.g., investments in real estate, calculation of trade values and so forth.

growth in GDP. A fundamental piece of the analysis in Piketty (2011) concerns the so-called "r/g logic", where r denotes the return to (existing) capital and g the rate of economic growth (creation of new capital). This is a central framework for understanding and explaining the relative importance of inheritance flows over time. But as Piketty (2011) acknowledges, there are several different types of capital (and capital owners) in the economy, including industries and other corporations, agricultural land and financial wealth. Therefore there is also a range of different rates of return to capital.

In Figure 8, we present the long run evolution of real economic growth g as well as some of the most relevant measures of r, covering different types of capital. Specifically, r_1 reflects the return to the gross Swedish private wealth, i.e., the annual percentage growth of the sum of non-financial and financial assets, while r_2 denotes the same for only financial assets. Moreover, r_3 denotes the gross surplus of the Swedish private sector (Edvinsson, 2005) and r_4 is the real return (capital gains and dividend yield) on the Swedish stock market since 1870. Finally, r_5 shows the rate of return to capital computed as the ratio of the wealth-income ratio (β) to the capital share in valued added (α), i.e., $r_5 = \alpha/\beta$.[19] [MORE ON THE FINDINGS]

[Figure 8 about here]

5. International comparisons

When comparing our Swedish findings to those made for France by Piketty (2011) and the U.K. by Atkinson (2012), there appear to be remarkable differences as well as several similarities. Figure 9 shows the inheritance-income ratio over the past two centuries for these countries. The first, most striking difference is the level of inheritance in the 1800s where the Swedish ratio is much lower than in France throughout the 19th century and also clearly below the U.K. observations at the end of the 19th and beginning of the 20th century.

[Figure 9 about here]

By the end of the Second World War inheritance as a share of national income had almost

[19] This calculation is based on a highly stylized setting, where the economy's output can be characterized as a Cobb-Douglas production function $Y = K^{\alpha}L^{1-\alpha}$, where the marginal product of capital, or the real rate of return to capital, is $r = \alpha K^{\alpha-1}L^{1-\alpha} = \alpha(Y/K)$. If we set K equal to private wealth W, then we have that $r = \alpha/\beta$. Data on Sweden's α come from Edvinsson (2005).

converged at about 5 percent, implying large falls from the turn of the century. This is a level around which all three countries stayed until the 1980s when inheritance seems to increase again, more so in France than in the U.K. and Sweden.

How can we understand these differences? One obvious way is to look at the different components of the formula, $B/Y = m \cdot \mu \cdot \beta$, used to calculate the inheritance-income ratio. Figure 10 illustrates the relative development of each of these components. Looking first at the 19th century difference, it is clear that this is almost entirely driven by the wealth-income ratio. In both the U.K. and in France private wealth was relatively constant at about 700 percent of national income throughout the 1800s. In Sweden the wealth-income ratio starts out below 400 percent in the early 1800s but moves up to about 500 percent starting around the early industrialization in the middle of the century. It is interesting to note how similar Sweden and the U.S. are with respect to wealth income ratios in the 19th century. Piketty and Zucman (2013) note the difference between the U.S. and "Old Europe" (they have data for France, the U.K. and Germany) and discuss possible reasons for this. They point to a combination of lower accumulated investment and land improvement relative to economic and population growth, and a "land abundance" effect (resulting in a lower capital share) in the U.S.

In the case of Sweden the explanation is likely to be somewhat different. Sweden in the early 1800s looks more like a "poverty trapped" country with low very low growth and little investment in capital. Though land abundant in the sense that population density was (and still is) very low in Sweden much of this land was not very productive under the technology available at the time. Many people left Sweden for America rather than expanding the frontier at home. Decomposing the national wealth into agricultural land and other forms of capital also suggests that it is the value of land in Sweden that is much lower than in France and the U.K., even though other domestic capital factors also contribute to the difference.[20] The start of industrialization after 1850 also means the start of capital build-up in Sweden (see Section 3 above for details on this development) but overall Sweden is clearly a country where wealth in relation to income is much less important than in the U.K. and in France.

The fall in inheritance flows to national income in the first half of the 20th century is similar

[20] Piketty and Zucman (2013) rightly warn for interpreting the decomposition of wealth into agriculture, housing, other domestic capital as data is sometimes difficult to interpret and compare especially across countries. The magnitudes and similarities between the value of agricultural land in Sweden and the U.S. on the one hand and France and the U.K. on the other hand, are indicative of important differences in this component.

in Sweden, France and the U.K. but much larger in the two latter cases. By 1950 the ratio has almost converged in the three countries. The decrease in France and the U.K. is attributed to the various shocks to capital that happened during the 1914–1945 period. Partly this was due to the wars but the largest impact came from anti-capital policies (rent-control that affected real-estate values, nationalization policies, increased taxation).[21] Sweden was, relatively speaking, less affected by such shocks. In particular, Sweden did not take part in either of the World Wars. There were periods of inflation, a stock market crash in the early 1930s, and taxes were introduced and raised over the period, but the most important factor was probably the high, sustained growth rates after 1920. In the period 1920–1950 average growth was about 3 percent.

Based on the simple Harrod-Domar-Solow formula, where the long run wealth of domestic agents held at home and abroad, the net national product, is equal to the net savings rate divided by the steady state growth rate, a doubling of the growth rate implies that the wealth-income ratio is halved at an unchanged savings rate. Assuming a growth rate of 1.4 percent (approximately the growth rate in Sweden 1950–1920) and a wealth-income ratio of 500 percent (approximately the ratio in Sweden around 1900) this would imply a 7 percent savings rate in a steady state. Assuming this rate would be unchanged but growth increases to 3 percent this would change the steady state wealth-income ratio to 230 percent, which is close to the 1950 level in Sweden. Overall it seems likely that wealth decreased in the first half of the 20th century in France, the U.K., as well as in Sweden, due to various shocks to capital. But in the case of Sweden a big contributing factor to the lower wealth-income ratio was high growth, which also lowered the importance of old wealth compared to new wealth given a certain savings ratio.

[Figure 10 about here]

The recent increase is more difficult to interpret. Clearly part of this is driven by an increased wealth-income ratio (see Piketty and Zucman, 2013) but there are also important differences in the movement of ratio of wealth of decedents to wealth of the living. In particular Piketty (2011) finds that gifts have increased significantly in recent decades increasing μ^* to above

[21] As Piketty (2011, p. 10.) puts it: "In effect, the 1914–1945 political and military shocks generated an unprecedented wave of anti-capital policies, which had a much larger impact on private wealth than the wars themselves".

200 percent. In Sweden we do not observe any such development. If anything μ^* has decreased slightly

One way to gain a deeper understanding of the long-run evolution of Swedish inheritance flow is to compare it, and its components β, μ^* and m, to the contemporaneous levels in France and the U.K. We observe all these variables in Piketty (2011) in the case of France. For the U.K., we rely on the study by Atkinson (2013), but as it does not contain a full set of tables we have acquired inheritance flow data from Piketty (2011), wealth-income ratios from Piketty and Zucman (2013, appendix tables), mortality data from the Human Mortality Database, and the level of μ^* through the other variables.[22]

Table 2 presents the percentage difference in inheritance flow and its components between Sweden, France and the U.K. for different time periods. The differences are averaged across certain historical period, selected so as to reflect relevant eras in the economic development of these countries.

For the 19th century ending with World War I, we are only able to compare Sweden with France due to a lack of data for the U.K. during this period. As was already shown in Figure 9 above, French inheritance flows over national income vastly exceeded the Swedish flows in this era, being about two thirds larger. Breaking up this difference across components, it appears that a larger French wealth-income ratio appears to explain most of this gap. In the 1820–1870 period, a larger French β explains all of the inheritance flow gap whereas in the 1870–1910 period the French β accounts for most of the gap, but the higher French mortality now also contributes, being on average 23 percent larger than the Swedish mortality. There are basically no differences in μ^* across the two countries, which is suggestive evidence of a common age-wealth life-cycle profile in 19th century Europe.

During the 20th century, French and Swedish inheritance flows are more similar in level and trends. The somewhat higher French level in the first half of the century is mostly driven by a higher French mortality rate. In the postwar era, the two countries were similar in most respects but since 1980 French inheritance flows has again exceeded the Swedish, this time

[22] We construct mortality as we did for Sweden, namely by relating the number of adult deaths to the number of adult living. Since there are no data for the U.K. before the 1920s, we use HMD data for England and Wales (available since the 1840s) for the whole period. We use the basic economic inheritance flow formula to back out μ^*, namely to use $\mu^* = (B/Y)/(m \cdot \beta)$.

primarily driven by a distinctly higher β in France and somewhat less by a higher French μ^*.

Comparing Sweden with the U.K., the only period with a distinct difference in inheritance flows is the early half of the 20th century. In this period, Swedish inheritance flows were about half as large as those in the U.K., and the difference was primarily driven by a much higher British μ^*. During the postwar period, the two countries had about the same level of inheritance flows over national income. Looking at the components in the most recent period, however, it seems as there was a trade-off between a larger U.K. wealth-income ratios and a lower U.K. μ^*.

[Table 2 about here]

6. Concluding discussion

In this paper we have estimated and sketched explanations to the long-run development of inheritance flows in Sweden over the past two hundred years. Our main finding is that – like in France and the U.K. – inheritance as a share of national income was historically most important in the 19th century, it then declined sharply in the first half of the 20th century, but has started to increase again in since the beginning of the 1980s.

Notwithstanding this common pattern there are also important results that are more specific for Sweden. In particular, the level of inheritance flows in 19th century Sweden was much lower than in France and the U.K. This difference is mainly due to wealth-income ratios being lower in Sweden. Compared to other countries in "Old Europe", Sweden stands out as a country with ratios much closer to those found in the U.S. and Canada at the time (see Piketty and Zucman, 2013). Even though highly speculative one might ask if this could say something about the relative ease by which Sweden both industrialized and democratized in the second half of the 19th and the beginning of the 20th century. Compared to France and the U.K., the tension between old and new wealth was simply much smaller in Sweden. Consequently the formation of more of a consensus view around the benefits of reforms could have been easier in Sweden, relatively speaking.[23]

[23] Acemoglu and Robinson (2002) sketch the conflicts around extending the franchise in England, France, and Sweden

In models where both political and economic change may be resisted by strong influential elites who benefit from the status quo, a smaller difference between old and new wealth has the dual benefit of both making expropriation of old wealth less profitable and at the same time making prospects of future gains from reform more attractive for everyone.[24] On the other hand, this type of interpretation also has its challenges, in particular when thinking about the similarities with the U.S. The Tocqueville-inspired view of America as a land of equal opportunity in the 19th century has led many to interpret the divergence between the American and the European social contracts as based in this fundamental difference in historical experience (see Piketty (1995) and references therein).

But if Sweden in the 19th century was more like the U.S. than like the rest of Europe in terms of wealth-income ratios, one may ask why Sweden came to develop the extensive welfare state. Maybe the answer lies in the distinct type of welfare state developed in Sweden, and Scandinavia more generally, which, even though extensive in many ways is more individualistic, and in this sense closer to the U.S., than its Continental European counterparts (ref Lars Trägårdh, och ev Karl Moene om Tocqueville och den nordiska modellen).

Swedish inheritance flows in the 20th century also shed new light on what has been driving the importance of inheritance over time. During the first half of the century the role of inheritance declined rapidly mainly due to declining wealth-income ratios. This was an era when rapid growth diminished old wealth relative to new wealth. Sweden was not hit by the major shocks in the 1914–1945 period in the same way as France and the U.K. but still converged to similar post-war levels of inheritance around 5–6 percent around 1950.

In the decades up until 1980 inheritance continued to decline now mainly due to an environment that was not very conducive to private wealth accumulation, a growth of welfare state programs, and in particular a pension system that decreased incentives to save privately, and in the 1950s and 1960s also due to continued rapid growth. This development changed after 1980 when asset values in Sweden were at a low point. As in many other countries there has

[24] Many have suggested explanations where ”old wealth” conflicts with possibilities of creating ”new wealth” to explain why industrialization and institutional change takes place in some countries but not others (see for example Krusell and Rios-Rull (1996) and references therein). In many of these contributions England is of course taken as a country where change happens early because the rules and regulations consequently promote change (Mokyr, 1990). As emphasized be Acemoglu and Robinson (2000, 2006) the attitude toward change depends both on economic and political gains and losses. This is not in conflict with our simple point, namely that a smaller difference between old and new wealth makes change easier.

been a rapid asset recovery period and capital income and capital gains have increased a lot relative to wages. At the same time incentives for private savings have increased and privately held wealth has grown. Inheritance however has not increased dramatically, yet. Unless there will be a major shift in terms of how much individuals decumulate when retired inheritance flows in Sweden are bound to become more important in the decades to come.

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Figure 1: Inheritance flow over national income in Sweden, 1810–2010

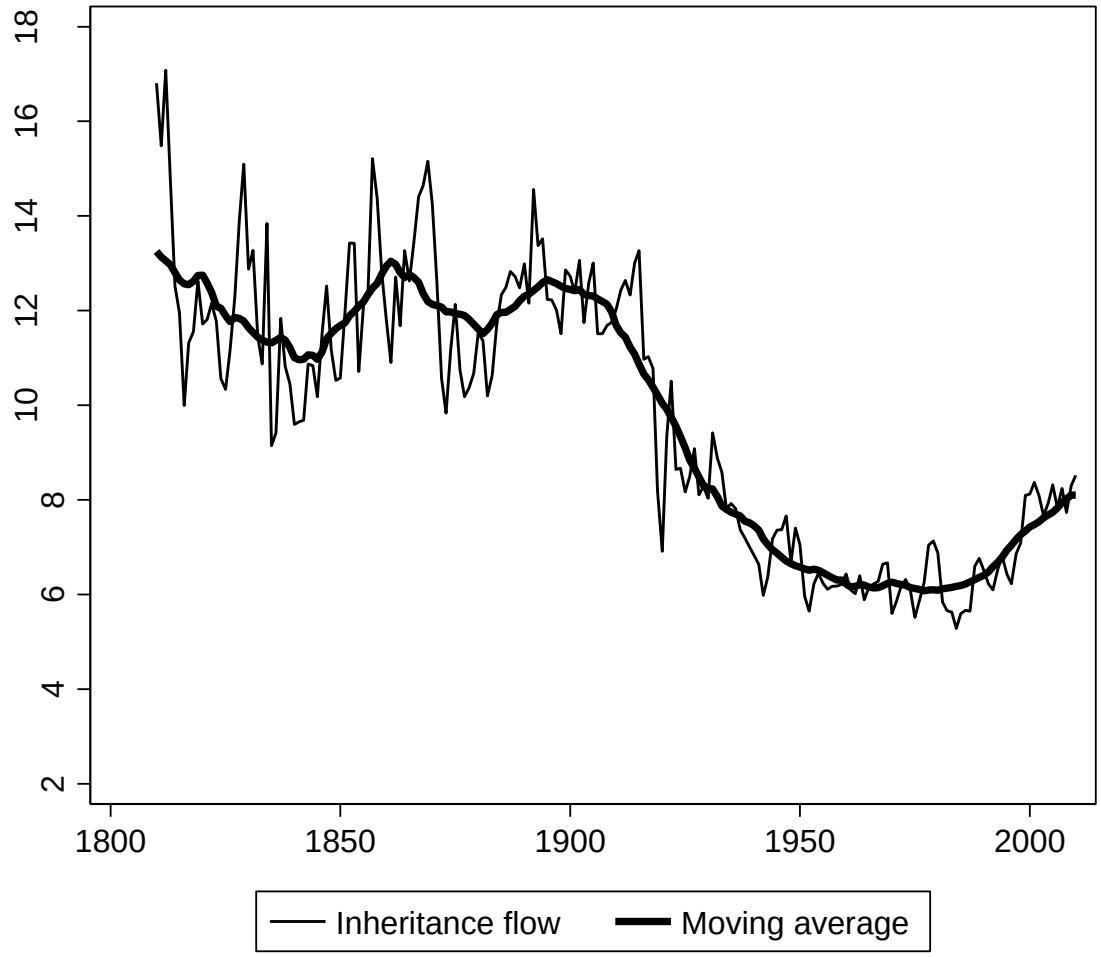
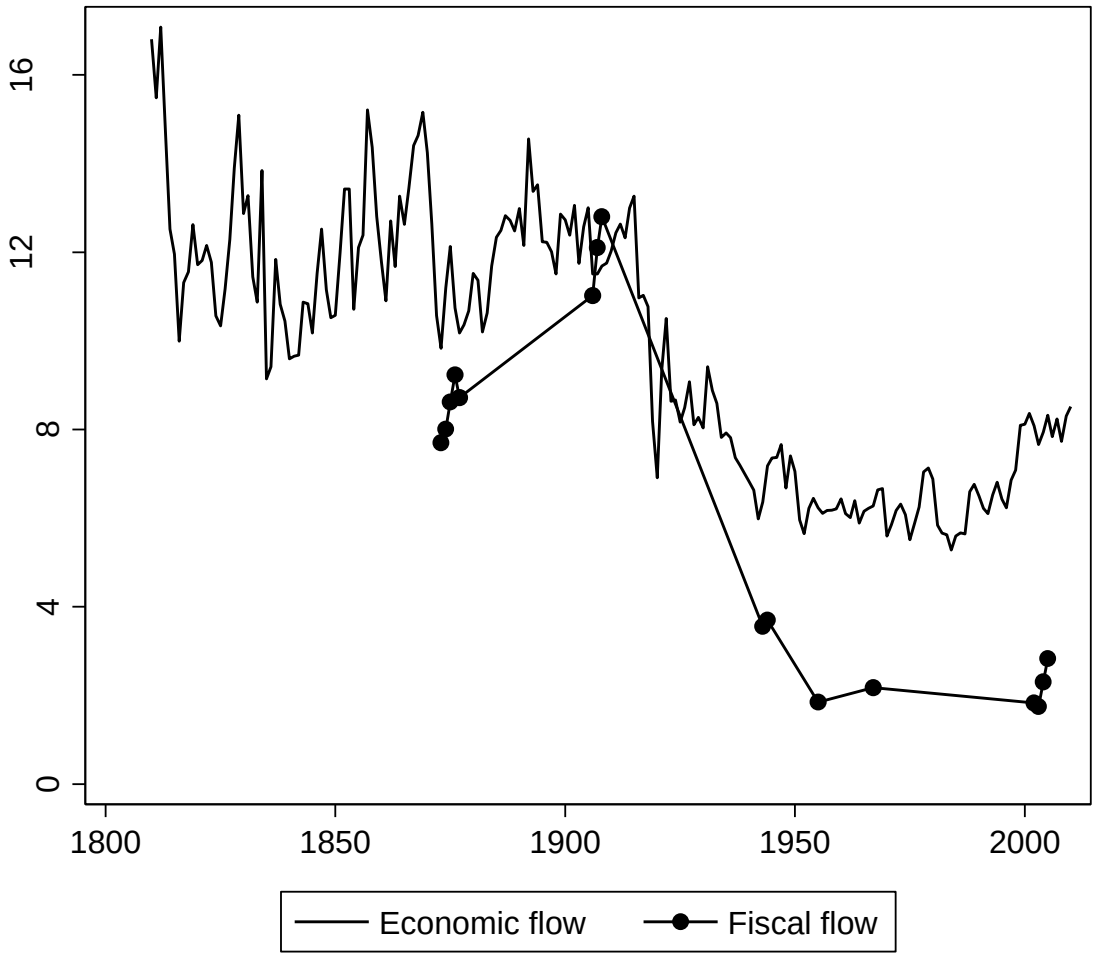
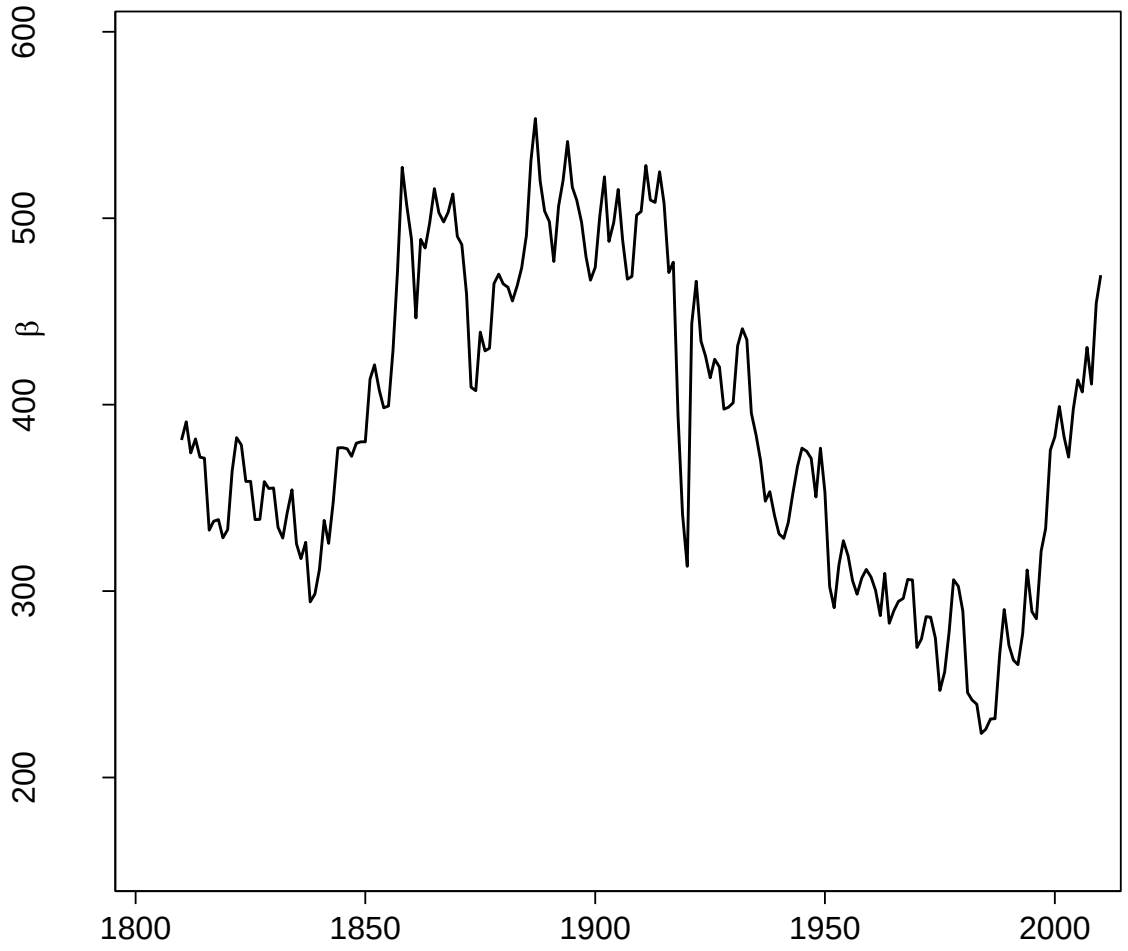


