On the Long-Run Evolution of Inheritance: France 1820-2050

Thomas Piketty

Paris School of Economics *

First version: November 13th, 2009

This version: September 3rd, 2010**

Revised & shortened version

Abstract: This paper attempts to document and account for the long run evolution of inheritance. We find that in a country like France the annual flow of inheritance was about 20%-25% of national income between 1820 and 1910, down to less than 5% in 1950, and back up to about 15% by 2010. A simple theoretical model of wealth accumulation, growth and inheritance can fully account for the observed U-shaped pattern and levels. Using this model, we find that under plausible assumptions the annual bequest flow might reach about 20%-25% of national income by 2050. This corresponds to a capitalized bequest share in total wealth accumulation well above 100%. Our findings illustrate the fact that when the growth rate g is small, and when the rate of return to private wealth r is permanently and substantially larger than the growth rate (say, r=4%-5% vs. g=1%-2%), which was the case in the 19th century and early 20th century and is likely to happen again in the 21st century, then past wealth and inheritance are bound to play a key role for aggregate wealth accumulation and the structure of lifetime inequality. Contrarily to a widely spread view, modern economic growth did not kill inheritance.

* Professor of Economics at the Paris School of Economics (PSE) & Directeur d'études at the Ecole des Hautes Etudes en Sciences Sociales (EHESS)

** I am grateful to seminar participants at the Paris School of Economics, Universitat Pompeu Fabra (Barcelona), the Massachussetts Institute of Technology, Harvard University, New York University, Boston University and the University of Chicago for helpful reactions. This revised and shortened version benefited from the comments of the editor and three referees. The full-length working paper version, as well as a detailed data appendix, is available on-line at www.jourdan.ens.fr/piketty/inheritance/. All comments are welcome (piketty@ens.fr).

1. Introduction

There are basically two ways to become rich: either through one's own work, or through inheritance. In Ancien Regime societies, as well as during the 19^{th} and early 20^{th} centuries, it was self-evident to everybody that the inheritance channel was an important one. For instance, 19^{th} and early 20^{th} centuries novels are full of stories where ambitious young men have to choose between becoming rich through their own work or by marrying a bride with large inherited wealth – and often opt for the second strategy. However, in the late 20^{th} and early 21^{st} centuries, most observers seem to believe that this belongs to the past. That is, most observers – novelists, economists and laymen alike – tend to assume that labor income is now playing a much bigger role than inherited wealth in shaping people's lives, and that human capital and hard work have become the key to personal material well-being. Although this is rarely formulated explicitly, the implicit assumption seems to be that the structure of modern economic growth has led to the rise of human capital, the decline of inheritance, and the triumph of meritocracy.

This paper asks a simple question: is this optimistic view of economic development justified empirically and well-grounded theoretically? Our simple answer is "no". Our empirical and theoretical findings suggest that inherited wealth will most likely play as big a role in 21^{st} century capitalism as it did in 19^{th} century capitalism – at least from an aggregate viewpoint.

This paper makes two contributions. First, by combining various data sources in a systematic manner, we document and establish a simple – but striking – fact: the aggregate inheritance flow has been following a very pronounced U-shaped pattern in France since the 19^{th} century. To our knowledge, this is the first time that such long-run, homogenous inheritance series are constructed for any country.

More precisely, we define the annual inheritance flow as the total market value of all assets (tangible and financial assets, net of financial liabilities) transmitted at death or through inter-vivos gifts during a given year.[1] We find that the annual inheritance flow was about 20%-25% of national income around 1900-1910. It then gradually fell to less than 10% in the 1920s-1930s, and to less than 5% in the 1950s. It has been rising regularly since then, with an acceleration of the trend during the past 30 years, and according to our latest data point (2008), it is now close to 15% (see Figure 1).

If we take a longer run perspective, then the 20^{th} century U-shaped pattern looks even more spectacular. The inheritance flow was relatively stable around 20%-25% of national income throughout the 1820-1910 period (with a slight upward trend), before being divided by a factor of about 5-6 between 1910 and the 1950s, and then multiplied by a factor of about 3-4 between the 1950s and the 2000s.

[1] It is critical to include both bequests (wealth transmitted at death) and gifts (wealth transmitted inter vivos) in our definition of inheritance, first because gifts have always represented a large fraction of total wealth transmission, and next because this fraction has changed a lot over time. Throughout the paper, the words "inheritance" or "bequest" or "estate" will refer to the sum of bequests and gifts, unless otherwise noted.

These are truly enormous historical variations – but they appear to be well founded empirically. In particular, we find similar patterns with our two fully independent estimates of the inheritance flow. The gap between our "economic flow" (computed from national wealth estimates, mortality tables and observed age-wealth profiles) and "fiscal flow" series (computed from bequest and gift tax data) can be interpreted as a measure of tax evasion and other measurement errors. This gap appears to approximately constant over time, and relatively small, so that our two series deliver fairly consistent long run patterns (see Figure 1).

If we use disposable income (national income minus taxes plus cash transfers) rather than national income as the denominator, then we find that the inheritance flow observed in the early 21st century is back to about 20%, i.e. approximately the same level as that observed one century ago. This comes from the fact that disposable income was as high as 90%-95% of national income during the 19th century and early 20th century (when taxes and transfers were almost non existent), while it is now about 70%. Though we prefer to use the national income denominator (both for conceptual and empirical reasons), this is an important fact to keep in mind. An annual inheritance flow around 20% of disposable income is a very large flow. It is typically much larger than the annual flow of new savings, and almost as big as the annual flow of capital income. As we shall see, it corresponds to a cumulated, capitalized bequest share in aggregate wealth accumulation well above 100%.

The second – and most important – contribution of this paper is to account for these facts, and to draw lessons for other countries and for the future. We show that a simple theoretical model of wealth accumulation, growth and inheritance can easily explain why the French inheritance flow seems to return to a high steady-state value around 20% of national income. Consider first a dynastic model where all savings come from inherited wealth. Wealth holders save a fraction g/r of their asset returns, so that aggregate private wealth W_t and national income Y_t grow at the same rate g, and the wealth-income ratio $\beta=W_t/Y_t$ is stationary. It is straightforward to prove that the steady-state inheritance flow-national income ratio in this "class saving" model is equal to $b_y=\beta/H$, where H is generation length (average age at parenthood). If β=600% and H=30, then b_y=20%. We show that this intuition can be generalized to more general saving models. Namely, as long as the (real) growth rate g is sufficiently small and the (real) rate of return on private wealth r is sufficiently large (say, g=1%-2% vs. r=4%-5%), then steady-state b_y tends to be close to β/H.

The key intuition boils down to a simple r>g logic. In countries with large growth, such as France in the 1950s-1970s, then wealth coming from the past (i.e. accumulated or received by one's parents or grand-parents, who were relatively poor as compared to today's incomes) does not matter too much. What counts is new wealth accumulated out of current income. Inheritance flows are bound to be a small fraction of national income. But in countries with low growth, such as France in the 19th century and since the 1970s, the logic is reversed. With low growth, successors simply need to save a small fraction g/r of their asset returns in order to ensure that their inherited wealth grows at least as fast as national income. In effect, g small and r>g imply that wealth coming from the past is being capitalized at a faster rate than national income. So past wealth tends to dominate new wealth, rentiers tend to dominate labor income earners, and inheritance flows are large relative to national income. As $g \to 0$, then $b_y \to \beta/H$ – irrespective of saving behavior.