Figure 2: Fiscal flow vs. economic flow of the inheritance share



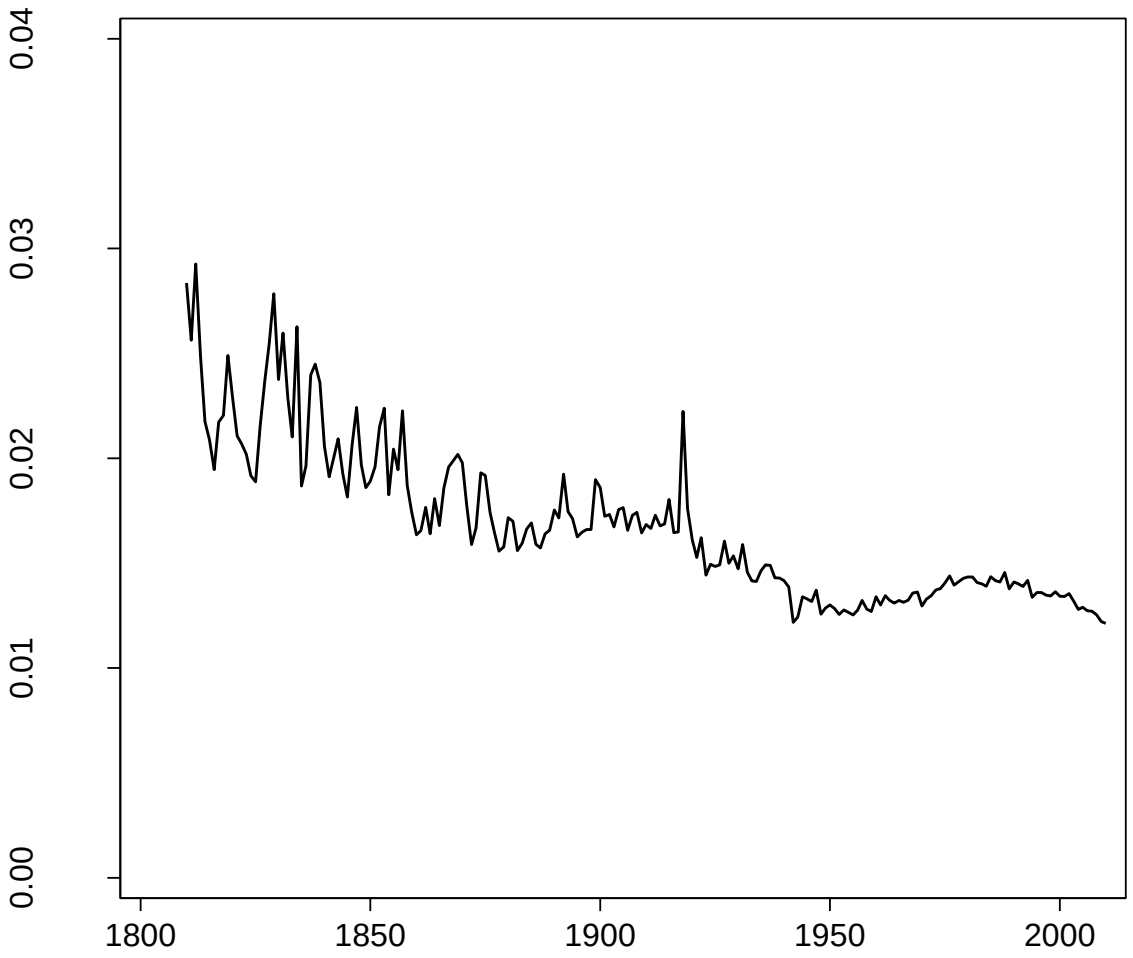
Note: Fiscal flow observations emanate from examinations of inheritance tax returns.

Figure 3: Private wealth-national income ratio in Sweden.



Source: Waldenström (2013).

Figure 4: Mortality among adults in Sweden, 1810–2010



Note: Mortality is measured as the number of deaths among people aged 18 years or more as a share of the living adult population. Data come from the Human Mortality Database.

Figure 5: Average wealth of the deceased divided by average wealth of the living, with correction for gifts *inter vivos* (μ^*) and without (μ).

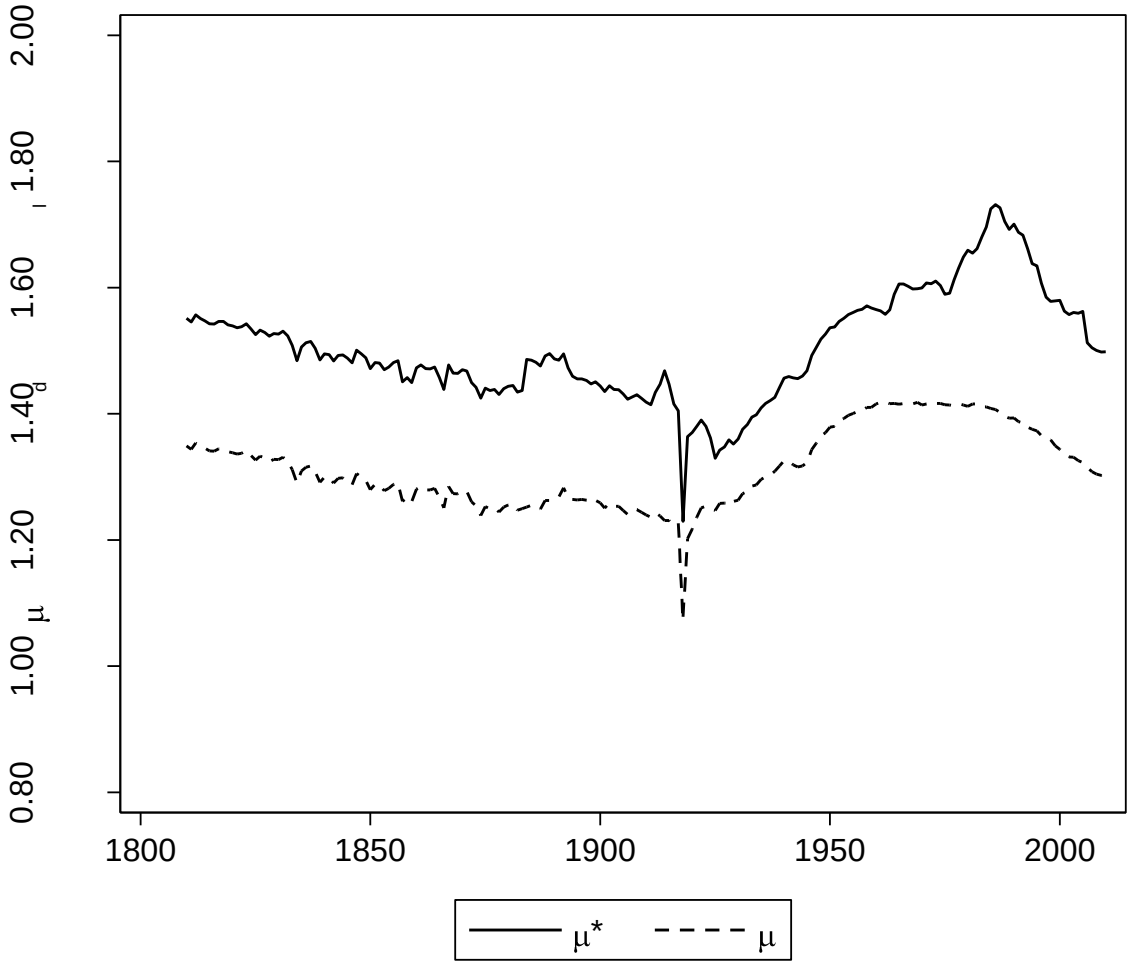


Figure 6: Robustness of economic inheritance flow with respect to different μ^*.

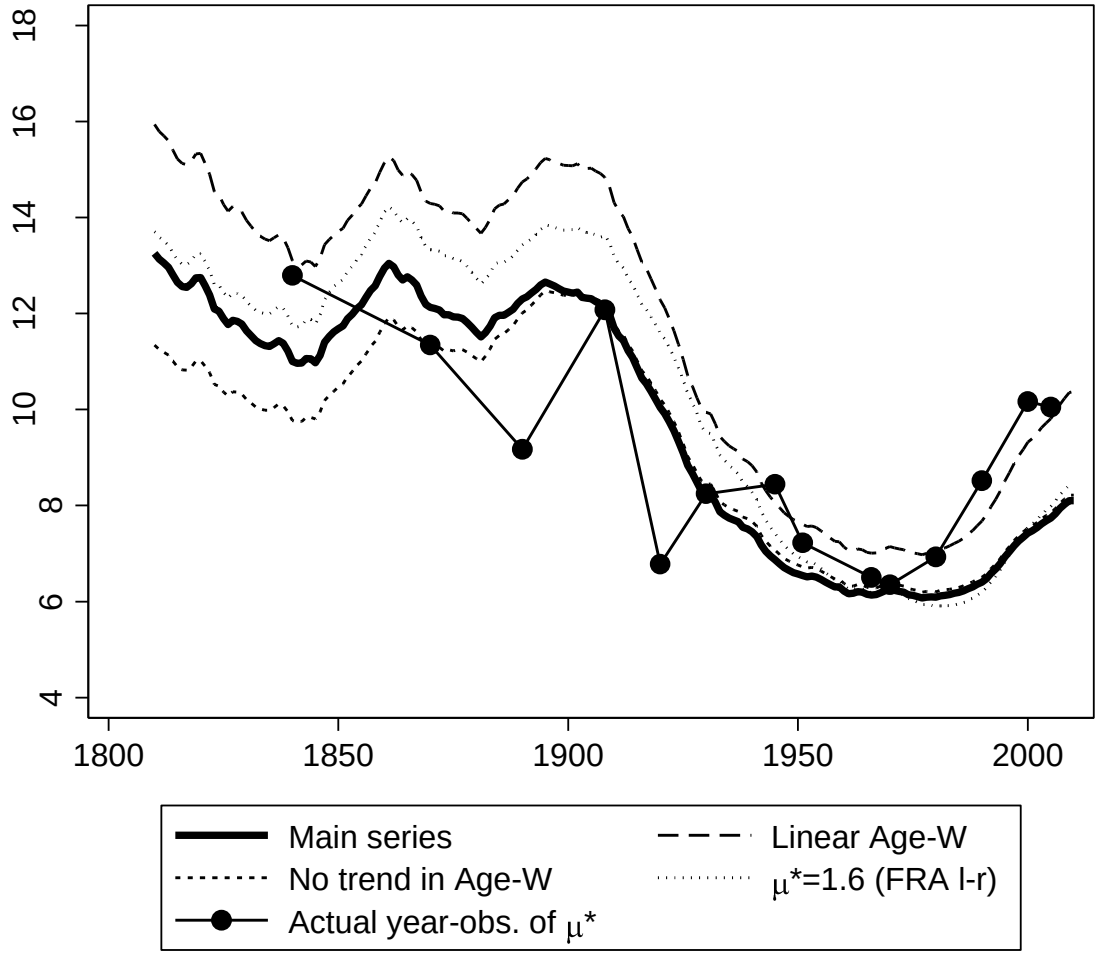
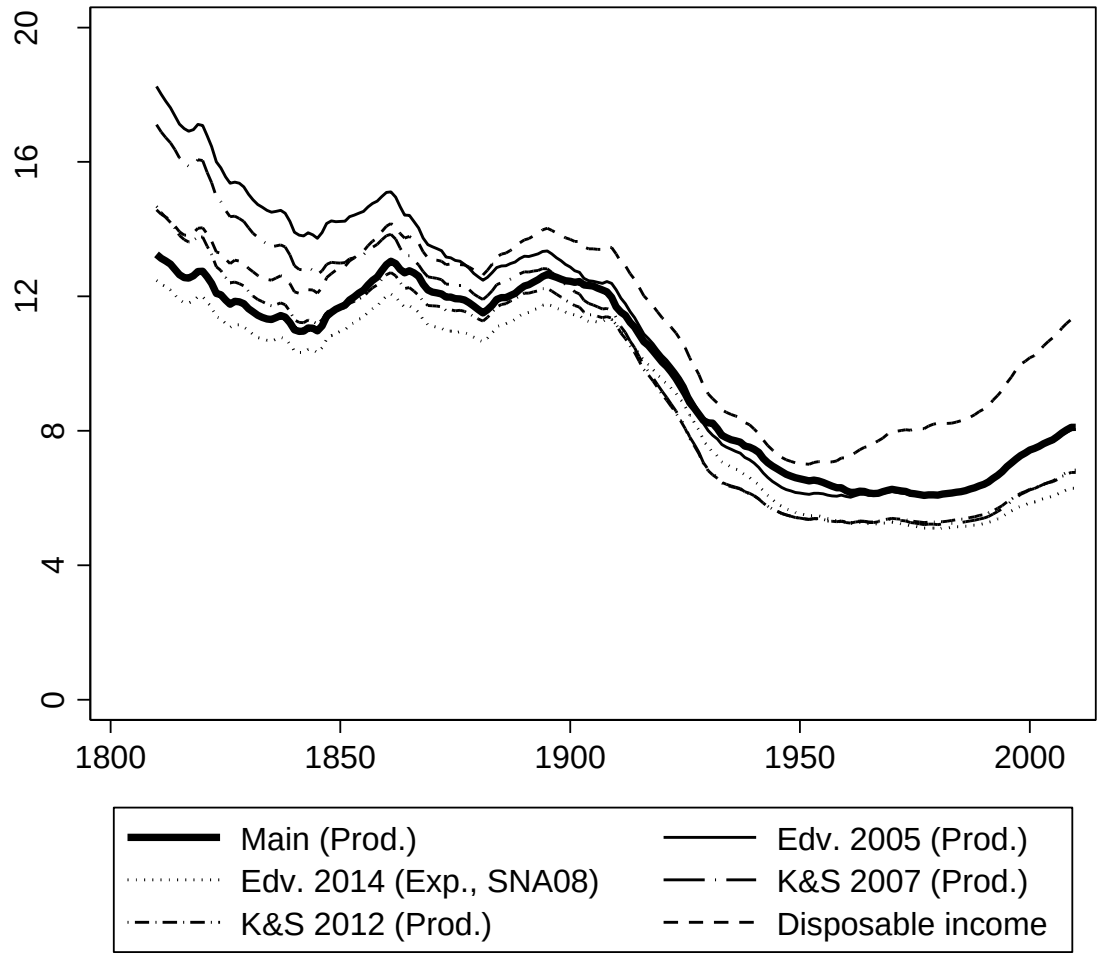
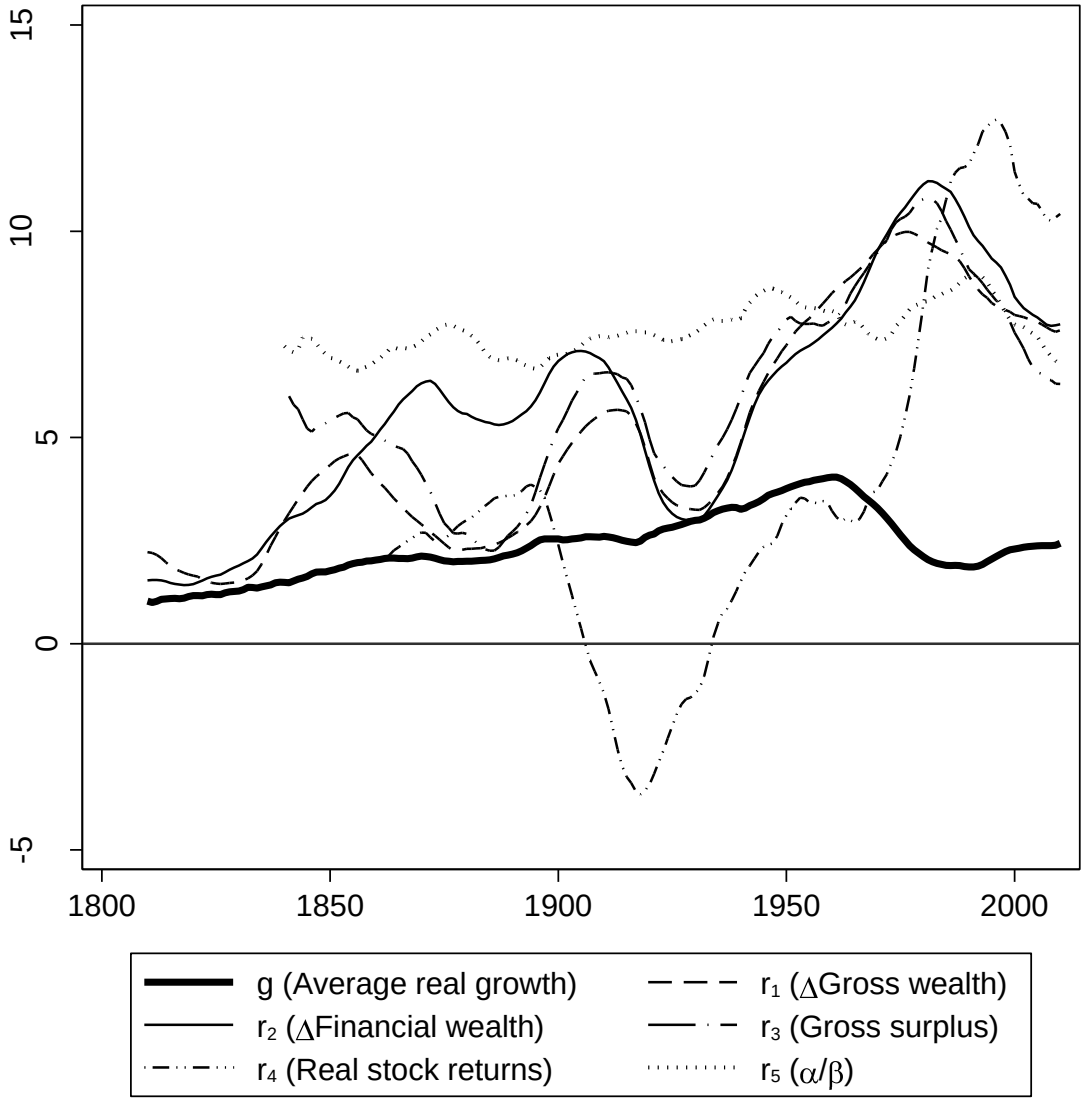