The r>g logic is simple, but powerful. We simulate a full-fledged, out-of-steady-state version of this model, using observed macroeconomic and demographic shocks. We are able to reproduce remarkably well the observed evolution of inheritance flows in France over almost two centuries. The 1820-1913 period looks like a prototype low-growth, rentier-friendly quasi-steady-state. The growth rate was very small: g=1.0%. The wealth-income ratio β was 600%-700%, the capital share α was 30%-40%, and the average rate of return on private wealth was as large as $r=\alpha/\beta$=5%-6%. Taxes at that time were very low, so after-tax returns were almost as high as pre-tax returns. It was sufficient for successors to save about 20% of their asset returns to ensure that their wealth grows as fast as national income (or actually slightly faster). The inheritance flow was close to its steady-state value $b_y=\beta/H$=20%-25%. The 1914-1945 capital shocks (involving war destructions, and most importantly a prolonged fall in asset prices) clearly dismantled this steady-state. It took a long time for inheritance flows to recover, especially given the exceptionally high growth rates observed during the 1950s-1970s (g=5.2% over 1949-1979). The recovery accelerated since the late 1970s, both because of low growth (g=1.7% over 1979-2009), and because of the long term recovery of asset prices and of the wealth-income ratio (β=500%-600% in 2008-9). As predicted by the theoretical model, the inheritance flow is now close to its steady-state value $b_y=\beta/H$=15%-20%.

We then use this model to predict the future. According to our benchmark scenario, based upon current growth rates and rates of returns, the inheritance flow will stabilize around 16% of national income by 2040, i.e. at a lower level than the 19th century steady-state. This is due both to higher projected growth rates (1.7% vs 1.0%) and to lower projected after-tax rates of return (3.0% vs 5.3%). In case growth slows down to 1.0% after 2010, and after-tax returns rise to 5.0% (which corresponds to the suppression of all capital taxes, and/or to a combination of capital tax cuts and a rising global capital share), then the model predicts that the inheritance flow will keep rising and converge towards 22%-23% after 2050. In all plausible scenarios, the inheritance-income ratio in the coming decades will be at least 15%-20%, i.e. closer to the 19th century levels than to the exceptionally low levels prevailing during the 1950s-1970s. A come-back to postwar levels would require pretty extreme assumptions, such as the combination of high growth rates (above 5%) and a prolonged fall in asset prices and aggregate wealth-income ratios.

Now, the fact that aggregate inheritance flows return to 19th century levels does not imply that the concentration of inheritance and wealth will return to 19th century levels. On distributional issues, this macro paper has little to say. We view the present research mostly as a positive exercise in aggregate accounting of wealth, income and inheritance, and as a building block for future work on inequality. One should however bear in mind that the historical decline of wealth concentration in developed societies has been quantitatively less important than some observers tend to imagine. E.g. according to the latest SCF, the top 10% owns 72% of U.S. aggregate wealth in 2007, while the middle 40% owns 26% and the bottom 50% owns 2%.[2] In a country like France, the top 10% currently owns about 60% of aggregate wealth, and the bottom 50% owns around 5%. These top decile wealth shares around 60%-70% are certainly lower than the top decile wealth shares above 90% observed in developed countries around 1900-1910, when there was basically no middle class at all.[3] But they are not that much lower. It has also been known for a long time that these high levels of wealth concentration have little to do with the life cycle: top wealth shares are almost as large within each age group.[4] The bottom line is that the historical decline in intra-cohort inequality of inherited wealth has been less important quantitatively than the long term changes in the aggregate inheritance-income ratio. So aggregate evolutions matter a lot for the study of inequality.

In order to illustrate this point, we provide applications of our aggregate findings to the measurement of two-dimensional inequality in lifetime resources (labor income vs inheritance) by cohort. By making approximate assumptions on intra cohort distributions, we compute simple inequality indicators, and find that they have changed a lot over the past two centuries. In the 19th century, top successors vastly dominated top labor earners (not to mention bottom labor earners) in terms of total lifetime resources. Cohorts born in the 1900s-1950s faced very different life opportunities. For the first time maybe in history, high labor income was the key for high material well-being. According to our computations, cohorts born in the 1970s and after will fall somewhere in between the "rentier society" of the 19th century and the "meritocratic society" of the 20th century – and in many ways will be closer to the former.

Do our findings also apply to other countries? We certainly do not pretend that the fairly specific U-shaped pattern of aggregate inheritance flows found for France applies everywhere as a universal law. It probably also applies to Continental European countries that were hit by similar growth and capital shocks. For countries like the U.S. and the U.K., which were little hit by war destructions, but suffered from the same mid-century fall in asset prices, the long-run U-shaped pattern of aggregate inheritance flows was possibly somewhat less pronounced.[5] In fact, we do not really know. We tried to construct similar series for other countries. But unfortunately there does not seem to exist any other country with estate tax data that is as long run and as comprehensive as the French data.

In any case, even though we cannot make detailed cross country comparisons at this stage, the economic mechanisms revealed by the analysis of the French historical experience certainly apply to other countries as well. In particular, the r>g logic applies everywhere, and has important implications. For instance, it implies that in countries with very large economic and/or demographic growth rates, such as China or India, inheritance flows must be a

[2] Here we simply report raw wealth shares from the 2007 Survey of consumer finances (see Kennickell (2009, Table 4)), with no correction whatsoever. Kennickell also compares the top wealth levels reported in the SCF with other sources (such as Forbes 500 rankings), and finds that the SCF understates top wealth shares.
[3] See Piketty, Postel-Vinay and Rosenthal (2006).
[4] See e.g. Atkinson (1983, p.176, table 7.4) for U.K. top wealth shares broken down by age groups.
[5] See section 3.2 below.

relatively small fraction of national income. Conversely, in countries with low economic growth and projected negative population growth, such as Spain, Italy or Germany, then inheritance is bound to matter a lot during the 21st century. Aggregate inheritance flows will probably reach higher levels than in France. More generally, a major difference between the U.S. and Europe (taken as a whole) from the viewpoint of inheritance might well be that demographic growth rates have been historically larger in the U.S., thereby making inheritance flows relatively less important. This has little to do with cultural differences. This is just the mechanical impact of the $r>g$ logic. And this may not last forever. If we take a very long run, global perspective, and make the assumption that economic and demographic growth rates will eventually be relatively small everywhere (say, $g=1\%-2\%$), then the conclusion follows mechanically: inheritance will matter a lot pretty much everywhere.

The rest of this paper is organized as follows. In section 2, we relate this work to the existing literature. In section 3, we describe our methodology and data sources. In section 4, we present a decomposition of the U-shaped pattern into three components: an aggregate wealth-income effect, a mortality effect, and a relative wealth effect. In section 5, we provide theoretical results on steady-state inheritance flows. In section 6, we report simulation results based upon a full fledged version of this model. In section 7, we present applications of our results to the study of lifetime inequality. Section 8 offers concluding comments.

2. Related literature

2.1. Literature on top incomes

This paper is related to several literatures. First, this work represents in our view the logical continuation of the recent literature on the long run evolution of top income and top wealth shares initiated by Piketty (2001, 2003), Atkinson (2005) and Piketty and Saez (2003). In this collective research project, we constructed homogenous, long run series on the share of top decile and top percentile income groups in national income, using income tax return data. The resulting data base now includes annual series for over 20 countries, including most developed economies over most of the 20th century.[6] One of the main findings is that the historical decline in top income shares that occurred in most countries during the first half of the 20th century has little to do with a Kuznets-type process. It was largely due to the fall of top capital incomes, which apparently never fully recovered from the 1914-1945 shocks, possibly because of the rise of progressive income and estate taxes (the “fall of rentiers”). Another important finding is that the large rise in top income shares that occurred in the U.S. (and, to a lesser extent, in other anglo-saxon countries) since the 1970s seem to be mostly due to the unprecedented rise of very top labor incomes (the “rise of working rich”).

[6] See Atkinson and Piketty (2007, 2010) for the complete set of country studies, and Atkinson, Piketty and Saez (2010) for a recent survey. To a large extent, this project is a simple extension of Kuznets (1953) pioneering and innovative work. Kuznets was the first researcher to combine income tax return data with national income accounts data in order to compute top income shares series, using U.S. data over the 1913-1948 period. In a way, what we do in the present paper is also following Kuznets: we attempt to integrate national income and wealth accounts with income and estate tax data in a conceptually consistent manner.

One important limitation of this literature, however, is that although we did emphasize the distinction between top labor vs. top capital incomes, we did not go all the way towards a satisfactory decomposition of inequality between a labor income component and an inherited wealth component. First, due to various legal exemptions, a growing fraction of capital income has gradually escaped from the income tax base (which in several countries has almost become a labor income tax in recent decades), and we did not attempt to impute full economic capital income (as measured by national accounts).[7] This might seriously affect some of our conclusions (e.g. about working rich vs rentiers),[8] and is likely to become increasingly problematic in the coming decades. So it is important to develop ways to correct for this. Next, even if we were able to observe (or impute) full economic capital income, this would not tell us anything about the share of capital income coming from one's own savings and the share originating from inherited wealth. In income tax returns, one does not observe where wealth comes from. For a small number of countries, long run series on top wealth shares (generally based upon estate tax returns) have recently been constructed.[9] These studies confirm that there was a significant decline in wealth concentration during the 1914-1945 period, apparently with no recovery so far.[10] But they do not attempt to break down wealth into an inherited component and a life-cycle or self-made component: these works use estate tax data to obtain information about the distribution of wealth among the living (using mortality multiplier techniques), but not to study the level of inheritance flows per se.[11]

This paper attempts to bridge this gap, by making use of the exceptionally high quality of French estate tax data. We feel that it was necessary to start by trying to reach a better understanding of the aggregate evolution of the inheritance-income ratio, which to us was very obscure when we started this research. The next step is naturally to close this detour via macroeconomics and to integrate endogenous distributions back into the general picture.

2.2. Literature on intergenerational transfers and aggregate wealth accumulation

The present paper is also very much related to the literature on intergenerational transfers and aggregate wealth accumulation. However as far we know our paper is the first attempt to account for the observed historical evolution of inheritance, and to take a long run perspective

---

[7] Partial corrections were made for a number of countries, but there was no systematic attempt to develop an imputation method. One should be aware of the fact that for most countries (including France, the U.K. and the U.S.), our series measure the share of top reported incomes (rather than top economic incomes).

[8] Wolff and Zacharias (2009) attempt to combine income and wealth data from the SCF in order to obtain more comprehensive measures of top capital income flows in the US during the 1980s-1990s. As they rightly point out, it is not so much that the "working rich" have replaced "coupon-clipping rentiers", but rather that "the two groups now appear to co-habitate at the top end of the distribution".

[9] See Kopczuk and Saez (2004) for the U.S., Piketty, Postel-Vinay and Rosenthal (2006) for France, and Roine and Waldenstrom (2009) for Sweden. These studies follow the pioneering work by Lampman (1962) and Atkinson and Harrison (1978), who respectively use U.S. 1922-1956 estate tax tabulations and U.K. 1923-1972 estate tax tabulations in order to compute top wealth share series.

[10] Given the relatively low quality of available wealth data for the recent period, especially regarding top global wealth holders, one should be modest and cautious about this conclusion.

[11] One exception is Edlund and Kopczuk (2009), who use the fraction of women in top estate brackets as a proxy for the relative importance of inherited vs self-made wealth. This is a relatively indirect way to study inheritance, however, and it ought to be supplemented by direct measures.

on these issues. Although the perception of a long term decline of inheritance relatively to labor income seems to be relatively widespread, to our knowledge there are very few papers which formulate this perception explicitly.[12] For instance, in their famous controversy about the share of inheritance in U.S. aggregate wealth accumulation, both Kotlikoff and Summers (1981, 1988) and Modigliani (1986, 1988) were using a single – and relatively ancient and fragile – data point for the U.S. aggregate inheritance flow (namely, for year 1962). In addition to their definitional conflict, we believe that the lack of proper data contributes to explain the intensity of the dispute, which the subsequent literature did not fully resolve.[13] In the working paper version, we use our aggregate inheritance flows series to compute inheritance shares in the total stock of wealth.[14] The bottom line is that with annual inheritance flows around 20% of national income, the cumulated, capitalized bequest share in aggregate wealth is bound to be well above 100% - which in a way corroborates the Kotlikoff-Summers viewpoint. We hope that our findings contribute to clarify this long standing dispute.

2.3. Literature on calibrated models of wealth distributions

Our work is also related to the recent literature attempting to use calibrated general equilibrium models in order to replicate observed wealth inequality. Several authors have recently introduced new ingredients into calibrated models, such as large uninsured idiosyncratic shocks to labor earnings, tastes for savings and bequests, and/or asset returns.[15] In addition to the variance and functional form of these shocks, one key driving force in these models is naturally the macroeconomic importance of inheritance flows: other things equal, larger inheritance flows tend to lead to more persistent inequalities and higher steady-state levels of wealth concentration. However this key parameter tends to be imprecisely calibrated in this literature, and is generally underestimated: it is often based upon relatively ancient data (typically dating back to the KSM controversy and using data from the 1960s-1970s) and frequently ignores inter vivos gifts.[16] We hope that our findings can contribute to offer a stronger empirical basis for these calibrations.

2.4. Literature on estate multipliers

Finally, our paper is closely related to the late 19th century and early 20th century literature on national wealth and the so-called “estate multiplier”. At that time, many economists were computing estimates of national wealth, especially in France and in the UK. In their view, it

---

[12] E.g. Galor and Moav (2006) take as granted the “demise of capitalist class structure”, but are not fully explicit about what they mean by this. It is unclear whether this is supposed to be an aggregate phenomenon (involving a general rise of labor income relatively to capital income and/or inheritance) or a purely distributional phenomenon (involving a compression of the wealth distribution, for given aggregate wealth-income and inheritance-income ratios). De Long (2003) takes a long term perspective on inheritance and informally discusses the main effects at play. However his intuition according to which the rise of life expectancy per se should lead to a decline in the relative importance of inheritance turns out to be wrong, as we show in this paper.

[13] See e.g. Blinder (1988), Kessler and Masson (1989), Gale and Scholz (1994), Gokhale et al (2001).

[14] See Piketty (2010, section 7.3).