Figure 7: Robustness of economic inheritance flow with respect to different definitions of national income.



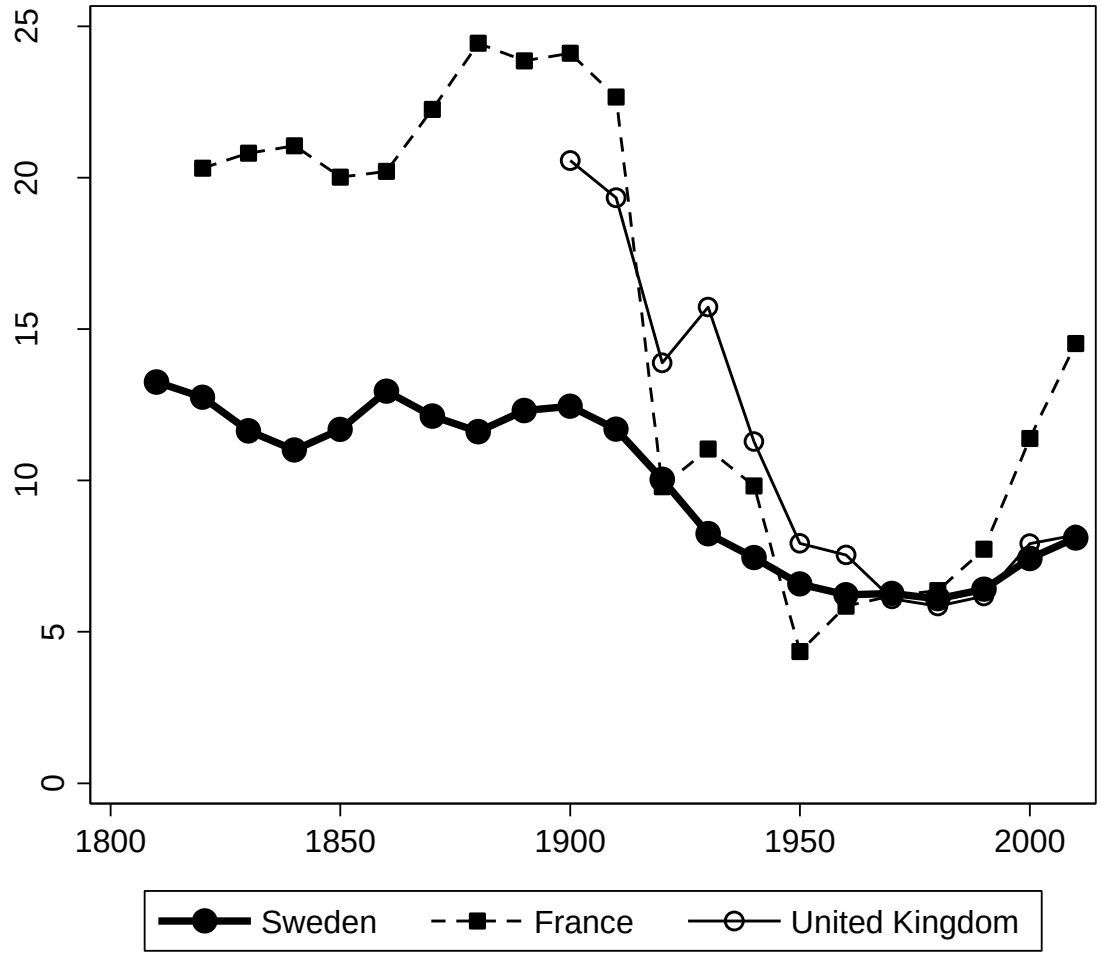
Note: "Prod." denotes that national income is based on GDP by activity, generated using the production approach. "Exp." denotes that national income is based on GDP by expenditure using the expenditure approach. "SNA08" denotes a series adjusted to fit the levels of the most recent revision of SNA. Disposable income is national income plus transfers less taxes (estimated as fixed share of national income before 1950).

Figure 8: Rates of return to capital and real economic growth (%)



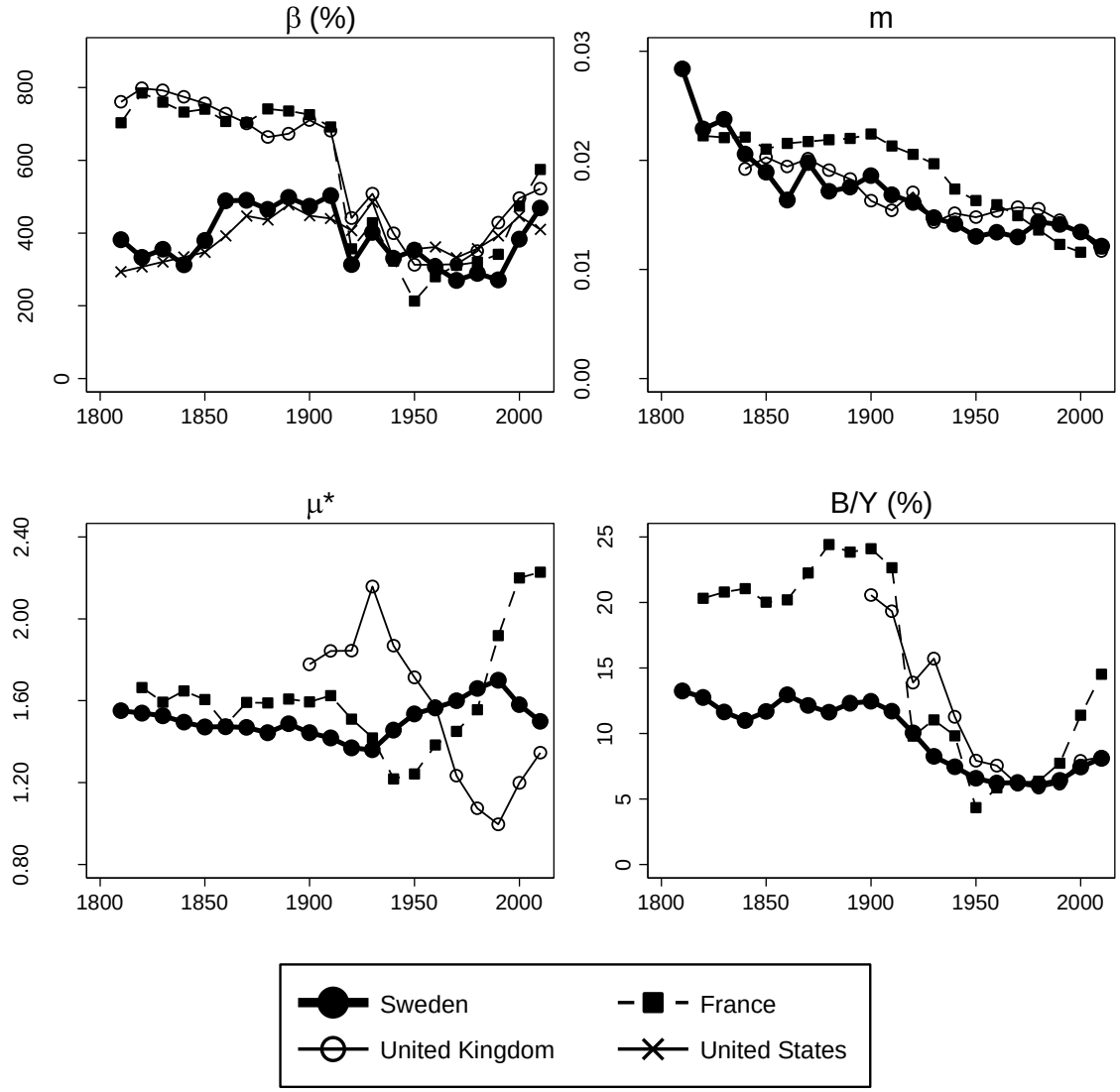
Note: All series are 20-year moving averages to smooth out annual fluctuations. GDP per capita growth is from Edvinsson (2014), "Gross wealth" and "Financial wealth" are the annual percentage increases in the stocks of gross wealth and financial assets reported in this study. "Gross surplus" is the surplus of the entire private sector 1850–2000, reported by Edvinsson (2005), "Real stock returns" comes from Waldenström (2014) and the α/β uses an α from Edvinsson (2005) for 1850–2000 (defined as gross surplus divided by total value added) and from IMF for 2000–2010 (using the series "Industry, share of GDP (%)").

Figure 9: Inheritance over national income (B/Y) in Sweden, France and the United Kingdom.



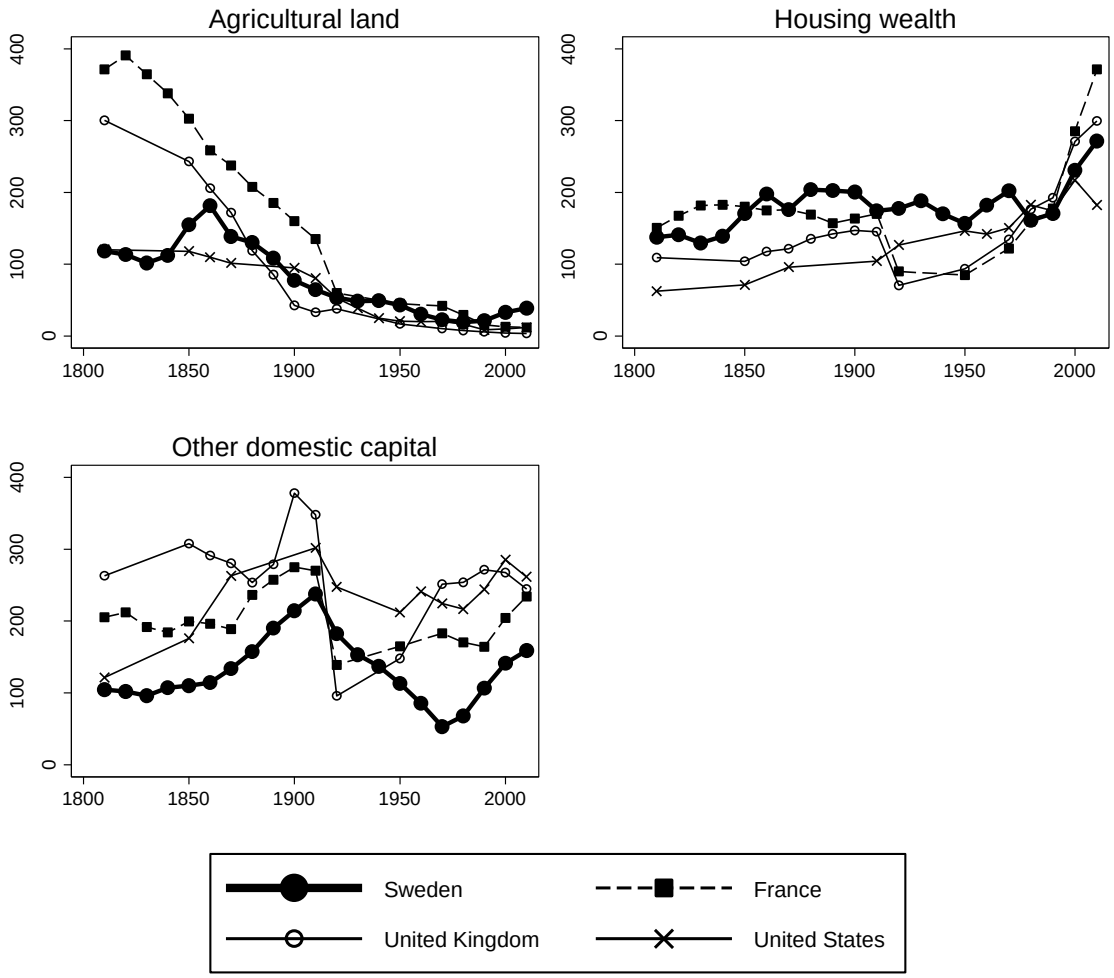
Source: Sweden: this paper. France: Piketty (2011). The UK: Atkinson (2013).

Figure 10: Components of inheritance-income flows in Sweden, France, the United Kingdom and the United States, 1810–2010.



Source: Wealth-income ratio for Sweden from Waldenström and Ohlsson (2013) and for the other countries Piketty and Zucman (2013). Mortality for France comes from Piketty (2011), and for Sweden and the UK from Human Mortality Database. The estimated μ^* for the U.K. comes from dividing the estimated inheritance flow (B/Y) with the product of the wealth-income ratio β and the mortality rate m.

Figure 11: Components of private wealth in four countries (share of national income, %).



Note: Agricultural land include both farmland and timber tracts but excludes buildings and constructions. Housing wealth includes other land and (urban and agricultural) dwellings. Other domestic capital represents the remaining domestic private wealth, primarily net financial assets. Data for France, the U.K. and the U.S. come from Piketty and Zucman (2013) and data for Sweden come from this paper.

Table 1: Decomposing changes in inheritance flows in Sweden (%).

	Average annual percent change in inheritance flow ($\Delta B/Y$)	with contribution from:		
		Mortality (Δm)	Ratio of average wealth of deceased and living ($\Delta \mu^*$)	Wealth-income ratio ($\Delta \beta$)
1810s–1870s	–0.3	–0.5	–0.1	0.4
1870s–1910s	0.1	0.0	–0.1	0.2
1910s–1950s	–1.6	–0.8	0.3	–1.0
1950s–1980s	–0.1	0.3	0.3	–0.8
1980s–2010s	1.2	–0.5	–0.4	2.1

Note: Percentage points reflect the compounded average annual change between periods. Decennial averages are being used.

Table 2: Comparative inheritance flow decomposition: Sweden vs. France and the U.K.

	Difference from Sweden (%):	with contribution from (%):		
	Inheritance flow (B/Y)	Mortality (m)	Ratio of average wealth of deceased and living (μ^*)	Wealth-income ratio (β)
France				
1820s–1870s	83	8	7	60
1870s–1910s	87	22	10	39
1910s–1950s	37	28	3	4
1950s–1980s	–9	14	–12	–9
1980s–2010s	32	–8	24	18
United Kingdom				
1910s–1950s	69	0	38	23
1950s–1980s	9	14	–12	10
1980s–2010s	–5	2	–28	32

Note: Percentage points reflect the ratio of levels in France and the UK to the respective levels in Sweden. Decennial averages are being used.

Appendix: Age-wealth profiles: Historical evidence and simulations

7. Historical age-wealth profiles in Sweden

Data on the historical evolution of age-wealth profiles in Sweden are scarce. We have searched for evidence in Censuses, public investigations and academic research and managed to locate half a dozen of observations of early age-wealth profiles recorded in the 1840s–1890s, 1908, 1920, 1930, 1945, 1951 and 1966. From 1968 up to 2007 administrative public register databases at Statistics Sweden are available. After 2007, individual information about wealth is no longer available due to the removal of the wealth tax.

In this appendix, we describe how historical age-wealth profiles for Sweden are recorded and estimated for the full period 1810–2010. We begin by describing each of the historical observations in separate subsections. Thereafter we continue by explaining how we simulated annual age-wealth profiles, and provide results from a number of goodness of fit and sensitivity analyses associated with these simulations.