[15] See e.g. Castaneda, Dias-Gimenes and Rios-Rull (2003), DeNardi (2004), Nirei and Souma (2007), Benhabib and Bisin (2009), Benhabib and Zhu (2009), Fiaschi and Marsili (2009) and Zhu (2010). See Cagetti and De Nardi (2008) for a recent survey of this literature.

[16] See Piketty (2010, section 7.3).

was obvious that most wealth derives from inheritance. They were satisfied to find that their national wealth estimates W_t (obtained from direct wealth census methods) were always approximately equal to 30-35 times the inheritance flow B_t (obtained from tax data). They interpreted 30-35 as generation length H, and they viewed the estate multiplier formula $e_t=W_t/B_t=H$ as self-evident.[17] In fact, it is not self-evident. This formula is not an accounting equation, and strictly speaking it is valid only under fairly specific models of saving behaviour and wealth accumulation. It is difficult to know exactly what model the economists of the time had in mind. From their informal discussions, one can infer that it was close to a stationary model with zero growth and zero saving (in which case $e_t=H$ is indeed self-evident), or maybe a model with small growth originating from slow capital accumulation and a gradual rise of the wealth-income ratio. Of course we now know that capital accumulation alone cannot generate positive self-sustained growth: one needs positive rates of productivity growth $g>0$. Economists writing in the 19th and early 20th centuries were not fully aware of this, and they faced major difficulties with the modelling of steady-state, positive self-sustained growth. This is probably the reason why they were unable to formulate an explicit dynamic, non-stationary model explaining where the estate multiplier formula comes from.

The estate multiplier literature disappeared during the interwar period, when economists realized that the formula was not working any more, or more precisely when they realized that it was necessary to raise the multiplier e_t to as much as 50 or 60 in order to make it work (in spite of the observed constancy of H around 30).[18] Shortly before World War 1, a number of British and French economists also started realizing on purely logical grounds that the formula was too simplistic. They started looking carefully at age-wealth profiles, and developed the so-called "mortality multiplier" literature, whereby wealth-at-death data is being re-weighted by the inverse morality rate of the given age group in order to generate estimates for the distribution of wealth among the living (irrespective of whether this wealth comes from inheritance or not).[19] Unlike the estate multiplier formula, the mortality multiplier formula is indeed a pure accounting equation, and makes no assumption on saving behaviour. The price to pay for this shift to pure accounting is that the mortality multiplier approach does not say anything about where wealth comes from: this is simply a statistical technique to recover the cross-sectional distribution of wealth among the living.[20]

In the 1950s-1960s, economists then started developing the life cycle approach to wealth accumulation.[21] This was in many ways the complete opposite extreme to the estate multiplier approach. In the life cycle model, inheritance plays no role at all, individuals die with zero

[17] For standard references on the "estate multiplier" formula, see Foville (1893), Colson (1903) and Levasseur (1907). The approach was also largely used by British economists (see e.g. Giffen (1878)), though less frequently than in France, probably because French estate tax data was more universal and easily accessible, while the British could use the income flow data from the schedular income tax system.
[18] See e.g. Colson (1927), Danysz (1934) and Fouquet (1982).
[19] See Mallet (1908), Séailles (1910), Strutt (1910), Mallet and Strutt (1915) and Stamp (1919). This approach was later followed by Lampan (1962) and Atkinson and Harrison (1978). See also Shorrocks (1975).
[20] The accounting equation given in section 3 below ($e_t=W_t/B_t=1/\mu_t m_t$) is of course identical to the mortality multiplier formula, except that we use it the other way around: we use it to compute inheritance flows from the wealth stock, while it has generally been used to compute the wealth of living from decedents' wealth.
[21] See e.g. Brumberg and Modigliani (1954), Ando and Modigliani (1963) and Modigliani (1986).

wealth (or little wealth), and the estate multiplier $e_t=W_t/B_t$ is infinite (or very large, say 100 or more). It is interesting to note that this theory was formulated precisely at the time when inheritance was at its historical nadir. According to our series, inheritance flows were about 4% of national income in the 1950s-1960s, vs. as much as 20%-25% at the time of estate multiplier economists. Presumably, economists were in both cases very much influenced by the wealth accumulation and inheritance patterns prevailing at the time they wrote.

Our advantage over both estate-multiplier and life-cycle economists is that we have more years of data. Our two-century-long perspective allows us to clarify these issues and to reconcile the various approaches into a unified framework (or so we hope). The lifecycle motive for saving is logically plausible. But it clearly cohabits with many other motives for wealth accumulation (bequest, security, prestige and social status, etc.). Most importantly, we show that with low growth rates and high rates of return, past wealth naturally tends to dominate new wealth, and inheritance flows naturally tend to converge towards levels that are not too far from those posited by the estate multiplier formula, whatever the exact combination of these saving motives might be.

3. Data sources and methodology

The two main data sources used in this paper are national income and wealth accounts on the one hand, and estate tax data on the other hand. Before we present these two data sources in a more detailed way, it is useful to describe the basic accounting equation that we will be using throughout the paper in order to relate national accounts and inheritance flows.

3.1. Basic accounting equation: $B_t/Y_t = \mu_t\ m_t\ W_t/Y_t$

If there was no inter vivos gift, i.e. if all wealth transmission occurred at death, then in principle one would not need any estate tax data in order to compute the inheritance flow. One would simply need to apply the following equation:

$$B_t/Y_t = \mu_t\ m_t\ W_t/Y_t$$

$$\text{I.e.} \qquad b_{yt} = \mu_t\ m_t\ \beta_t \qquad (3.1)$$

With: B_t = aggregate inheritance flow
Y_t = aggregate national income
W_t = aggregate private wealth
m_t = mortality rate = (total number of decedents)/(total living population)
μ_t = ratio between average wealth of the deceased and average wealth of the living
$b_{yt} = B_t/Y_t$ = aggregate inheritance flow-national income ratio
$\beta_t = W_t/Y_t$ = aggregate private wealth-national income ratio

Alternatively, equation (3.1) can be written in per capita terms:

$$b_t/y_t = \mu_t\, w_t/y_t = \mu_t\, \beta_t \qquad (3.2)$$

With: b_t = average inheritance per decedent
y_t = average national income per living individual
w_t = average private wealth per living individual

Equation (3.1) is a pure accounting equation: it does not make any assumption about behaviour or about anything. For instance, if the aggregate wealth-income ratio β_t is equal to 600%, if the annual mortality rate m_t is equal to 2%, and if people who die have the same average wealth as the living (μ_t=100%), then the annual inheritance flow b_{yt} has to be equal to 12% of national income. In case old-age individuals massively dissave in order to finance retirement consumption, or annuitize their assets so as to die with zero wealth, as predicted by the pure life-cycle model, then μ_t=0% and b_{yt}=0%. I.e. there is no inheritance at all, no matter how large β_t and m_t might be. Conversely, in case people who die are on average twice as rich as the living (μ_t=200%), then for β_t=600% and m_t=2%, the annual inheritance flow has to be equal to 24% of national income.

If we express the inheritance flow B_t as a fraction of aggregate private wealth W_t, rather than as a fraction of national income Y_t, then the formula is even simpler:

$$b_{wt} = B_t/W_t = \mu_t\, m_t \qquad (3.3)$$

I.e. the inheritance-wealth ratio b_{wt} is equal to the mortality rate multiplied by the μ_t ratio. In case μ_t=100%, e.g. if the age-wealth profile is flat, then b_{wt} is equal to the mortality rate. The estate multiplier e_t=W_t/B_t is simply the inverse of b_{wt}. We will return to the evolution of the inheritance-wealth ratio b_{wt} later in this paper. But for the most part we choose to focus attention upon the inheritance-income ratio b_{yt} and accounting equation (3.1), first because the evolution of the wealth-income ratio β_t=W_t/Y_t involves economic processes that are interesting per se (and interact with the inheritance process); and next because national wealth data is missing in a number of countries, so that for future comparison purposes we find it useful to emphasize b_{yt} ratios, which are easier to compute (if one has fiscal data). Also, b_{yt} has arguably greater intuitive economic appeal than b_{wt}. E.g. it can easily be compared to other flow ratios such as the capital share α_t or the saving rate s_t.

An example with real numbers might be useful here. In 2008, per adult national income was about 35,000€ in France. Per adult private wealth was about 200,000€. That is, β_t=W_t/Y_t=w_t/y_t=560%. The mortality rate m_t was equal to 1.2%, and we estimate that μ_t was approximately 220%.[22] It follows from equations (3.1) and (3.3) that the inheritance-income ratio b_{yt} was 14.5% and that the inheritance-wealth ratio b_{yt} was 2.6%. It also follows from equation (3.2) that average inheritance per decedent b_t was about 450,000€, i.e. about 12.5

[22] In 2008, French national income Y_t was about 1,700 billions €, aggregate private wealth W_t was about 9,500 billions €, adult population was about 47 millions, so y_t≈35,000€ and w_t≈200,000€. The number of adult decedents was about 540,000, so the mortality rate m_t≈1.2%. For exact values, see Appendix A, Tables A2-A4.

years of average income y_t (μ_t x β_t = 12.5). One can then introduce distributional issues: about half of decedents have virtually no wealth, while the other half owns about twice the average (i.e. about 25 years of average income); and so on.

What kind of data do we need in order to compute equation (3.1)? First, we need data on the wealth-income ratio $\beta_t=W_t/Y_t$. To a large extent, this is given by existing national accounts data, as described below. Next, we need data on the mortality rate m_t. This is the easiest part: demographic data is plentiful and easily accessible. In practice, children usually own very little wealth and receive very little income. In order to abstract from the large historical variations in infant mortality, and in order to make the quantitative values of the m_t and μ_t parameters easier to interpret, we define them over the adult population. That is, we define the mortality rate m_t as the adult mortality rate, i.e. the ratio between the number of decedents aged 20-year-old and over and the number of living individuals aged 20-year-old and over. Similarly, we define μ_t as the ratio between the average wealth of decedents aged 20-year-old and over and the average wealth of living individuals aged 20-year-old and over.[23]

Finally, we need data to compute the μ_t ratio. This is the most challenging part, and also the most interesting part from an economic viewpoint. In order to compute μ_t we need two different kinds of data. First, we need data on the cross-sectional age-wealth profile. The more steeply rising the age-wealth profile, the higher the μ_t ratio. Conversely, if the age-wealth profile is strongly hump-shaped, then μ_t will be smaller. Next, we need data on differential mortality. For a given age-wealth profile, the fact that the poor tend to have higher mortality rates than the rich implies a lower μ_t ratio. In the extreme case where only the poor die, and the rich never die, then the μ_t ratio will be permanently equal to 0%, and there will be no inheritance. There exists a large literature on differential mortality. We simply borrow the best available estimates from this literature. We checked that these differential mortality factors are consistent with the age-at-death differential between wealthy decedents and poor decedents, as measured by estate tax data and demographic data; they are consistent.[24]

Regarding the age-wealth profile, one would ideally like to use exhaustive, administrative data on the wealth of the living, such as wealth tax data. However such data generally does not exist for long time periods, and/or only covers relatively small segments of the population. Wealth surveys do cover the entire population, but they are not fully reliable (especially for top wealth holders, which might bias estimated age-wealth profiles), and in any case they are not available for long time periods. The only data source offering long-run, reliable raw data on age-wealth profiles appears to be the estate tax itself.[25] This is wealth-at-death data, so one needs to use the differential mortality factors to convert them back into wealth-of-the-living age-wealth profiles.[26] This data source combines many advantages: it covers the entire

---

[23] Throughout the paper, “adult” means “20-year-old and over”. In practice, children wealth is small but positive (parents sometime die early), so we need to add a (small) correcting factor to the μ_t ratio. See Appendix B2.
[24] See Appendix B2 for sensitivity tests. We use the mortality differentials due to Attanasio and Hoynes (2000).
[25] This does not affect the independence between the economic and fiscal series, because for the economic flow computation we only use the relative age-wealth profile observed in estate tax returns (not the absolute levels).
[26] Whether one starts from wealth-of-the-living or wealth-at-death raw age-wealth profiles, one needs to use differential mortality factors in one way or another in order to compute the μ_t ratio.

population (nearly everybody has to file an estate tax return in France), and it is available on a continuous and homogenous basis since the beginning of the 19th century. We checked that the resulting age-wealth profiles are consistent with those obtained with wealth tax data and (corrected) wealth survey data for the recent period (1990s-2000s); they are consistent.[27]

We have now described how we proceed in order to compute our "economic inheritance flow" series using equation (3.1). There is however one important term that needs to be added to the computation in order to obtain meaningful results. In the real world, inter vivos gifts do play an important role in the process of intergenerational wealth transmission and in shaping the age-wealth profile. In France, gifts have always represented a large fraction of total wealth transmission (around 20%-30%). Moreover this fraction has changed a lot over time (currently it is almost 50%). Not taking them into account would bias the results in important ways. The simplest way to take gifts into account is to correct equation (3.1) in the following way:

$$\mathbf{B_t/Y_t = \mu_t^* \, m_t \; W_t/Y_t} \qquad \mathbf{(3.1')}$$

With: $\mu_t^* = (1+v_t)\, \mu_t$ = gift-corrected ratio between decedents wealth and wealth of the living
$v_t = V_t^{f0}/B_t^{f0}$ = observed fiscal gift-bequest ratio
B_t^{f0} = raw fiscal bequest flow (total value of bequests left by decedents during year t)
V_t^{f0} = raw fiscal gift flow (total value of inter vivos gifts made during year t)

Equation (3.1') simply uses the observed, fiscal gift-bequest ratio during year t and upgrades the economic inheritance flow accordingly. Intuitively, the gift-corrected ratio μ_t^* attempts to correct for the fact that the raw μ_t under-estimates the true relative importance of decedents' wealth (decedents have already given away part of their wealth before they die, so that their wealth-at-death looks artificially low), and attempts to compute what the μ_t ratio would have been in the absence of inter-vivos gifts. This simple way to proceed is not fully satisfactory, since yeart-t donors and year-t decedents are usually not the same individuals (on average gifts are made about 7-8 years before the time of death). In the simulated model, we re-attribute gifts to the proper generation of decedents, and re-simulate the entire age-wealth profile dynamics in the absence of gifts. We show that this creates time lags, but does not significantly affect long-run levels and patterns of the inheritance-income ratio.