The structure of the historical data on Swedish wealth distributions across age is relatively homogenous over time, with most sources describing the population divided into age classes, with the number of wealth holders and the sum of their net wealth in each of these classes. However, some differences are worth noting.

i) The *unit of observation* is the individual, but in the 19th century probate wealth data point we rely on probated, i.e., deceased, individuals.

ii) The *sample population* is the full adult Swedish population (18 years and older). One exception is the 19th century observation which only covers a parish in Southern Sweden. Another is the tax-return based register data between 1968 and 2006, for which we only have annual information about tax-assessed wealth for those in the population with high enough net wealth to reach the tax threshold. The share of wealth taxpayers was between five and ten percent of all taxpayers during this period (Hochguertel and Ohlsson, 2012). For the period 2000–2007, we also observe the market-valued net wealth of all Swedish individuals in a parallel register database built Statistics Sweden called the Wealth Register (Statistics Sweden, 2006).

iii) The *concept of wealth* is tax-assessed wealth except in the 2000s. For the observations in the 20th century up until 2006, this means that wealth is the net assets taxable according to contemporary wealth tax assessments ("skattepliktig förmögenhet"). Wealth is here defined as the sum of real and financial assets less debts. Assets are reported in tax-assessed values, meaning that some assets, e.g., real estate and corporate stock, are not always reported at their full market value (see Roine and Waldenström, 2009, for a detailed discussion). The 19th century wealth is based on probate records, and thus refers to the rules of the 19th century estate and inheritance tax legislation (see Ohlsson, 2011; Du Rietz, Henrekson and Waldenström, 2012).

For the years in the 2000s, we observe wealth both from the tax return-based registers and in the Wealth Register. The concept of wealth in the latter database deviates from the former in several ways. Most importantly, the Wealth Register reports assets in current market values as opposed to tax-assessed values in all the other sources. For housing equity, market values are

retrieved from average sales price ratios computed at the municipal level by Statistics Sweden. For financial assets, market prices at year end for corporate stocks, mutual funds, and bonds are used. Additionally, there are some items included that do not generally appear in tax-assessments and personal tax returns, e.g., condominiums. Despite the important differences between the Wealth Register data of the 2000s (using market-valued wealth for the entire population) and the tax register wealth of the period between 1968 and 1999 (using tax-valued wealth for a small share of the population), we show below that the age-wealth profiles derived from these sources do not differ greatly.

iv) Age classes are not homogenously reported across observations. Specifically, we do not observe wealth at each yearly age but rather in intervals of ages. These intervals also differ across data points as shown by the appendix tables below. For the period from 1968 onwards, however, we have microdata allowing us to use either yearly or year-interval age classes.

To homogenize the age classes across samples, we compute weighted average ages using actual population statistics on the number of living men and women in each age class times their respective age divided by the total number of men and women in each age class. Note that this weighting procedure becomes especially important for the calculation of a representative age for the open age interval in the top of the age distribution when otherwise an arbitrarily set top age could bias the results. Through this procedure, we get a certain age that corresponds to a certain average wealth for all years, which allows for the imputation strategy to attribute age-wealth profiles for all ages and all years in the studied period.

7.1 The 19th century age-wealth profile

There exist a number of studies where Swedish economic historians have collected data from probate records and estate tax returns with the ambition to reconstruct household portfolios (see, e.g., Isacson, 1979; Magnusson, 1983; Ericsson, 1992; Lindgren, 2002; Hellgren, 2003; Lilja, 2004; Perlinge, 2005). Unfortunately, few of these report the net (or gross) wealth across age classes.

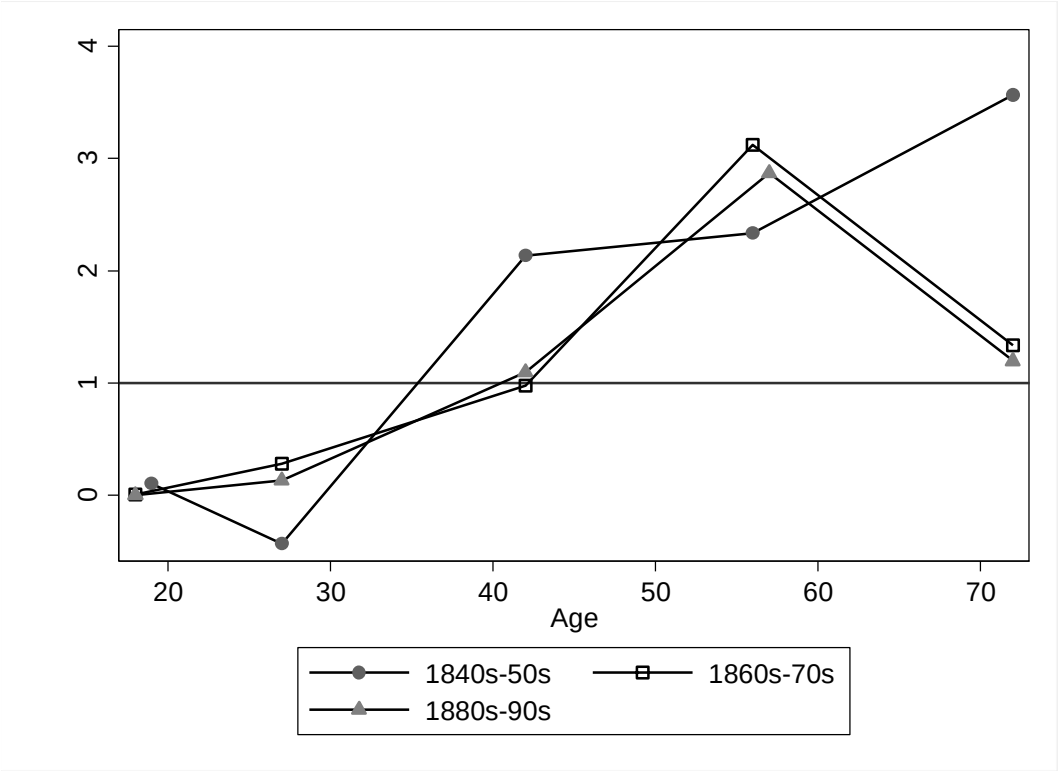
The only two sources of 19th age-wealth distributions to our knowledge are Håkan Lindgren's study of the extent of informal credits in the mid-sized city of Kalmar between 1840 and 1900 and Anders Perlinge's dissertation about the evolution of household indebtedness in the Vånga parish in Sothern Sweden between the 1840s and the 1890s (Perlinge, 2005). In both these studies, information are provided about the total number of deceased, the sum of their net wealth, and the total wealth of the living population (calculated by multiplying the wealth of the deceased by inverse mortality multipliers). These numbers are reported for each decade and men and women in six age cohorts.

An important drawback of both of these studies is their limited geographical coverage. Kalmar was by all means a significant city, being Southwestern Sweden's principal commercial and shipping center Sweden's seventh most populous city. In fact, Lindgren (2002) argues that the city of Kalmar may be a quite typical region for the whole of 19th century Sweden, placed in the country-side and yet taking part in the industrial boom of the end of the century. Perlinge's studied parish is much smaller and exclusively rural. Yet his database is rich both in terms of the number of studied estates, as well as the level of detail regarding the composition of estates in terms of different asset and debt components.

In order to reduce some of the small sample bias coming from having such a small number of

deceased in each decade, we sum all the deaths and sums of wealth landing at three 19th century observations: 1840s (encompassing the 1841–1845 Kalmar and the 1840–1859 Vånga), 1870s (1871–1875 Kalmar and 1860–1879 Vånga) and the 1890s (1901-1905 Kalmar and 1880–1899 Vånga). Figure A1 shows the normalized average wealth of these summary series.

Figure A1: Age-wealth profiles between 1840s and 1890s



Note: Normalized average wealth is defined as $\overline{W}_{l,i}/\overline{W}_{l}$. Data come from Table A3.

Table A1: Age-wealth profiles between 1840s and 1890s: Kalmar city

Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth ($W_{l,a}$)	Average wealth ($\bar{W}_{l,a}$)	Normalized average wealth ($\bar{W}_{l,a}/\bar{W}_l$)
1841–1845					
15–19	27	630			
20–34	42	1,652	–1,014,758	–614	–0.71
35–49	56	1,103	2,461,423	2,232	2.58
50–40	72	598	1,162,130	1,943	2.24
65–	19	245	1,054,587	4,304	4.97
All	39	4,228	3,663,382	866	1.00
1871–1875					
15–19	18	924			
20–34	27	2,359	3,693,793	1,566	0.27
35–49	42	2,053	11,721,115	5,709	0.98
50–40	56	1,264	22,269,970	17,619	3.01
65–	72	477	3,672,043	7,698	1.32
All	40	7,077	41,356,921	5,844	1.00
1901–1905					
15–19	18	1,211			
20–34	27	3,104	5,234,230	1,687	0.12
35–49	42	2,388	37,166,680	15,567	1.10
50–40	57	1,707	73,000,918	42,778	3.03
65–	72	1,172	19,756,758	16,857	1.19
All	42	9,581	135,158,586	14,108	1.00

Note: For age group 15–19 years we only have information about the number of individuals. "Average age, weighted" represents the actual average age within each age classes, calculated as the number of adults times their respective age (in yearly age classes) divided by the number of adults using population data from Statistics Sweden. "Normalized average wealth" is the ratio of average wealth of the living in each age class to the average wealth of the living in the whole population. Data come from adjusted data from Lindgren (2002), kindly provided by Håkan Lindgren.

Table A2: Age-wealth profiles between 1840s and 1890s: Vånga parish

Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth ($W_{l,a}$)	Average wealth ($\bar{W}_{l,a}$)	Normalized average wealth ($\bar{W}_{l,a}/\bar{W}_l$)
1840–1859					
15–19	27	1,133	212,986	188	0.49
20–34	42	807	236,678	293	0.76
35–49	56	518	561,920	1,085	2.82
50–40	72	255	125,527	492	1.28
65–	19	427	72,029	169	0.44
All	39	3,140	1,209,140	385	1.00
1860–1879					
15–19	18	462	21,630	47	0.16
20–34	27	1,079	335,671	311	1.08
35–49	42	891	230,701	259	0.90
50–40	56	471	197,353	419	1.45
65–	72	205	111,157	542	1.88
All	40	3,108	896,512	288	1.00
1880–1899					
15–19	18	446	0	0	0.00
20–34	27	822	237,269	289	0.73
35–49	42	794	206,271	260	0.66
50–40	57	673	269,439	400	1.01
65–	72	410	528,364	1,289	3.27
All	42	3,145	1,241,343	395	1.00

Note: See Table A1 for description of variables. Data come from adjusted data from Perlinge (2005), kindly provided by Anders Perlinge.

Table A3: Age-wealth profiles between 1840s and 1890s: Kalmar city and Vånga parish

Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth ($W_{l,a}$)	Average wealth ($\bar{W}_{l,a}$)	Normalized average wealth ($\bar{W}_{l,a}/\bar{W}_l$)
1840–1859		1,057	72,029	68	0.10
15–19	27	2,785	–801,772	–288	–0.44
20–34	42	1,910	2,698,101	1,413	2.14
35–49	56	1,116	1,724,050	1,545	2.34
50–40	72	500	1,180,114	2,360	3.57
65–	19	7,368	4,872,522	661	1.00
All	39				
1860–1879		1,386	21,630	16	0.00
15–19	18	3,438	4,029,464	1,172	0.28
20–34	27	2,944	11,951,816	4,060	0.98
35–49	42	1,735	22,467,323	12,949	3.12
50–40	56	682	3,783,200	5,547	1.34
65–	72	10,185	42,253,433	4,149	1.00
All	40				
1880–1905		1,657	0	0	0.00
15–19	18	3,926	5,471,499	1,394	0.13
20–34	27	3,182	37,372,951	11,747	1.10
35–49	42	2,380	73,270,357	30,792	2.87
50–40	57	1,582	20,285,122	12,822	1.20
65–	72	12,726	136,399,928	10,719	1.00
All	42	1,057	72,029	68	0.10

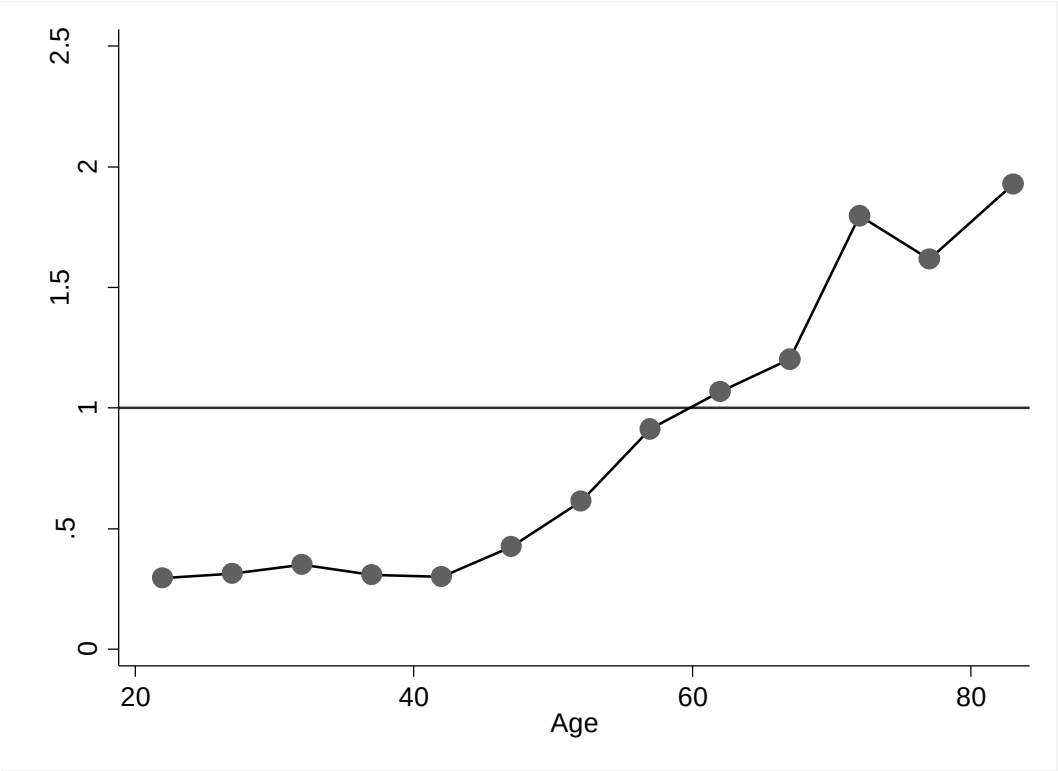
Note: These data are sums of the values for Kalmar city (Table A1) and the Vånga parish (Table A2). See further the notes under these tables.

7.2 The 1908 age-wealth profile

The earliest source of a nationally representative Swedish age-wealth distribution is to our knowledge a public investigation from 1910 which reports average net wealth across age classes in 1908 (Flodström, 1910). These data are based on a rich sample of estate reports for Swedish deceased in 1908, with estate wealth multiplied by inverse mortality multipliers for a number of groups of different age, gender and civil status.[25] Additional data were also collected by the investigators for the years 1906 and 1907. These years were not analyzed at the same depth as 1908, but they allow for robustness checks especially with regard to the possibility of observing extreme values in estate samples in individual years. These checks do not suggest any oddities in the 1908 data.[26] Figure A2 shows the observed age-wealth profile in 1908.

[25] See Flodström (1910, Table K) The classes are, except age (which can be found in Table A2): unmarried men; unmarried women; married men; married women; widowers and divorced men; widows and divorced women.
[26] We use all the data from 1906–1908 when estimating the fiscal inheritance flow, shown in the paper's sections 2 and 3.

Figure A2: Age-wealth profile in 1908



Note: Normalized average wealth, $\bar{W}_{l,i}/\bar{W}_l$, come from Table A2.

Table A2: Age-wealth profile in 1908

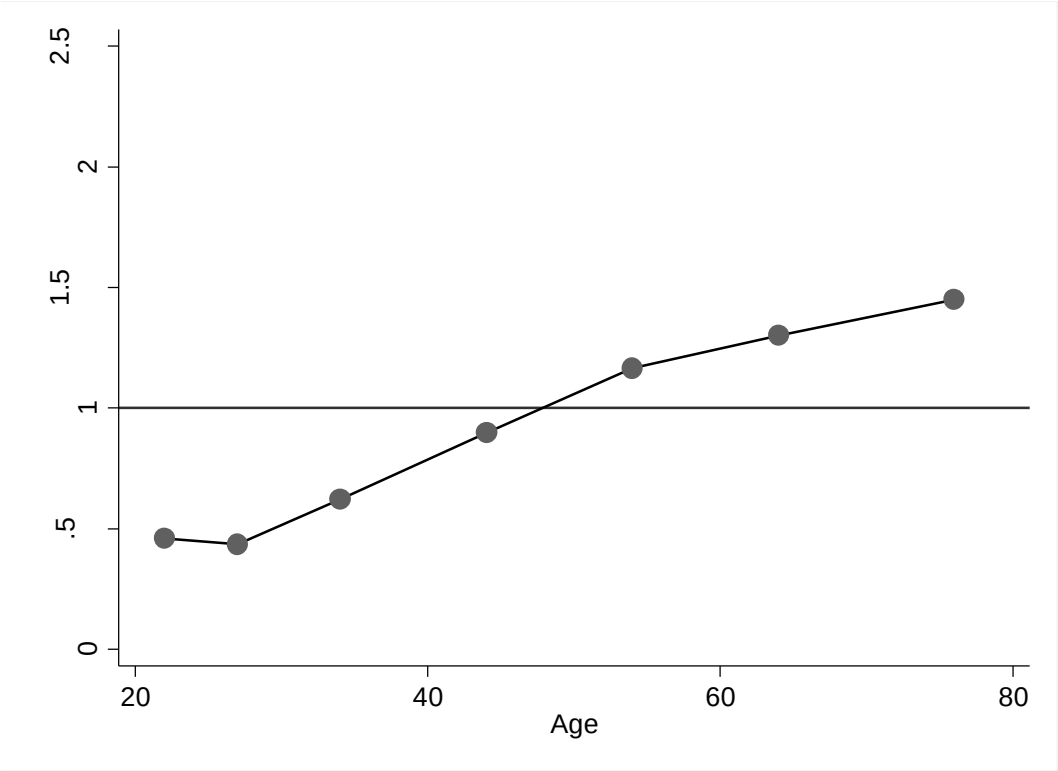
Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth ($W_{l,a}$)	Average wealth ($\bar{W}_{l,a}$)	Normalized average wealth ($\bar{W}_{l,a}/\bar{W}_l$)
20–25	22	2,217	3,670	1,656	0.30
25–30	27	19,500	34,406	1,764	0.31
30–35	32	24,333	47,697	1,960	0.35
35–40	37	48,651	84,110	1,729	0.31
40–45	42	92,686	155,551	1,678	0.30
45–50	47	115,237	275,009	2,386	0.43
50–55	52	130,129	447,122	3,436	0.61
55–60	57	111,116	570,291	5,132	0.91
60–65	62	113,618	680,638	5,991	1.07
65–70	67	118,104	797,013	6,748	1.20
70–75	72	106,644	1,076,455	10,094	1.80
75–80	77	97,414	884,023	9,075	1.62
80–	83	84,839	918,178	10,823	1.93
All	42	1,064,488	5,974,168	5,612	1.00

Note: Data from Flodström (1910, Table K).

7.3 The 1920 age-wealth profile

The Census of 1920 was the first Census to report information about income and wealth for the Swedish population. We use information on taxable net wealth reported for different age-classes in Statistics Sweden (1927, p. 124).

Figure A3: Age-wealth profile in 1920



Note: Normalized average wealth, $\overline{W}_{l,i}/\overline{W}_{l}$, come from Table A3.

Table A3: Age-wealth profile in 1920

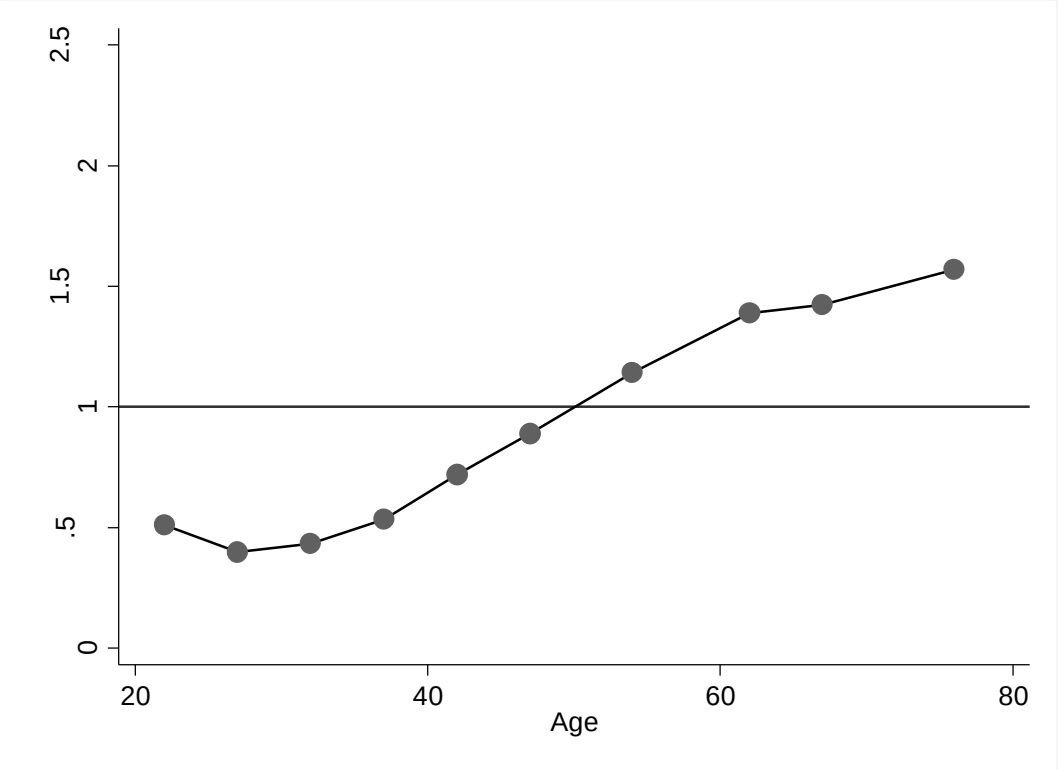
Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth $(W_{l,a})$	Average wealth $(\overline{W}_{l,a})$	Normalized average wealth $(\overline{W}_{l,a}/\overline{W}_{l})$
20–25	22	13,511	140,489	10,398	0.46
25–30	27	29,877	295,449	9,889	0.44
30–40	34	115,335	1,623,130	14,073	0.62
40–50	44	150,211	3,055,765	20,343	0.90
50–60	54	143,099	3,778,595	26,405	1.16
60–70	64	109,791	3,237,024	29,484	1.30
70–	76	60,206	1,978,308	32,859	1.45
All	42	622,030	14,108,760	22,682	1.00

Note: Data from Statistics Sweden (1927), p. 124.

7.4 The 1930 age-wealth profile

We use data from the 1930 Census to get information about age-wealth profiles in this year. Data were collected from Statistics Sweden, Statistical Yearbook of 1945 (table 254, p. 302-303), and further information is provided in the Census volume Statistics Sweden (1938, pp. 114ff).

Figure A4: Age-wealth profile in 1930



Note: Normalized average wealth, $\bar{W}_{l,i}/\bar{W}_l$, come from Table A4.

Table A4: Age-wealth profile in 1930

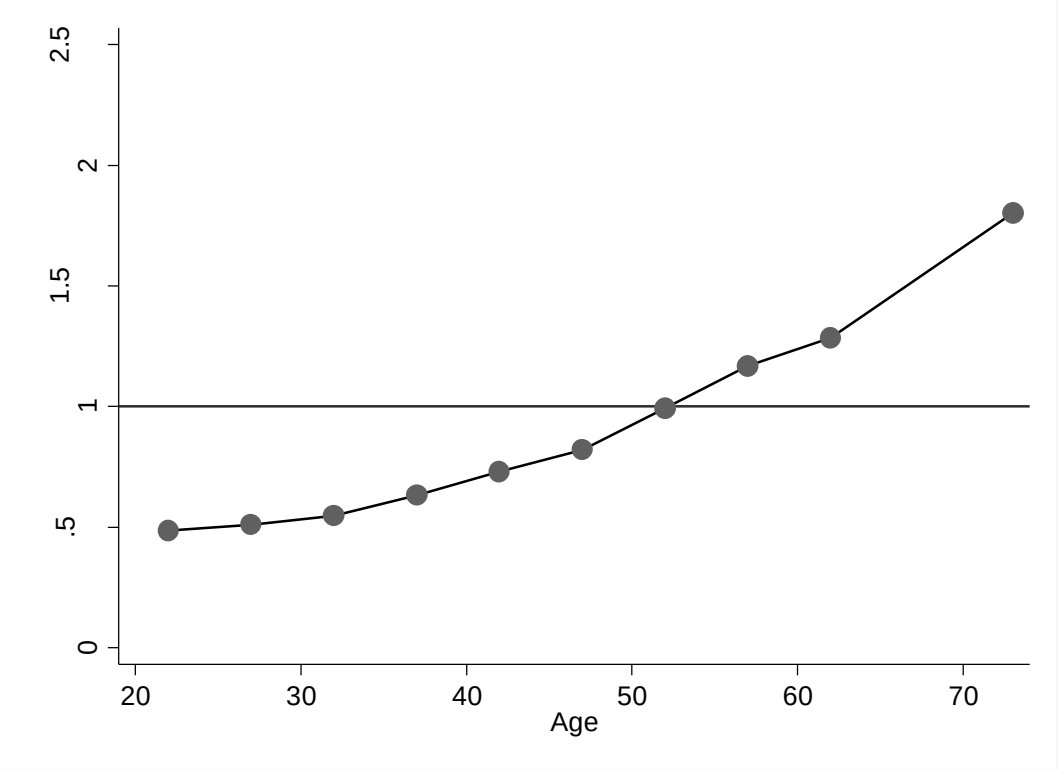
Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth ($W_{l,a}$)	Average wealth ($\bar{W}_{l,a}$)	Normalized average wealth ($\bar{W}_{l,a}/\bar{W}_l$)
20–25	22	21,092	193,332	9,166	0.51
25–30	27	40,907	292,687	7,155	0.40
30–35	32	63,579	493,105	7,756	0.43
35–40	37	81,083	776,190	9,573	0.53
40–45	42	93,689	1,210,785	12,923	0.72
45–50	47	99,087	1,584,295	15,989	0.89
50–60	54	193,389	3,967,681	20,517	1.14
60–65	62	79,322	1,976,612	24,919	1.39
65–70	67	71,227	1,819,991	25,552	1.42
70–	76	101,694	2,865,782	28,180	1.57
All	43	845,069	15,180,460	17,964	1.00

Note: Data from Statistical Yearbook of Statistics Sweden, 1945 (table 254, p. 302-303).

7.5 The 1945 age-wealth profile

We collect information about the Swedish age-wealth population in 1945 from the Census of that year (Statistics Sweden, Statistical Yearbook of 1950, table 303, p. 320–321). Further information is available in Statistics Sweden (1951, table 1, p. 2). This Census observations differs somewhat from the 1920 and 1930 observations since the 1945 data are based on an eight percent sample of the population and not the full population as in the previous years. The listed numbers are scaled up so as to cover the whole population.

Figure A5: Age-wealth profile in 1945



Note: Normalized average wealth, $\bar{W}_{l,i}/\bar{W}_l$, come from Table A5.

Table A5: Age-wealth profile in 1945

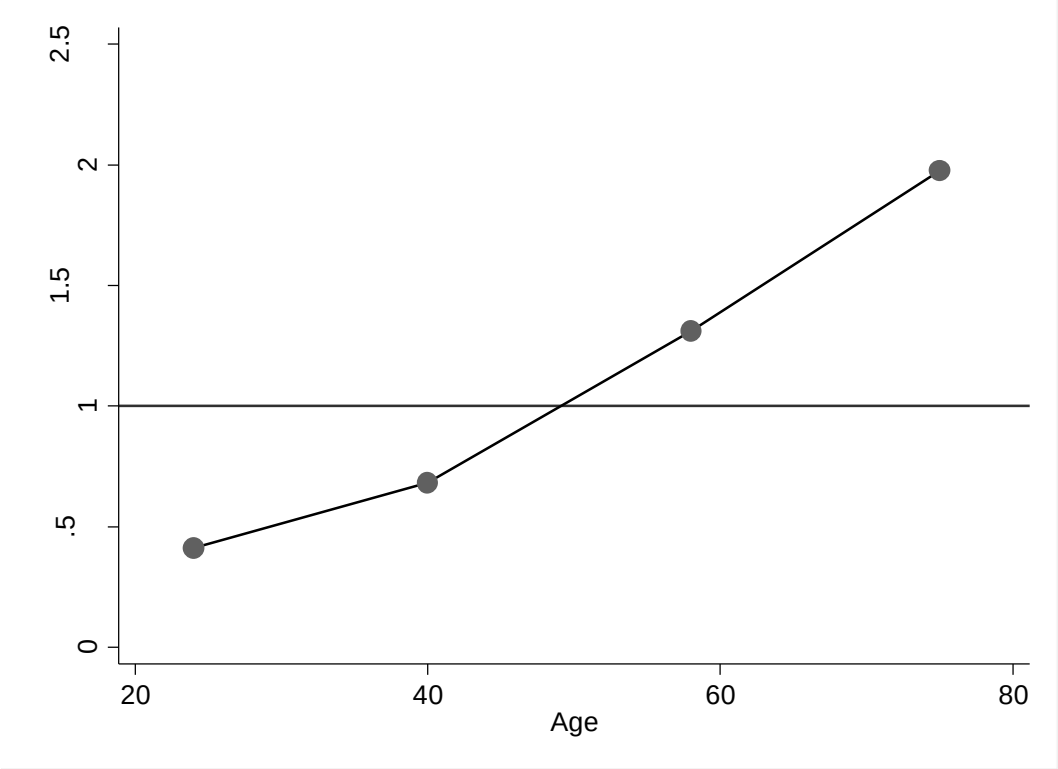
Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth ($W_{l,a}$)	Average wealth ($\bar{W}_{l,a}$)	Normalized average wealth ($\bar{W}_{l,a}/\bar{W}_l$)
20–25	22	37,591	376,970	10,028	0.49
25–30	27	66,145	695,818	10,520	0.51
30–35	32	97,999	1,110,111	11,328	0.55
35–40	37	131,944	1,725,186	13,075	0.63
40–45	42	145,358	2,193,481	15,090	0.73
45–50	47	147,896	2,504,670	16,935	0.82
50–55	52	141,332	2,900,492	20,523	0.99
55–60	57	131,205	3,168,052	24,146	1.17
60–65	62	111,512	2,965,116	26,590	1.29
65–	73	196,709	7,327,399	37,250	1.80
All	43	1,207,691	24,967,295	20,674	1.00

Note: Data come from Statistics Sweden, Statistical Yearbook of 1950, table 303, p. 320–321.

7.6 The 1951 age-wealth profile

Information about the Swedish age-wealth profile comes from the Census of 1950, collected from Statistics Sweden, Statistical Yearbook of 1957, table 388, p. 316. Further information can be found in Statistics Sweden (1956, table 1, p. 2).

Figure A6: Age-wealth profile in 1951



Note: Normalized average wealth, $\bar{W}_{l,i}/\bar{W}_l$, come from Table A6.

Table A6: Age-wealth profile in 1951

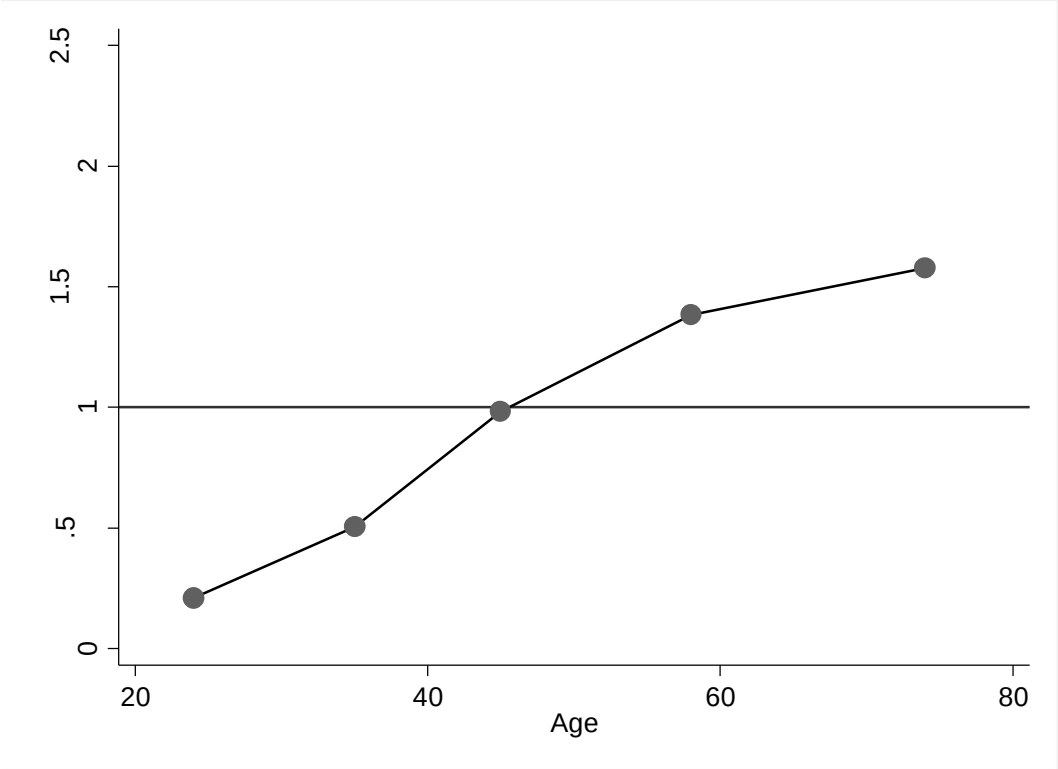
Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth $(W_{l,a})$	Average wealth $(\bar{W}_{l,a})$	Normalized average wealth $(\bar{W}_{l,a}/\bar{W}_l)$
16–30	24	293,000	1,743	5,949	0.41
31–50	40	913,000	8,976	9,831	0.68
51–67	58	675,000	12,750	18,889	1.31
68–	75	259,000	7,378	28,486	1.98
All	44	2,140,000	30,847	14,414	1.00

Note: Data come from Statistics Sweden, Statistical Yearbook of 1957, table 388, p. 316.

7.7 The 1966 age-wealth profile

A public investigation called The Capital Taxation Committee ("Kapitalskatteberedningen") was summoned in 1967 to make a complete overhaul of the taxation of capital in Sweden. As part of the investigation, data on the Swedish age-wealth were collected and compiled (SOU 1969:54, tables 17 and 18, pp. 217–218). The numbers are based on a large stratified sample of the Swedish adult population, based on the tax register over individual taxable net wealth for the year 1966.[27]

Figure A7: Age-wealth profile in 1966



Note: Normalized average wealth, $\bar{W}_{l,i}/\bar{W}_l$, come from Table A7.

Table A7: Age-wealth profile in 1966

Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth $(W_{l,a})$	Average wealth $(\bar{W}_{l,a})$	Normalized average wealth $(\bar{W}_{l,a}/\bar{W}_l)$
20–29	24	587,511	3,685	6,272	0.21
30–39	35	535,844	8,105	15,126	0.50
40–49	45	589,281	17,402	29,531	0.98
50–66	58	1,080,967	44,890	41,528	1.38
67–	74	567,246	26,863	47,357	1.58
All	46	3,360,849	100,945	30,036	1.00

Note: Data from SOU 1969:54, tables 17 and 18, pp. 217–218.

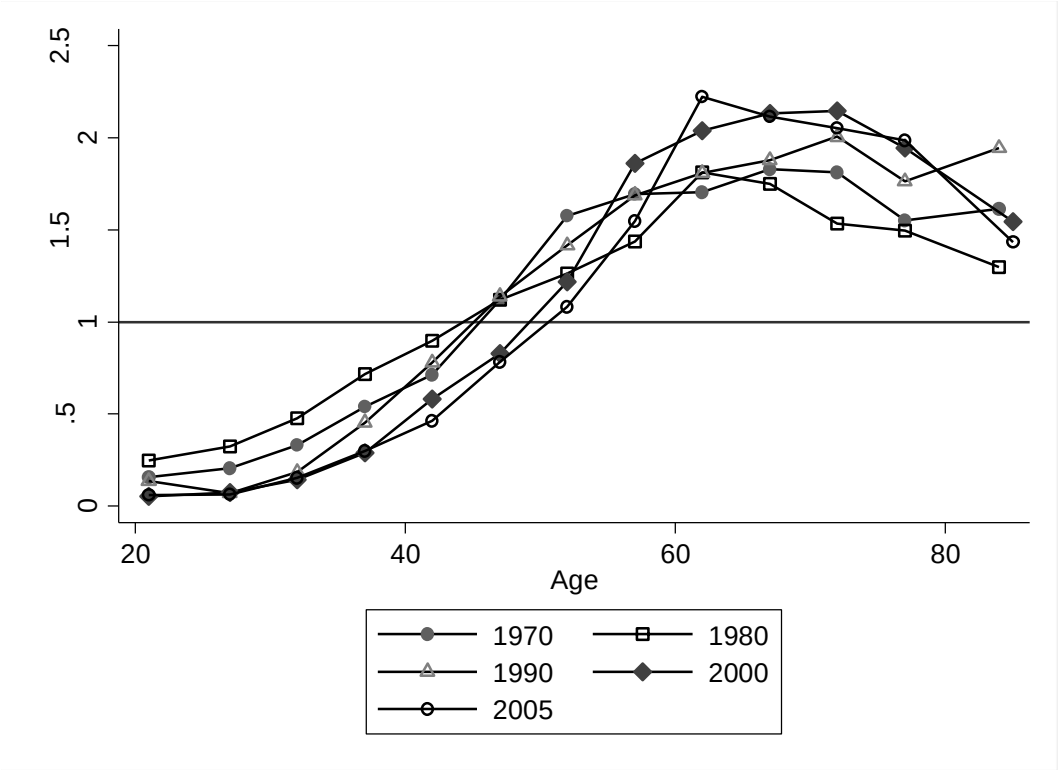
[27] Specifically, 2 percent of individuals with wealth between 0.1 and 0.3 million SEK were sampled, 5 percent between 0.3 and 1 million SEK, 20 percent between 1 and 5 million SEK and 100 percent with wealth above 5 million SEK. The average taxable net wealth in 1966 was 0.027 million SEK. See further SOU 1969:54, pp. 188–191.