Before we present and analyse the results of these computations, we give more details about our two main data sources: national accounts data and estate tax data. Readers who feel uninterested by these details might want to go directly to section 4.

3.2. National income and wealth accounts: Y_t and W_t

National income and wealth accounts have a long tradition in France, and available historical series are of reasonably high quality.[28] In particular, the national statistical institute (Insee)

[27] See Appendix B2 and section 4.3 below.

has been compiling official national accounts series since 1949. Homogenous, updated national income accounts series covering the entire 1949-2008 period and following the latest international guidelines were recently released by Insee. These are the series we use in this paper for the post-1949 period, with no adjustment whatsoever. National income Y_t and its components are defined according to the standard definitions: national income equals gross domestic product minus capital depreciation plus net foreign factor income, etc.[29]

Prior to 1949, there exists no official national accounts series in France. However a very complete set of retrospective, annual income accounts series covering the 1896-1949 period was compiled and published by Villa (1994). These series use the concepts of modern national accounts and are based upon a systematic comparison of raw output, expenditure and income series constructed by many authors. Villa also made new computations based upon raw statistical material. Although some of the year-to-year variations in this data base are probably fragile, there are good reasons to view these annual series as globally reliable.[30] These are the series we use for the 1896-1949 period, with minor adjustments, so as to ensure continuity in 1949. Regarding the 1820-1900 period, a number of authors have produced annual national income series, but we are not sure that the limited raw statistical material of the time makes such an exercise really meaningful. Moreover we do not really need annual series for our purposes. So for the 19th century, we use decennial-averages estimates of national income (these decennial averages are almost identical across the different authors and data sources), and we assume fixed growth rates, saving rates and factor shares within each decade.[31]

The national wealth part of our macro data base requires more care than the national income part. It is only in 1970 that Insee started producing official, annual national wealth estimates in addition to the standard national income estimates. For the post-1970 period, the wealth and income sides of French national accounts are fully integrated and consistent. That is, the balance sheets of the personal sector, the government sector, the corporate sector, and the rest of the world, estimated at asset market prices on January 1st of each year, are fully consistent with the corresponding balance sheets estimated on the previous January 1st and the income and savings accounts of each sector during the previous year, and the recorded changes in asset prices.[32] We use these official Insee balance sheets for the 1970-2009 period, with no adjustment whatsoever. We define private wealth W_t as the net wealth (tangible assets, in particular real estate, plus financial assets, minus financial liabilities) of the

---

[28] All national accounts series, references and computations are described in a detailed manner in Appendix A. Here we simply present the main data sources and conceptual issues.

[29] Throughout the paper we always use net-of-depreciation series, i.e. we deduct depreciation from all capital shares, saving rates and rates of return estimates. According to available national accounts series, depreciation rates have been relatively stable around 10%-12% of GDP in the long run in France (see Appendix A, Table A5).

[30] In particular, the factor income decompositions (wages, profits, rents, business income, etc.) series released by Villa (1994) rely primarily on the original series constructed by Dugé de Bernonville (1933-1939), who described very precisely all his raw data sources and computations. For more detailed technical descriptions of the Dugé and Villa series, see Piketty (2001, pp.693-720).

[31] We used the 19th century series due to Bourguignon and Lévy-Leboyer (1985) and Toutain (1987).

[32] The concepts and methods used in Insee-Banque de France balance sheets are broadly similar to the flows-of-funds and tangible-assets series released by the U.S. Federal Reserve and Bureau of Commerce.

personal sector. W_t is estimated at current asset market prices (real estate assets are estimated at current real estate prices, equity assets are estimated at current stock market prices, etc.). This is what we want, since our objective is to relate aggregate private wealth to the inheritance flow, and since – according to estate tax law – the value of bequests is always estimated at the market prices of the day of death (or on the day the gift is made). It is conceptually important to use private wealth W_t rather than national wealth (i.e. the sum of private wealth and government wealth). Private wealth can be transmitted at death, while government wealth cannot. Practically, however, this does not make a big difference, since private wealth generally represents over 90% of national wealth (i.e. net government wealth is typically positive but small).

Prior to 1970, we use various non-official, national wealth estimates. For the 1820-1913 period, national wealth estimates are plentiful and relatively reliable. This was a time of almost zero inflation (0.5% per year on average during the 1820-1913 period), so there was no big problem with asset prices. Most importantly, the economists of the time were very much interested in national wealth (which they found more important than national income), and many of them produced sophisticated estimates. They used the decennial censuses of tangible assets organized by the tax administration (the tax system of the time relied extensively on the property values of real estate, land and business assets, so such censuses played a critical role). They took into account the growing stock and bond market capitalisation and the booming foreign assets, and they explained in a careful manner how they made corrections in order to avoid all forms of double counting. We do not pretend that these national wealth estimates are perfectly comparable to today's official balance sheets. They are never available on an annual basis, and cannot be used to do short run business cycle analysis. But as far as decennial averages are concerned, the margins of error on these estimates are probably less than 5%-10%. As compared to the enormous historical variations in aggregate wealth-income and inheritance-income ratios, this is negligible.

The period 1914-1969 is the time period for which French national wealth estimates are the most problematic. This was a chaotic time for wealth, both because of war destructions and because of large inflation and wide variations in the relative price of the various assets. Very few economists compiled detailed, reliable national balance sheets for this time period. We proceed as follows. We use only two data points, namely the 1925 estimate due to Colson (1927), and the 1954 estimate due to Divisia, Dupin and Roy (1956). These are the two most sophisticated estimates available for this time period. For the missing years, we compute private wealth W_t by estimating a simple wealth accumulation equation, based upon the private saving flows S_t coming from national income accounts. Generally speaking, year-to-year variations in private wealth W_t can be due either to volume effects (savings) or to price effects (asset prices might rise or fall relatively to consumer prices). That is, the accumulation equation for private wealth can be written as follows:

$$\mathbf{W_{t+1} = (1+q_{t+1})\,(1+p_{t+1})\,(W_t + S_t) \qquad (3.4)}$$

In equation (3.4), p_{t+1} is consumer price inflation between year t and year t+1, and q_{t+1} is the real rate of capital gain (or capital loss) between year t and year t+1, which we define as the excess of asset price inflation over consumer price inflation. For the 1970-2009 period, since French national income and wealth accounts are fully integrated, q_t can indeed be interpreted as the real rate of capital gains. For the pre-1970 period, q_t is better interpreted as a residual error term: it includes real asset price inflation, but it also includes all the variations in private wealth that cannot be accounted for by saving flows. For simplicity, we assume a fixed q_t factor during the 1954-1970 period (i.e. we compute the implicit average q_t factor needed to account for 1970 private wealth, given 1954 private wealth and 1954-1969 private savings flows). We do the same for the 1925-1954 period, the 1913-1925 period, and for each decade of the 1820-1913 period. The resulting decennial averages for the private wealth-national income ratio $\beta_t = W_t/Y_t$ are plotted on Figure 2. Summary statistics on private wealth accumulation in France over the entire 1820-2009 period are given on Table 1.