7.8 Age-wealth profiles since 1968

From 1968 onwards, Sweden launched comprehensive population register databases with demographical and taxation-related information. These registers have been compiled into smaller, nationally representative databases, and we use one of these, the LINDA database, to retrieve information about the average taxable wealth across age classes. LINDA consists of a 3,35% sample of the population, representing between 200,000 and 300,000 individuals during the studied period. While this sample size is sufficiently large for our purposes, there is still a risk that single extreme observations may influence the results and we therefore use three-year averages to smooth out the influence of single-year/individual observations. As noted above, we have no information about wealth after 2007 due to the abolishment of the wealth tax in 2007.

In our estimation of μ, we wish to combine the historical evidence presented earlier and the modern data. To avoid unbalancing the age-wealth sample, especially avoiding giving too much weight to the modern era when we have annual observations, we restrict the modern sample in two ways. First, we only use five dates, 1970 (1969–1971), 1980 (1979–1981), 1990 (1989–1991), 2000 (1999–2001) and 2005 (2004–2006). These years are used since they cover the entire register period. Second, we harmonize these modern observations with the historical evidence by collapsing the yearly age levels into age intervals. We choose the 13 age classes reported in the 1908 sample. Figure A8 shows the resulting age-wealth profiles for the four modern reference years.

Figure A8: Age-wealth profiles in 1970, 1980, 1990, 2000 and 2005



Note: Normalized average wealth is defined as $\bar{W}_{l,i}/\bar{W}_l$, (see, e.g., Table A1). Observations are three-year averages, with the denoted years as midpoint.

Table A8: Age-wealth profile in 1980

Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth ($W_{l,a}$)	Average wealth ($\bar{W}_{l,a}$)	Normalized average wealth ($\bar{W}_{l,a}/\bar{W}_l$)
18–25	21	26,423	277,789	10,714	0.23
25–30	27	19,878	290,353	14,792	0.32
30–35	32	22,064	476,299	21,879	0.48
35–40	37	21,066	709,929	32,893	0.72
40–45	42	16,328	665,902	41,158	0.90
45–50	47	14,557	751,501	51,385	1.12
50–55	52	15,254	878,254	57,839	1.26
55–60	57	16,801	1,101,146	65,827	1.44
60–65	62	16,176	1,371,559	83,188	1.81
65–70	67	15,153	1,200,803	80,209	1.75
70–75	72	12,909	906,172	70,386	1.53
75–80	77	9,159	629,605	68,524	1.49
80–	84	9,756	623,511	61,381	1.34
All	47	215,524	9,882,823	45,855	1.00

Note: Data from Statistics Sweden, LINDA. The register variable on net taxable wealth is called formskp in 1979–1981. The equivalent variables are sfo in 1969–1971 and formskp in 1989–1991.

Table A9: Age-wealth profile in 2005 (2004–2006)

Age class (a)	Average age, weighted (a)	Number of wealth holders (N_a)	Sum of wealth ($W_{l,a}$)	Average wealth ($\bar{W}_{l,a}$)	Normalized average wealth ($\bar{W}_{l,a}/\bar{W}_l$)
18–25	21	25,267	134,724	4,493	0.04
25–30	27	18,649	105,616	5,751	0.06
30–35	32	20,964	286,154	14,017	0.14
35–40	37	22,103	583,707	26,892	0.26
40–45	42	20,631	1,044,556	51,554	0.50
45–50	47	19,837	1,697,403	84,418	0.82
50–55	52	19,689	2,242,371	115,362	1.12
55–60	57	21,592	3,692,950	172,161	1.68
60–65	62	18,349	4,296,455	228,976	2.23
65–70	67	13,920	3,017,726	217,788	2.12
70–75	72	11,816	2,502,822	212,296	2.07
75–80	77	10,858	2,146,673	196,702	1.92
80–	85	17,939	3,044,973	146,278	1.43
All	49	241,620	24,794,941	102,627	1.00

Note: Data from Statistics Sweden, LINDA. The register variable on net taxable wealth is called fsp.

As discussed above, the register data consists of tax-assessed wealth for all years up to and including 2006, but also third-party reported market-valued wealth for the period 2000–2007. In our main analysis, we only use the tax-assessed wealth to retain consistency with the historical evidence which exclusively consists of tax-assessed wealth. However, we argue, and also show in the paper's robustness analysis, that the tax-assessed wealth provides a suffi-

ciently good view of the true age-wealth patterns in the Swedish economy.

One indication of the robustness of using tax-assessed wealth to conjecture age-wealth profiles is shown in Figure A11. Here we use yearly ages and instead age-classes as before. The main message is that the age-wealth profile looks roughly the same when one uses tax-assessed wealth of a small share of the population (those with taxable wealth) and market-valued wealth of the whole population. This result provides support for using tax-assessed wealth in our analysis.

Figure A9: Age-wealth profile in 2005, tax-valued vs. market-valued wealth

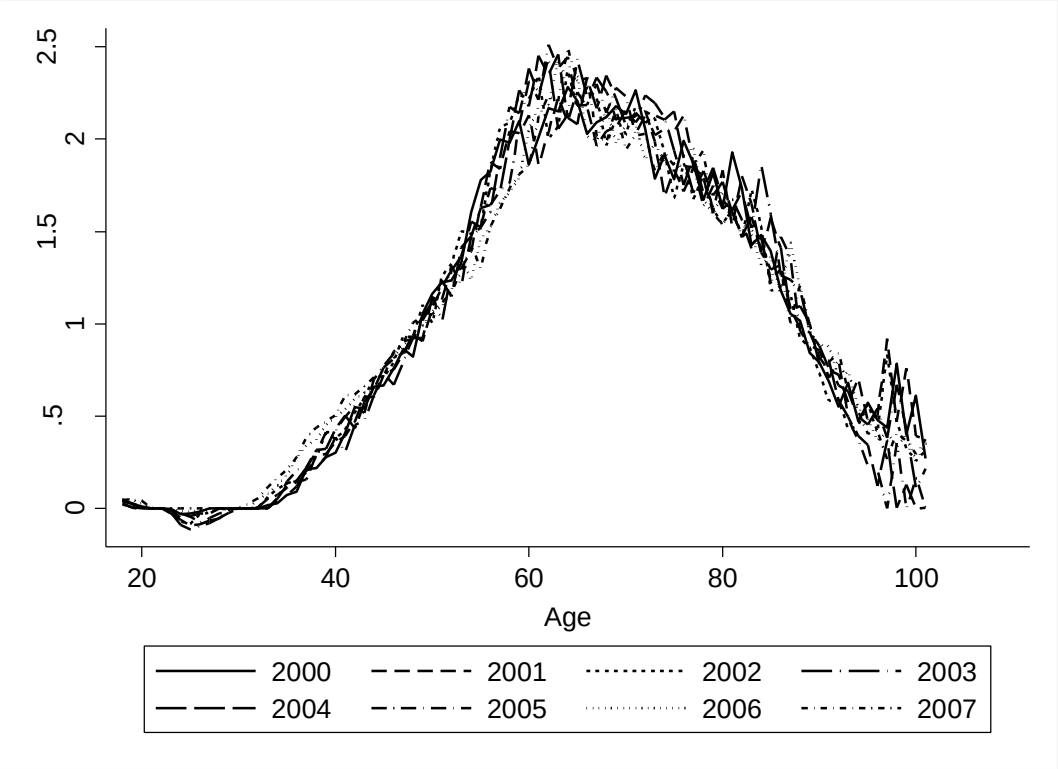
Note: Normalized average wealth, $\bar{W}_{l,a}/\bar{W}_{l}$, annual values corresponding to values in Tables A10 and A11. Observations are three-year averages, with the denoted year as midpoint.

Table A10: Age-wealth profile in 2004–2006, market-valued wealth (SEK).

Age (a)	Number of wealth holders (N_a)	Sum of wealth ($W_{l,a}$)	Average wealth ($\bar{W}_{l,a}$)	Normalized average wealth ($\bar{W}_{l,a}/\bar{W}_{l}$)
20	3,691	258,706	63	0.11
30	3,981	578,937	101	0.18
40	4,568	1,711,256	335	0.59
50	3,968	2,775,591	628	1.10
60	4,379	4,397,395	924	1.62
70	2,484	2,479,160	1,016	1.78
80	2,026	1,735,173	892	1.56
90	688	461,297	775	1.36
100	31	11,337	449	0.79
All	243.366	139,027,796	412	1.00

Note: Data from Statistics Sweden's Wealth Register and LINDA. The register variable on wealth is fnettw.

Figure A10: Age-wealth profile in 2000–2007, market-valued wealth



Note: Normalized average wealth, $\bar{W}_{l,i}/\bar{W}_l$. Data come from Statistics Sweden's Wealth Register and LINDA. The variable names in Register database for net wealth are "fnettw" and "cfnetto".

8. Simulation of annual age-wealth profiles, 1810–2010

In this section, we show how we go from the historical observations of Swedish age-wealth profiles during a few years to having a full set of age-wealth observations for each year and age during the entire period of study, 1810–2010.

As is explained in the main paper, the estimation of Swedish inheritance flows across time requires historical values for the model parameter μ^*, the ratio of average wealth of the deceased population to the average wealth of the living population adjusted for the flow of *inter vivos* gifts across generations that takes may not be captured in the probates. This can actually be done using information about the distribution of wealth of Swedish adults at different ages using the formula

$$\mu^* = \frac{\bar{W}_d}{\bar{W}_l} = \sum_i \frac{M_a}{M}\left(\frac{\bar{W}_{l,a}}{\bar{W}_l}\right) \quad , \tag{1}$$

where M_a is mortality in age class a and W_a wealth in age class a. Note that our μ^* includes all *inter vivos* gifts since we incorporate the observed wealth of the whole living population at a certain point in time, and any gifts that have been given should thus be included in the wealth of the living individuals regardless of their age.

The challenge with estimating μ^* for the full time period is that we lack complete historical

information about wealth of Swedish adults across all ages and years back to 1810. Our solution is to use the historical observations reported above to construct a complete dataset by way of simulation. From the Human Mortality Database, we get mortality in each age class M_a (and thus population mortality M) during the full period.

We compute the ratio between the average wealth of different age groups and the average wealth of the adult population as a whole, $\frac{\bar{W}_{l,a}}{\bar{W}_l}$, for all years and ages by regressing the observed historical ratios (reported above) on a set of age and year polynomials. Our main specification looks as follows:

$$\left(\frac{\bar{W}_{l,a}}{\bar{W}_l}\right)_t = b_0 + b_j \sum_{j=1}^{4} Age_{a,t}^{j} + c \cdot Year_t + d(Age_a * Year_t) \qquad (2)$$

The results from this regression are shown in the first column of Table A1. As can be seen from the table, not all age and year regressors are significantly different from zero, but the overall explanatory power (R^2) is still relatively high, around 80 percent. The table also reports the output from four alternative specifications in which variants of the age and year polynomials, and interactions between them, are included. The resulting model parameters associated with these regressions are presented in the subsections below.

Table A11: Polynomial regressions underlying simulated age-wealth profiles

	Main model	Linear model	No trend-model
Age	–0.116	0.030***	0.021
	(0.201)	(0.002)	(0.200)
Age^2	–0.006		–0.000
	(0.006)		(0.007)
Age^3	0.000		0.000
	(0.000)		(0.000)
Age^4	–0.000		–0.000
	(0.000)		(0.000)
$Year$	–0.011***	–0.004***	
	(0.003)	(0.001)	
$Age * Year$	0.000***		
	(0.000)		
$Constant$	9.110***	6.426*	0.900
	(3.263)	(3.628)	(1.317)
Observations	126	126	126
R-squared	0.631	0.567	0.566

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

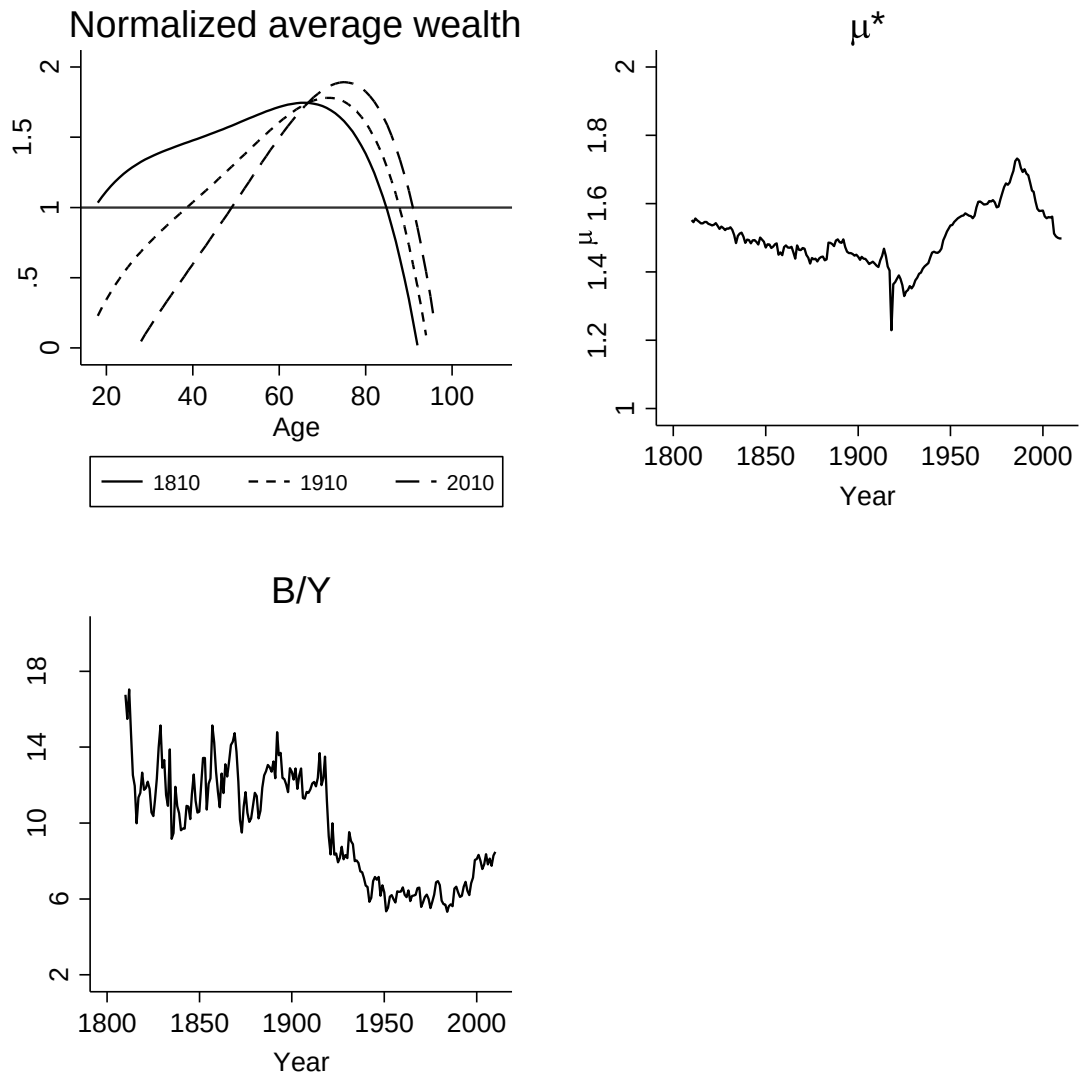
Based on the regression output in Table A1, we impute fitted values, $\left(\widehat{\frac{\bar{W}_{l,a}}{\bar{W}_l}}\right)_t$, for each age between 18 and 110 and year between 1810 and 2010. Then we multiply these fitted age-average wealth ratios with the age- and year-specific mortality ratios, $\frac{M_{at}}{M_a}$. Summing these products over ages, we obtain a time series with annual values equal to the right hand side of equation (1) above, i.e., $\widehat{\mu^*}_t$.

Figure A11 contains three panels. The upper left shows the estimated normalized average wealth ($\widehat{\bar{W}_{l,a}/\bar{W}_l}$) over the life cycle for three years, 1810, 1910 and 2010. The ratio equals one when the age group has an average wealth equal to the population average wealth. As can be seen, the simulated ratios are below one for people up to about 45 years of age and then above one up to their 80's or low 90's when it starts decreasing rapidly.

Is this simulated life cycle pattern with accumulation (relative to the average) up to a certain age and then decumulation evidence in favor of the standard hump-shaped life cycle profile of the Ando-Modigliani model? Actually no. It is crucial to note that the decumulation begins very late in life. In 1810, when the expected life span was 40 years for newborns and 70 years for people living to see their 50th birthday (see Statistics Sweden, 1969, table 42, p. 118), the estimated relative average wealth increases up to age 70. That is, people accumulated wealth virtually to their expected point of death! Similarly, in 1910 people accumulated wealth up to the age of 72 while the average life span was 54 years and the expected life at 50 was 74 years. In 2010, the pattern is somewhat weakened. People accumulated up to the age of 74 while the expected life span had increased to around 80 (see Statistics Sweden, 2013), suggesting an earlier decumulation than in historical periods.

Figure A11 also presents the estimated μ^* and the implied inheritance flow (B/Y), which is the same series as in our main paper.