Again, we do not pretend that the resulting annual series are fully satisfactory. We certainly do not recommend that one uses them for short run business cycle analysis, especially for the 1913-1925 and 1925-1954 sub-periods, for which the simplifying assumption of a fixed capital gain effect makes little sense. However we believe that the resulting decennial averages are relatively precise. In particular, it is reassuring to see that most of wealth accumulation in the medium and long run seems to be well accounted for by savings. This suggests that saving rates are reasonably well measured by our national accounts series, and that in the long run there exists no major divergence between asset prices and consumer prices. The fact that our private wealth series delivers economic inheritance flow estimates that are reasonably well in line with the observed fiscal flow also gives us confidence about our wealth estimates.

A few additional points about the long-run evolution of the wealth-income ratio β_t might be worth noting here.[33] Consider first the 1820-1913 period. We find that β_t gradually rose from about 550%-600% around 1820 to about 650%-700% around 1900-1910 (see Figure 2). The real growth rate g of national income was 1.0%.[34] The savings rate s was about 8%-9%, so that the average savings-induced wealth growth rate $g_{ws}=s/\beta$ was 1.4%. I.e. it was larger than g. This explains why the wealth-income ratio was rising during the 19th century: savings were slightly higher than the level required for a steady-state growth path (i.e. the savings rate was slightly higher than $s^*=\beta g$=6%-7%). The observed real growth rate of private wealth g_w was actually 1.3%, i.e. slightly below g_{ws}. In our accounting framework, we attribute the differential to changes in the relative price of assets, and we find a modest negative q effect (-0.1%) (see Table 1). Of course, it could just be that we slightly overestimate 19th century saving rates, or that we slightly underestimate the 19th century rise in the wealth-income ratio, or both. But the

[33] For a detailed analysis of our macro series and a number of sensitivity tests, particularly regarding the 1914-1969 period, see Appendix A3-A5. In the appendix we also show that it is preferable to identify capital gains and losses as a residual term from a macroeconomic wealth accumulation equation rather than by using available asset price index series (which in the long run appear to be highly unreliable, and generally to overestimate asset price variations; this methodological conclusion probably applies to other countries as well).

[34] All "real" growth rates (either for national income or for private wealth) and "real" rates or return referred to in this paper are defined relatively to consumer price inflation. Any CPI mismeasurement would translate into similar changes for the various rates without affecting the differentials and the ratios.

important point is that our stock and flow series are broadly consistent. It is also interesting to note that a very substantial fraction of the 19th century rise in the wealth-income ratio (and possibly all of it) went though the accumulation of large foreign assets.[35]

Consider now the 1913-2009 period. The real growth rate g of national income was 2.6%, thanks to the high-growth postwar decades. The real growth rate of private wealth g_w was 2.4%. Given observed saving flows (and taking into account wartime capital destructions, which we include in volume effects), private wealth should have grown slightly faster, i.e. we find that the saving-induced wealth growth rate g_{ws} was 2.9%. We again attribute the differential to real capital gains, and we find a modest negative q effect (-0.4%) (see Table 1). Taken literally, this would mean that the 1949-2009 gradual rise in the relative price of assets has not yet fully compensated the 1913-1949 fall, and that asset prices are currently about 30% lower than what they were at the eve of World War 1. Again, it could also be that we slightly overestimate 20th century saving flows, or underestimate end-of-period wealth stocks, or both.[36] But the point is that our stock and flow data are consistent. In the long run, the bulk of wealth accumulation is well accounted for by savings, both during the 19th and the 20th centuries. As a first approximation, the 1913-1949 fall in the relative price of assets was compensated by the 1949-2009 rise, so that the total 1913-2009 net effect is close to zero.

The other important finding is that the 1913-1949 fall in the aggregate wealth-income ratio was not due – for the most part – to the physical destructions of the capital stock that took place during the wars. We find that β_t dropped from about 600%-650% in 1913 to about 200%-250% in 1949. Physical capital destructions per se seem to account for little more than 10% of the total fall. On the basis of physical destructions and the observed saving response (saving flows were fairly large in the 1920s and late 1940s), we find that private wealth should have grown at g_{ws}=0.9% per year between 1913 and 1949, i.e. almost as fast as national income (g=1.3%). However the market value of private wealth fell dramatically (g_w=-1.7%), which we attribute to a large negative q effect (q=-2.6%). This large real rate of capital loss can be broken down into a variety of factors: holders of nominal assets (public and private bonds, domestic and foreign) were literally expropriated by inflation; real estate prices fell sharply relatively to consumer prices (probably largely due to sharp rent control policies enacted in the 1920s and late 1940s); and stock prices also fell to historical lows in 1945 (probably reflecting the dramatic loss of faith in capital markets after the Great Depression, as well as the large nationalization policies and capital taxes enacted in 1945). 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.

[35] Net foreign assets gradually rose from about 2% of private wealth in 1820 to about 15% around 1900-1910, i.e. from about 10% of national income to about 100% of national income. See Appendix A, Table A16.

[36] In the benchmark estimates reported on Table 1, private saving flows are defined as the sum of personal savings and net corporate retained earnings (our preferred definition). If we instead use personal saving flows, we find a lower g_{ws} (2.0%) and a modest positive q effect (+0.4%). Taken literally, this would mean that asset prices are currently about 40% higher than what they were in 1913, but that if we deduct the cumulated value of corporate retained earnings, then they are actually 30% smaller. Within our accounting framework, retained earnings account for about a third of total real capital gains during the 1949-2009 period, which seems reasonable. For detailed results, see Appendix A5, Table A19, from which Table 1 is extracted.

This asset price effect also explains why the wealth-income ratio seems to have fallen substantially in countries whose territories were not directly hit by the wars. In the U.K., the private wealth-national income ratio was apparently as large as 650%-750% in the late 19th and early 20th century, down to 350%-400% in the 1950s-1970s, up to about 450%-550% in the 1990s-2000s.[37] In the U.S., it seems to have declined from about 550%-600% in the early 20th century and in the interwar period to about 350%-400% in the 1950s-1970s, up to 450%-500% in the 1990s-2000s.[38] This suggests that both countries have gone through the same U-shaped pattern as France – albeit in a less pronounced manner, which seems consistent with the above observations. We stress however that these illustrative U.K.-U.S. figures are not fully homogenous over time; nor are they fully comparable to our French series. To make proper comparisons, one would need to assemble the same type of homogenous Y_t and W_t series which we constructed for France, which to our knowledge has never been done for other countries over such long time periods.

3.3. Estate tax data: B_t^f, μ_t and v_t

Estate tax data is the other key data source used in this paper.[39] It plays an essential role for several reasons. First, because of various data imperfections (e.g. regarding national wealth estimates), we thought that it was important to compute two independent measures of inheritance flows: one "economic flow" indirect measure (based upon national wealth estimates and mortality tables, as described above) and one "fiscal flow" direct measure. The fiscal flow is a direct measure in the sense that it was obtained simply by dividing the observed aggregate bequest and gift flow reported to the tax administration (with a few corrections, see below) by national income, and therefore makes no use at all of national wealth estimates. Next, we need estate tax data in order to compute the gift-bequest ratio $v_t = V_t^{f0}/B_t^{f0}$, and in order to obtain reliable, long-run data on the age-wealth profile and to compute the μ_t ratio. Finally, we also use estate tax data in order to know the age structure of decedents, heirs, donors and donees, which we need for our simulations.