Figure A11: Age-wealth profiles, implied μ^* and inheritance flow (B/Y): Main model

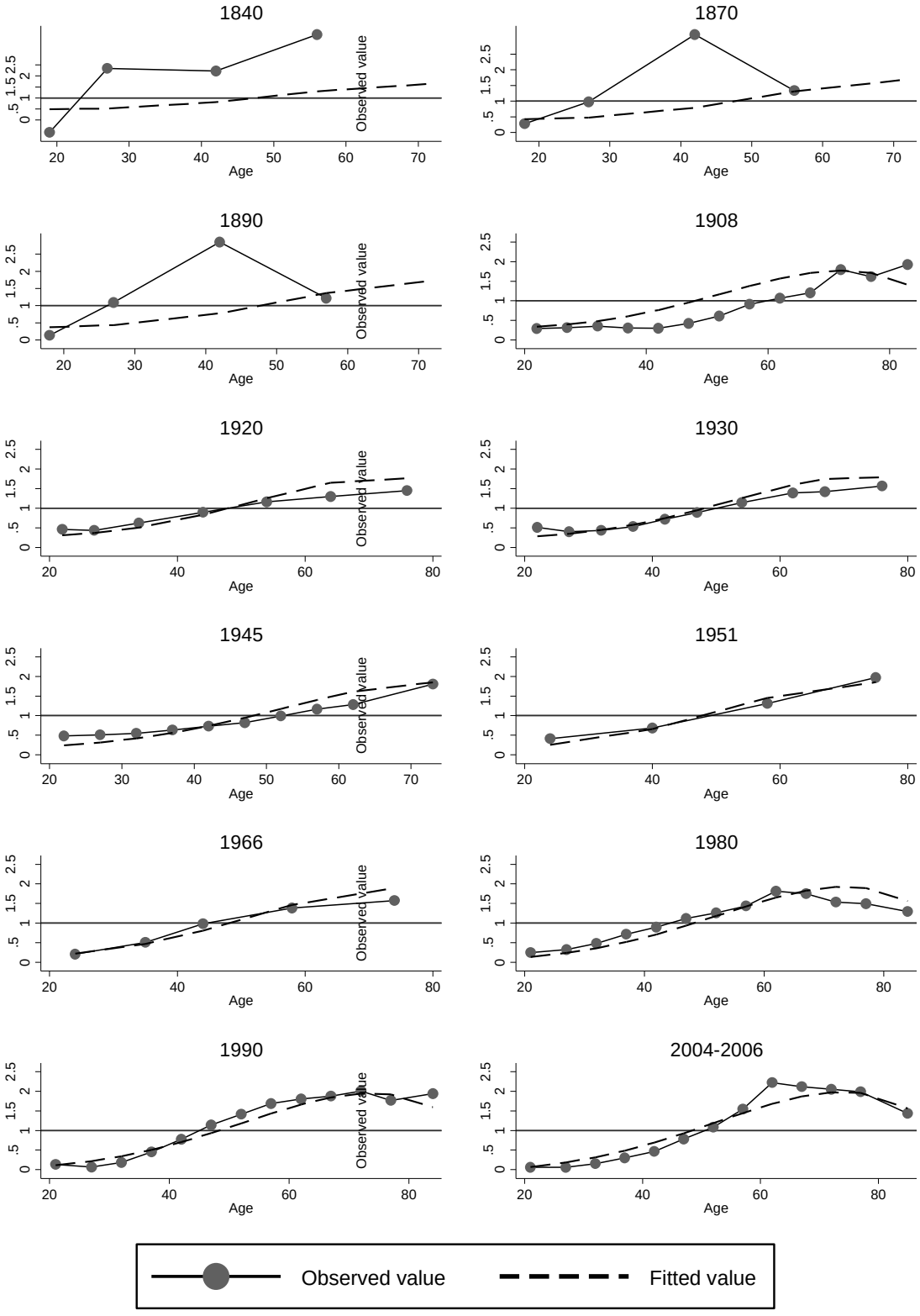


Note: The normalized average wealth, $\overline{W}_{l,a}/\overline{W}_{l}$, the ratio of average wealth of the living in each age class to the average wealth of the living in the whole population.

How well does the simulated age-normalized wealth profile match the underlying historical observations? Figure A12 provides a simple goodness of fit test, in which we simply plot the simulated profiles onto the actual evidence for the respective years. This check is mainly ocular, and inspecting the results gives a good sense of how well the model fits the data. Especially during the 19th century the differences are at times quite large, which is expected given the small and highly specific sample of age-wealth observations used for these early years.

One common pattern seems to be that the decumulation presented in the simulated profiles is not as evidence in the historical evidence up to the 1950's. Since we are using grouped data for all years before 1968, it is possible that the grouping of individuals in age classes may explain why we cannot see any decumulation in earlier times.

Figure A12: Goodness of fit: simulated and actual age-wealth profiles (main model)



Note: The figures show observed and simulated values of the normalized average wealth, $\bar{W}_{\iota,a}/\bar{W}_{\iota}$, the ratio of average wealth of the living in each age class to the average wealth of the living in the whole population.

9. Robustness checks: different models when simulating age-wealth profiles

One element of uncertainty in our estimations of historical age-wealth profiles is the assumed model specification in equation (2) and its impact on the resulting μ^* and inheritance flow. Because of this uncertainty, this section presents the results from using four alternative specifications.

9.1 Using linear age and year trends and age-year interaction

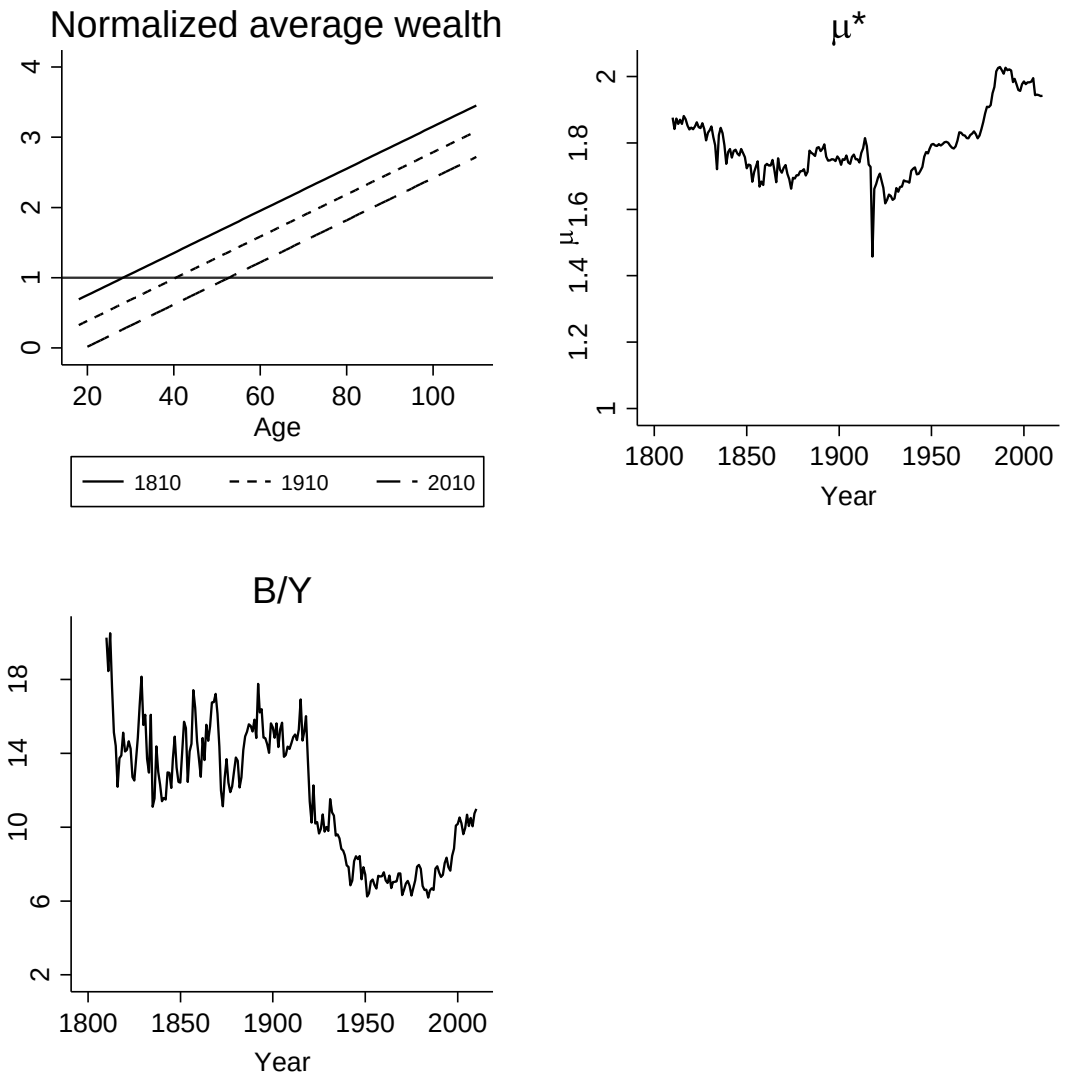
In our first alternative specification, we remove the polynomials in age and run a linear model with an interaction term between age and year.

$$\left(\frac{\bar{W}_{l,a}}{\bar{W}_l}\right)_t = b_0 + b \cdot Age_a + c \cdot Year_t + d(Age_a * Year_t) \quad (3)$$

Figure A13 presents the results from using simulated age-wealth profiles based on this linear specification (see also Table A11, column 2, for the regression output). The age-wealth profile is quite different, naturally due to the fact that there are no polynomials in age and thus no room for a gradual transition from accumulation to decumulation. The estimated μ^* is at the same level as in the main model but only up to the postwar era, thereafter it continues to increase all the way up to 2010. This increase reflects that the relative wealth decumulation among the elderly observed in the main model is not present in the linear model (by construction through the absence of age polynomials). The increase in β therefore translates into a higher μ^*in the period after 1980.

Looking at the inheritance flow in the linear model, the overall level is slightly higher than in the main model, with the flow surpassing ten percent in 2010 (as opposed to eight percent in our main model). Still, the time profile looks similar as in the main model, with a relatively high level during the 19th century up to the 1910s, and thereafter a secular decline up to the late 1980s when the inheritance flow increases sharply.

Figure A13: Age-wealth profiles, implied μ^* and inheritance flow (B/Y): Linear model



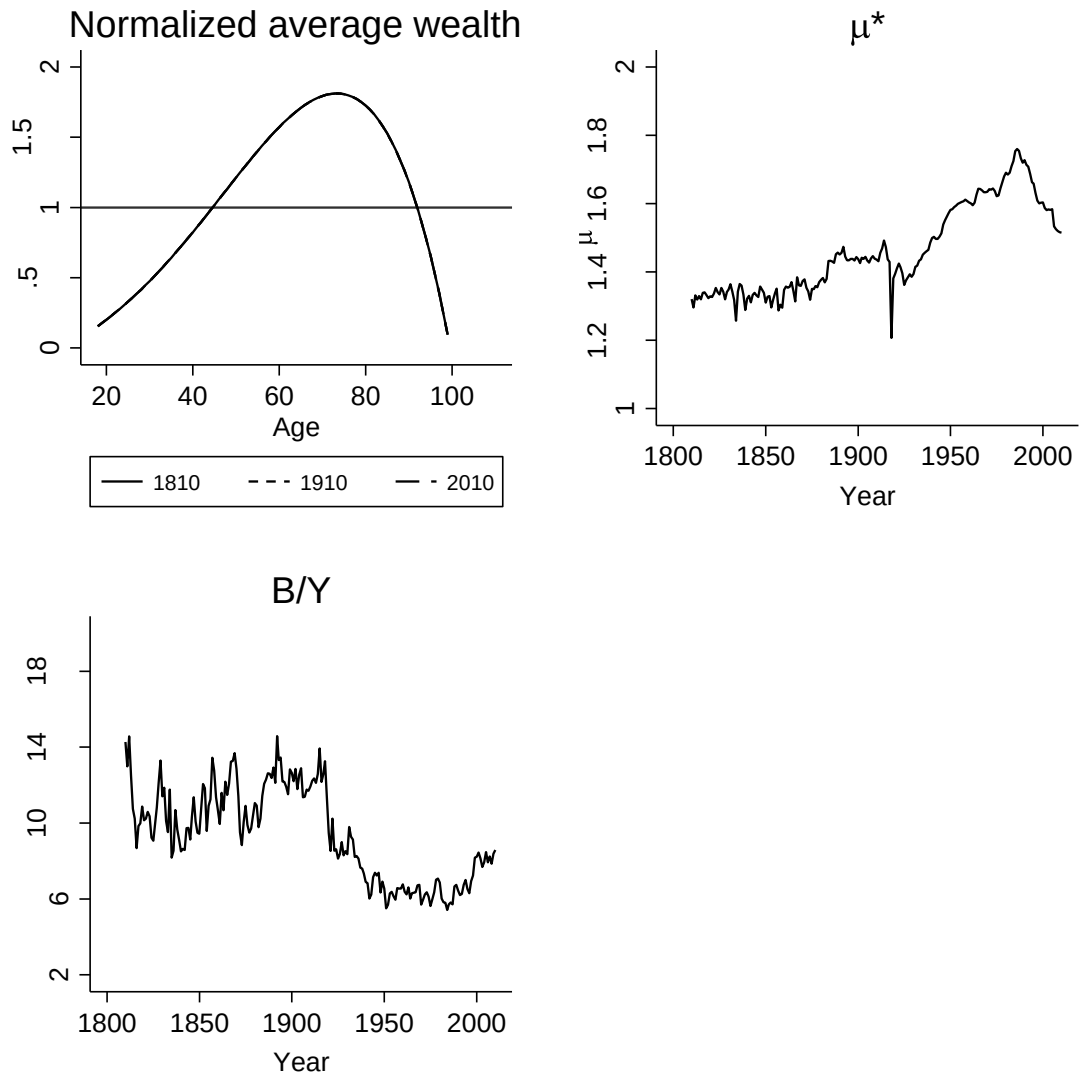
9.2 Using age polynomials but no time trend

Another alternative specification used is one where we remove time entirely from the regression model:

$$\left(\frac{\overline{W}_{l,a}}{\overline{W}_l}\right)_t = b_0 + b_j \sum_{j=1}^{4} Age_{a,t}^{j} \quad (1)$$

Figure A14 shows the results from a simulated age-wealth profile without time trend. The result is quite striking: there is remarkably little difference between the main results in Figure A12 and these results. Of course, the simulated age-wealth profiles are constant over time, but the implied μ^* is only slightly lower than in the main model. For this reason, the resulting inheritance flow is almost the same.

Figure: Age-wealth profiles, implied μ^* and inheritance flow (B/Y): No time trend



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Appendix Fiscal Flow

This appendix gives details on Swedish estate data, both in the form of estate inventory reports and estate tax data. It also explains what is available to capture gifts (*inter vivos*).

10. Swedish estate data

It has been compulsory in Sweden to file estate inventory reports (or probate records) since 1734. Estate inventory reports have been carefully kept in Sweden for centuries and have also been easily accessible at the local courts and the regional archives. After a period of time estate reports have then been moved to the regional archives. Soltow (1985) uses estates reports as one of his sources for studying wealth in Sweden in the beginning of the 1800s. Some researchers have based their studies on data sampled from specific geographic areas.[28]

However, the responsibility for registering estate inventory reports was moved from the district courts to the Swedish Tax Agency 1 July 2001. All estate reports are now registered in the Inheritance Tax Register. There are two main parts of this register: First, there is an electronic database where the basic information from the estate report is registered. Since the repeal of the inheritance tax in 2005, this database is, unfortunately, incomplete with respect to economic variables whereas the demographic information still is complete. Second, all documents in each report are scanned and attached to the database entry. This part of the register is still complete.

We use estate data from the BELINDA databases for the years 2002–2005. Statistics Sweden was commissioned to organize data on intergenerational transfers (estates, inheritances, taxable gifts during the previous ten years, and insurance payments) using the Inheritance Tax Register of the Swedish Tax Agency as a starting point. Three data sets have been produced:[29]

• All bequests. The inheritance tax data base provides economic information for all estates 2002-2004. This gives a schematic view of the different aspects of intergenerational transfers. The information is, however, not detailed. The items of the estate are valued at tax values and not at market values. There are about 90,000 observations per year and more than 80 variables in this data set.

• All taxable gifts. The register covers all taxable gifts during the period 2002-2004. From 2005 and on, there are no data because of the repeal of the gift tax. There are about 30,000 observations per year and about 10 variables in this data set.

• Bequests of a representative sample. The scanned estate reports provide much richer information. It is possible to construct detailed balance sheets with several different items of financial assets, real assets, and debts. It is also possible to have data both at tax values and market values. There is also information on who receives the inheritances and how much they receive. It, however, requires considerable resources to collect and transform these data to become electronically accessible. Our basic approach is to focus on the estate reports of deceased people who were included in Statistics Sweden's LINDA data base. The LINDA sam-

[28] Lindgren (2002), for example, uses estate reports from the town of Kalmar 1840-1905 to study the use of promissory notes to provide credit.

[29] The Swedish Research Council has funded the data base project. Data are available, subject to the usual standard secrecy examination, for researchers through Statistics Sweden's remote access system MONA.

ple is 3 percent of the Swedish population; consequently the sample size is approximately 3,000 estate reports annually. Data for 2004 and 2005 are available for research. There are more than 100 variables in this data set.

Over the years there have been previous attempts to collect and organise data on estates and inheritances. The official government committee on capital taxes (*Kapitalskatteberedningen*) did a very ambitious study of estate inventory reports registered in 1967. This is reported in Chapter 9 of SOU 1969:54. A decade before the official government on inheritance taxes (*Arvsskattesakkunniga*) published a similar study in SOU 1957:48. Similar data can also be found in SOU 1946:79 (*Statsskatteberedningen*).

In the beginning of the 1900s, Isidor Flodström organised a series of empirical studies of economic variables (*Finansstatistiska utredningar*). There is a very detailed account of estate reports 1906-1908 in Finansdepartementet (1910b), corresponding information on inheritances can be found in Finansdepartementet (1910a). Statistics based on estate reports from as early as 1873-1877 can be found in Finansdepartementet (1879).

All these historic studies are ambitious and produce interesting results but we still lack continuous time series for the aggregate estate amounts in Sweden over longer time series. What we do have is the aggregate values of the estates of the deceased in:

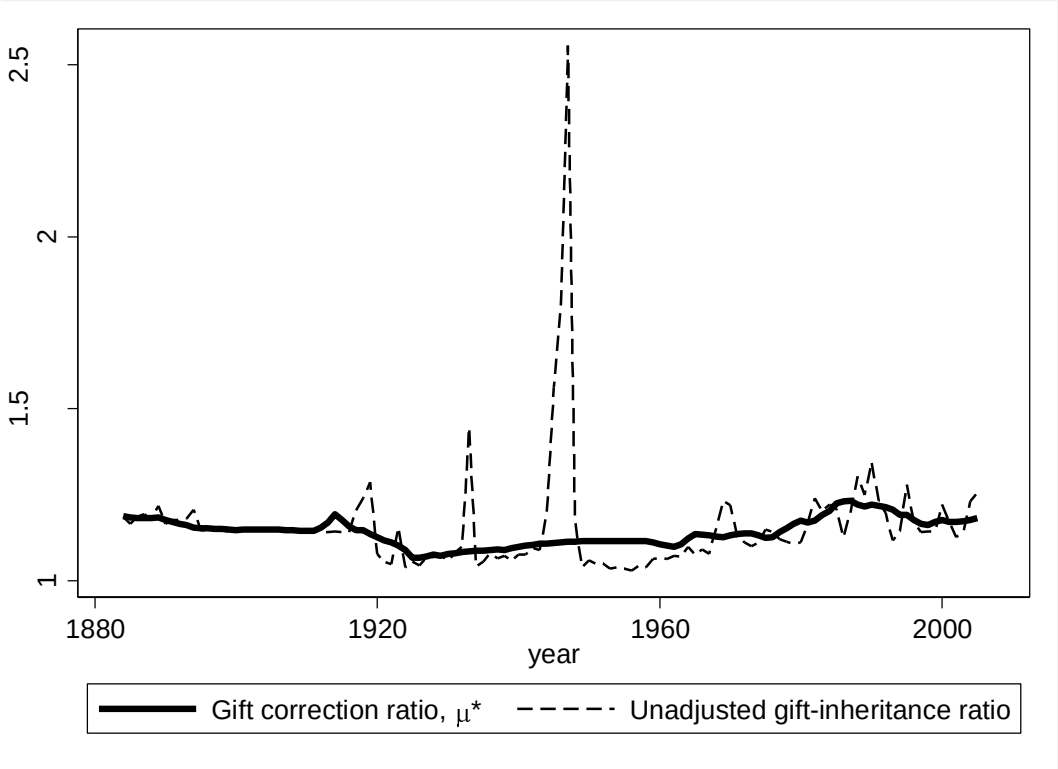
- 1873 – 1877
- 1906 – 1908
- 1943 – 1944
- 1954/55
- 1967
- 2002 – 2005

11. Gift correction

We need to add the annual flow of gifts to estate wealth that is transferred from the deceased to the heirs. Ohlsson (2011) reports the annual tax revenue from inheritance and estates during the period 1884–2004. He also reports the annual tax revenue during the period 1915 – 2004 when there also was a gift tax. The ratio of the sum of gift tax and inheritance (and estate) tax revenues to the inheritance (and estate) tax revenues is a correction coefficient which can be used to scale up either estate values 1873 – 1967 or the μ ratio to get the μ^* ratio. Figure 1 shows this correction coefficient over the period 1884–2004 being in the order of 5 – 18 percent. Note that there are two prominent spikes in the annual series. These spikes reflect behavioral effects of two tax reforms, both leading to increases in inheritance taxation relative to gift taxation. In 1934, the inheritance tax rate was sharply increased and in 1948, it was not only increased but also combined with an estate tax. For this reason, people started giving away larger shares of their wealth in order to minimize future inheritance taxation for their heirs, and our final series uses a version where we smooth out the gift amounts over a ten-year period after the 1934 reform and a 20-year period after the 1948 reform.

The BELINDA database provides information on the total taxable gift amounts in 2002–2004. The aggregate taxable gift amounts are close to 20 percent of the aggregate estate values. We, therefore, correct the aggregate estate using a factor of 20 percent.

Figure: Gift correction ratio of average wealth of the deceased over the living, μ^*/μ



Note: The unadjusted ratio (thin, dashed line) shows the sum of gifts and inheritances over the sum of inheritances. The gift correction ratio, μ^* (bold, solid line), shows the same ratio but when account is taken for gift tax increases in 1934 and 1948, leading to spikes in gift flows just preceding these tax increases (see further Ohlsson, 2011; Du Rietz, Henrekson and Waldenström, 2013). Gifts in 1933 are smoothed out during the following ten-year period and gifts in 1947 are smoothed out over the succeeding twenty-year period.

11.1 Survey evidence on gifts

The 1998 wave of the "Household market and nonmarket activities" survey (HUS) has answers from almost 3,000 individuals about *inter vivos* gifts and inheritances received. The dataset is rich in terms of property transfers. All adult members of the interviewed households were asked:

"Have you or anyone else in your household received a gift/an inheritance worth at least SEK 1,000 or an equivalent value?"

These transfer questions were retrospective and concerned all previous transfers although the questions were only asked in one wave of the survey. The respondents could report up to five gifts and five inheritances received. Nordblom and Ohlsson (2011) deflate all amounts to 1998 values using the consumer price index and a zero percent real interest rate.

Among the respondents 17.7 percent had received gifts, the unconditional average amount was SEK 13,000, while 29.3 percent of the respondents had received inheritances with an unconditional average amount of SEK 63,900. The gift amount is slightly above 20 percent of the inheritance amount. This supports a gift correction in the order of 20 percent.

12. Insurance correction

There are considerable amounts transferred from decedents to heirs via different insurance arrangements. Most of this wealth does not show up in the estate inventory reports. This is particularly true for insurance policies with premia that have been paid for with money that already has been taxed. Some insurance policies are, however, tax-deferred. When an heir receives the benefits from such a policy, the benefit amount was added to the inheritance amount when the inheritance tax amount was calculated.

The BELINDA database provides us with a lower bound for how important insurance was for wealth transfers from decedents to heirs in 2002 – 2005. Taxable insurance benefits to heirs motivate a correction in the order of 2 percent for these years.

13. Fiscal flow in Sweden

Figure Y shows the resulting result for our measure of the fiscal flow. We have divided our corrected estate values with the same income measure as in … It is clear from the figure that the fiscal flow was close to the economic flow during the 1870s and the 1900s. The fiscal flow became considerably smaller than the economic flow during the 1940s, the 1950s, and the 1960s. Our latest observations suggest that the fiscal flow has increased the last decades. The fiscal flow is, however, still much smaller than the economic flow.

What can explain the large discrepancy between the two flows? We suspect that non-taxable gifts and non-taxable insurance benefits may explain a considerable part of the difference between the two flows. Tax non-compliance might also be an important explanation. It should be stressed though that our last data point concerns 2005 when there no longer were any taxes on inheritances and gifts.

Appendix Mortality

14. Estimating mortality, population-wide and across age groups

Data on demographic variables for Sweden are available annually since 1751 in the Human Mortality Database.[30] We use the year tables specifying the number of living individuals ("Population size") and the number of deaths ("Deaths") for each age between 0 and 110+. Details on the data series is reported by Glei, Lindström and Wilmoth (2012). The data series reflect residents of Sweden, the *de jure* population. The main data source for the period from 1860 onwards is the population Censuses, launched each decade up to the mid- 20th century. For the period before 1860 data are based on exposure rates reported in five-year intervals.

Data quality is high throughout the time period, but highest from 1860 onwards. Prior to 1860 the accuracy is somewhat lower. For example, for Stockholm the *de facto* population is used. The age-specific numbers are also less reliable due to errors in the reporting routines. Specifically, there is evidence of age-heaping, with death counts being consistently higher in the younger five-year groups within each 10-multiple of age (e.g., 20–24, 30–34 etc.) than in the older five-year groups (e.g., 25–29, 35–39 etc.).

Our analysis of inheritance flows focuses on transfers from deceased adults to their relatives (mainly children). Therefore we only study the adult population and remove all individuals below 18 years of age in the calculations.

We define population mortality m as the relation between the number of deceased individuals during each year, M, and the number of living adult individuals, N, i.e., as:

$$m = \frac{M}{N} \ . \tag{A1}$$

We also divide the mortality into age-specific intervals. For each age a the number of adult deaths is M_a and the number of living adults N_a. Age-specific mortality rates is then computed as $m_a = M_a/N_a$ with the population mortality rate thus equaling $m = \sum_a M_a/N_a$.

15. Correcting for differential mortality across wealth classes

When estimating inheritance flows using mortality rates among people with different age and personal wealth, there may be a need to account for potential mortality differentials existing across groups with different wealth or, more generally, in different social classes.[31] In our particular case, the estimation of the parameter μ^* consists of calculating the average wealth of the deceased and the living populations, and these are numbers based on combining information about age-wealth profiles (either from estate tax returns as in France, see Piketty, 2011, or from wealth tax returns as in the case of Sweden, see this study) and information about age-specific mortality rates. As explained by Piketty (2010, section B2, pp. 77ff), poor people die off more often than rich people do, therefore the raw aggregate mortality numbers

[30] The HMD database (www.mortality.com) s constructed by demography researchers from different countries and made freely available to other researchers.
[31] See, e.g., the discussion of Atkinson and Harrison (1978), chapter 3, pp. 53ff.

across age cohorts found in the demographical databases need to be adjusted for the mortality differentials across social class. The wealthy are less likely to die at any age, and therefore the expected flow of inherited capital from that age needs to account for this lower wealth-adjusted mortality to avoid getting too high inheritance flows.

There is a large previous literature studying mortality differences across economic status, especially concerning recent decades. Looking specifically at personal wealth as a measure of status, Attanasio and Hoynes (2000) compute mortality differentials across different age-wealth cohorts in the United States during the 1980s. They find that the mortality among the relatively poor is consistently higher than the mortality among middle- and high-wealth groups. According to their estimates of individuals aged 50 years of higher, the mortality rate in the lowest wealth quartile was between two and three times higher than the mortality in the top three quartiles.[32] Similar evidence has been found by several other postwar studies for different countries.[33] In his study of inheritance in France, Piketty (2011) uses the social mortality differentials found by Attanasio and Hoynes (2000) when adjusting for the recorded mortalities for socioeconomic status over his entire study period 1820–2010. Piketty thereby assumes that these differences are both constant over time and regions.

However, can we be sure that the social gradient in mortality was the same a century ago or even before the industrial expansion? There is a specific literature looking at historical mortality differentials across socioeconomic groups. In a recent review, Bengtsson and van Hopper (2011) find that while such differentials have existed for a long time, the available evidence does not suggest that they were consistently larger in either pre-industrial or industrializing societies than today. Nor was there any seeming impact from industrialization on socioeconomic mortality differentials.

In the case of Sweden across historical eras, one recent analysis of mortality differentials across social classes in Southern Sweden during 1815–1968 fail to find any evidence of a gradient prior to World War II and only some evidence of such a gradient in the postwar era (Bengtsson and Dribe, 2011). Similar results are found by Edvinsson and Lindkvist (2011) in their study of 19th century mortality in a Swedish Northern town. Based on these results and earlier studies of Swedish mortality trends, these authors conclude that mortality differences between socioeconomic classes are a very recent phenomenon.

An older Swedish historical investigation of the link between mortality and wealth is Flodström's (1910) study of estates and wealth in the Swedish population in the years 1906–1908. Flodström discusses the mortality differentials and their importance for the computation of mortality multipliers for the Swedish wealth distribution. He refers to an earlier Danish investigation of mortality across three broader social classes in the 1870's and then he adjusts the findings from that study to match the Swedish situation. In Table 1 his mortality rates for Swedish towns around 1908 are presented for men and women across age cohorts and social class.[34] A main message from the table is that there was indeed a clear differential in mortality across classes; the highest class had a lower mortality than the population as a whole, with the

[32] See Attanasio and Hoynes (2000), table 4, p. 9.
[33] See further the discussion of Kopczuk and Saez (2004), Appendix B pp. 37–39.
[34] We have merged these two groups into one common group, "Urban Sweden", which is a aggregate wealth-weighted average between Stockholm (0.5) and provincial towns (0.5). The basis for regional wealth weights is property tax assessments, which show that Stockholm had 42 percent of the value of all urban non-agricultural property (SOS Statistisk Årsbok 1910, table 104, p. 138). Adding to this the fact that Stockholm was Sweden's financial centre and net financial assets were surely skewed towards Stockholm, and overall 50 percent-share of all the country's wealth is a plausible "educated guess".

differential being smaller in Stockholm than in other towns and smaller the older people get.

For women, the differential across social groups is much smaller than it is for men. In fact, it is almost insignificant, with the highest class having only a few percent smaller mortality rates than the population as a whole. The social mortality gradient for the whole Swedish urban population is therefore less pronounced than it is for men only. If one also would to include the rural population to achieve a gradient for the entire population, would that be steeper or flatter than the urban one? This is an empirical question for which we have no conclusive evidence, but some evidence is cited by Flodström (1910) from another Danish study of rural mortalities. The main conclusion from these data is that the mortality differentials across social groups are less pronounced in the countryside than in cities. Amending the numbers for Swedish urban males with numbers for women and for the rural population, it seems as the social mortality differentials in Sweden around 1900 were quite modest.

Table 1: Differential mortality rates across age and social class, Sweden 1908.

	Male mortality rate (%):			Female mortality rate (%):		
Age, years	All classes	The highest class	Share of the highest class in all	All classes	The highest class	Share of the highest class in all
			Stockholm:			
45 – 55	2.4	1.6	67%	1.2	1.0	88%
55 – 65	3.9	3.1	80%	2.0	1.7	87%
65 – 75	7.2	5.7	78%	4.4	4.3	98%
75 and older	14.7	13.9	95%	12.7	12.0	95%
			Swedish provincial towns:			
45 – 55	1.8	1.2	68%	1.0	0.9	83%
55 – 65	3.0	2.5	84%	1.8	1.8	95%
65 – 75	6.1	5.3	86%	4.3	3.5	81%
75 and older	13.9	11.3	81%	12.1	10.6	87%
			Urban Sweden (Stockholm + Swedish provincial towns):			
45 – 55	2.1	1.4	67%	1.1	1.0	86%
55 – 65	3.5	2.8	81%	1.9	1.8	92%
65 – 75	6.7	5.5	83%	4.4	3.9	90%
75 and older	14.3	12.6	88%	12.4	11.3	91%

Source: Table from Flodström (1910). "Urban Sweden" is a aggregate wealth-weighted average between Stockholm (0.5) and provincial towns (0.5). The basis for regional wealth weights is property tax assessments, which show that Stockholm had 42 percent of the value of all urban non-agricultural property (SOS Statistisk Årsbok 1910, table 104, p. 138). Adding to this the fact that Stockholm was Sweden's financial centre and net financial assets were surely skewed towards Stockholm, and overall 50 percent-share of all the country's wealth is a plausible "educated guess".

In comparison with the mortality differentials of Attanasio and Hoynes (2000), which are also used for 19th and 20th century France by Piketty (2011), these Swedish historical findings of small differentials are challenging. Mortality among the richest quartile of 50-year old U.S. household heads (mainly men) was about a fourth of the mortality among the whole population (0.2 percent vs. 0.9 percent).[35] According to Table 1, the mortality among the richest

[35] See Attanasio and Hoynes (2000), table 4, p. 9.

third among Stockholm males was two thirds of the population mortality (1.6 percent vs. 2.4 percent). For the oldest, aged 75 and above, mortality of the richest U.S. quartile was about half the population mortality but one twentieth among Stockholm males (and a fifth among males in other provincial towns).

We conclude from the Flodström (1910) investigation of urban males and females, from the Danish evidence of a smaller mortality differential in the rural regions than in cities, and also the analysis of Swedish historical demographers Bengtsson and Dribe (2011), that the mortality differentials in Sweden in historical time up to at least World War II *were substantially smaller* than those that Attanasio and Hoynes (2000) find for the U.S. of the 1980's.

Now to estimate Swedish wealth-adjusted mortalities by age, we use the numbers from Flodström (1910) in Table 1 to calculate the differential mortality for the rich. Specifically, we acknowledge the fact that the upper-class males of "Urban Sweden" were the owners of the bulk of the wealth in Sweden around the turn of the century, and this means that we can use the mortality differentials for urban men in the table for our purposes.[36] One may object by saying that also the non-elite urban men, against whom the mortality differential is geared, were wealthier than the rest of the non-wealthy or even poor population. If true the calculated mortality differential in Table 1 would be too small and probably also too flat over the age distribution. However, this is not necessarily the case. First, there were plenty of poor male industrial workers, close to the archetypical "proletariat" class, living in Swedish towns around the turn of the century 1900. Second, some women were surely among the wealthiest, and if we would weight them into the picture we would incorporate some of the even smaller and flatter mortality differential that is apparent among the urban females. Third, it is not obvious that the urban population was all that poorer than the city population; Sweden had a relatively high share of self-owning farmers and including them into the lower classes would not necessarily increase differentials, perhaps quite the contrary.

We therefore feel confident that the Swedish mortality differentials across social classes, and thus also across wealth levels, are appropriately represented by the numbers for urban males shown in Table 1. In our estimations, we adjust these differentials so as to match the methodology set out by Piketty (2011) where the differentials for practical purposes are characterized in terms of two social groups: the poor and the rich. The mortality rate at age a for the poor part of the population is denoted m_a^{Poor}, the mortality rate at age a for the rich population m_a^{Rich}, the mortality rate at age a for the whole population is denoted m_a. The poor, for which mortality rates are relatively high, are assumed to own one tenth of all private net wealth, which is historically is the share of wealth of the bottom half (and even bottom nine deciles) of the Swedish wealth distribution (Roine and Waldenström, 2009).[37] We need to translate the differentials between rich and poor (the rest) in Table 1, which only suggested how to scale down the mortality of the rich, such that the overall mortality rate is the same. This means that the poor have somewhat higher mortality rates than the population average such that the difference between rich and poor (according to Table 1) is sustained. The resulting differential mortality rates are shown in Table 2.

[36] "Urban Sweden" is a aggregate wealth-weighted average between Stockholm (0.5) and provincial towns (0.5). Basis for regional wealth weights is property tax assessments showing that Stockholm had 42 percent of the value of all urban non-agricultural property (SOS Statistisk Årsbok 1910, table 104, p. 138). Adding to this the fact that Stockholm was Sweden's financial centre and net financial assets were surely skewed towards Stockholm, and overall 50 percent-share of all the country's wealth is a plausible "educated guess".

[37] This wealth share is also assumed by Piketty (2011) in the case of France.

Table 2: Differential mortality rates across wealth classes in Sweden

	Age group (a)			
	18–54	55–64	65–74	75+
m_a^{Poor}/m_a^{Rich}	150%	124%	121%	114%
m_a^{Poor}/m_a	120%	110%	109%	106%
m_a^{Rich}/m_a	80%	89%	90%	93%
Wealth share of the poor	10%	10%	10%	10%
m_a^{Poor}/m_a^{Rich} in France	200%	180%	150%	130%

Note: The mortality differential for France comes from Piketty (2010), table B4, which is based on evidence in Attanasio and Hoynes (2000).

Our preferred social mortality multipliers are presented in Table 2, and they are used in all the analyses of the paper. However, since the mortality differentials found by the careful analysis of Attanasio and Hoynes (2000) for the U.S. in the 1980s were deemed as quite general, and thus also used for France over the entire 19th and 20th centuries, it would be interesting to see how different the Swedish mortality differentials are. Moreover, it would also be interesting to contrast the Swedish differentials with the "raw" situation without any differential mortality across wealth classes.

As robustness checks, Figure 1 shows three versions of the ratio of the average wealth of the deceased to the average wealth of the living (the μ^*-ratio), one where we adjust the mortality rates by the Swedish social class differences ("Differential mortality"), one where we use the Attanasio and Hoynes differentials ("Attanasio and Hoynes (2000)") and one where we make no adjustment at all ("raw"). The comparison shows that

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Kopczuk and Saez (2004), WP.

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Figure 1: Impact of mortality differentials on μ^*