French estate tax data is exceptionally good, for one simple reason. As early as 1791, shortly after the abolition of the tax privileges of the aristocracy, the French National Assembly introduced a universal estate tax, which has remained in force since then. This estate tax was universal because it applied both to bequests and to inter-vivos gifts, at any level of wealth, and for nearly all types of property (both tangible and financial assets). The key characteristic

[37] Here we piece together the following data sources: for the late 19th century and early 20th century, we use the private wealth and national income estimates of the authors of the time (see e.g. Giffen (1878) and Bowley (1920)); for the period going from the 1920s to the 1970s, we use the series reported by Atkinson and Harrison (1978); for the 1990s-2000s we use the official personal wealth series released on hmrc.gov.uk. See also Solomou and Weale (1997, p.316), whose 1920-1995 UK wealth-income ratio series display a similar U-shaped pattern (from 600% in the interwar down to 400% in the 1950s-1970s, up to 500%-600% in the 1980s-1990s).

[38] Here we use for the post-1952 period the net worth series (household and non-profit sectors) released by the Federal Reserve (see e.g. *Statistical Abstract of the U.S. 2010*, Table 706), and for the pre-1952 period the personal wealth series computed by Kopczuk and Saez (2004, Table A) and Wolff (1989). .

[39] All estate tax series, references and computations are described in a detailed manner in Appendix B. Here we simply present the main data sources and conceptual issues.

of the tax is that the successors of all decedents with positive wealth, as well as all donees receiving a positive gift, have always been required to file a return, no matter how small the estate was, and no matter whether the heirs and donees actually ended up paying a tax or not. This followed from the fact that the tax was thought more as a registration duty than as a tax: filling a return has always been the way to register the fact that a given property has changed hands and to secure one's property rights.[40]

Between 1791 and 1901, the estate tax was strictly proportional. The tax rate did vary with the identity of the heir or donee (children and surviving spouses have always faced much lower tax rates than other successors in the French system), but not with the wealth level. The proportional tax rates were fairly small (generally 1%-2% for children and spouses), so there was really very little incentive to cheat. The estate tax was made progressive in 1901. At that time, the top marginal rate applying to children heirs was as small as 5%. It was sharply increased in the 1920s. By the mid 1930s it was 35%; it is currently 40%. Throughout the 20th century, these high top statutory rates were only applied to small segments of the population and assets. So the aggregate effective tax rate on estates has actually been relatively stable around 5% over the past century in France.[41]

The introduction of tax progressivity did not significantly affect the universal legal requirement to fill a return, no matter how small the bequest or gift. There is ample evidence that this legal requirement has been applied relatively strictly, both before and after the 1901 reform. In particular, the number of estate tax returns filled each year has generally been around 65% of the total number of adult decedents (about 350,000 yearly returns for 500,000 adult decedents, both in the 1900s and in the 2000s). This is a very large number, given that the bottom 50% of the population hardly owns any wealth at all. We do upgrade the raw fiscal flow in order to take non-filers into account, but this is a small correction (generally 5%-10%).

The other good news for scholars is that the raw tax material has been well archived. Since the beginning of the 19th century, tax authorities transcribed individual returns in registers that have been preserved. In a previous paper we used these registers to collect large micro samples of Paris decedents every five year between 1807 and 1902, which allowed us to study the changing concentration of wealth and the evolution of age-wealth profiles.[42] Ideally one would like to collect micro samples for the whole of France over the two-century period. But this has proved to be too costly so far.

So in this paper we rely mostly on aggregate national data collected by the tax administration. For the 1826-1964 period, we use the estate tax tabulations published on a quasi-annual

[40] This is reflected in the official name of the tax, which since 1791 has always been "droits d'enregistrement" (more specifically, "droits d'enregistrement sur les mutations à titre gratuity" (DMTG)), rather than "impôt sur les successions et les donations". In the U.S., the estate tax is simply called the "estate tax".

[41] See Appendix A, Table A9, col. (15). This low aggregate effective tax rate reflects the fact that top rates only apply to relatively high wealth levels (e.g. the top 40% marginal rate currently applies to per children, per parent bequests above 1.8 millions euros), and the fact that tax exempt assets and tax rebates for inter vivos gifts have become increasingly important over time. See Appendix B for more details.

[42] See Piketty, Postel-Vinay and Rosenthal (2006).

basis by the French Ministry of Finance. For the whole period, these tables indicate the aggregate value of bequests and gifts reported in estate tax returns, which is the basic information that we need. Starting in 1902, these annual publications also include detailed tabulations on the number and value of bequests and gifts broken down by size of estate and age of decedent or donor. These tabulations were abandoned in the 1960s-1970s, when the tax administration started compiling electronic files with nationally representative samples of bequest and gift tax returns. We use these so-called "DMTG" micro files for years 1977, 1984, 1987, 1994, 2000 and 2006. The data is not annual, but it is very detailed. Each micro-file includes all variables reported in tax returns, including the value of the various types of assets, total estate value, the share going to each heir or donee, and the demographic characteristics of decedents, heirs, donors and donees.

We proceed as follows. We start from the raw fiscal bequest flow B_t^{f0}, i.e. the aggregate net wealth transmitted at death, as reported to tax authorities by heirs. We do not exclude the estate share going to surviving spouses, first because it has always been relatively small (about 10%),[43] and next because we choose in the present paper to adopt a gender-free, individual-centred approach to inheritance. We ignore marriage and gender issues altogether, which given our aggregate perspective seems to be the most appropriate option.[44]

We first make an upward correction to B_t^{f0} for non filers (see above), and we then make another upward correction for tax exempt assets. When the estate tax was first created, the major exception to the universal tax base was government bonds, which benefited from a general estate tax exemption until 1850. Between 1850 and World War 1, very few assets were exempted (except fairly specific assets like forests). Shortly after World War 1, and again after World War 2, temporary exemptions were introduced for particular types of government bonds. In order to foster reconstruction, new real estate property built between 1947 and 1973 also benefited from a temporary exemption. Most importantly, a general exemption for life insurance assets was introduced in 1930. It became very popular in recent decades. Life insurances assets were about 2% of aggregate wealth in the 1970s and grew to about 15% in the 2000s. Using various sources, we estimate that the total fraction of tax exempt assets in aggregate private wealth gradually rose from less than 10% around 1900 to 20% in the interwar period, 20%-25% in the 1950s-1970s and 30%-35% in the 1990s-2000s. We upgrade the raw fiscal bequest flow accordingly.[45]

We apply the same upward corrections to inter vivos gifts, leaving the gift-bequest ratio v_t unaffected. To the extent that gifts are less well reported to tax authorities than bequests, this

---

43 The spouse share has always been about 10% of the aggregate estate flow, vs. 70% for children and 20% for non-spouse, non-children heirs, typically siblings and nephews/nieces (see Appendix C2). It is unclear why one should exclude the spouse share and not the latter. In any case, this would make little difference.

44 Gender-based wealth inequality is an important issue. On average, women have been almost as rich as men in France ever since the early 19th century (with aggregate women-men wealth ratios usually in the 80%-90% range; this is largely due to the gender neutrality of the 1804 Civil Code; see Piketty et al (2006)). So the aggregate consequences of ignoring gender issues cannot be very large, and must be roughly the same throughout our two-century period (as a first approximation).

45 For a detailed discussion of sources and various sensitivity tests, see Appendix B1.

implies that we probably under-estimate their true economic importance. Also, in this paper we entirely ignore informal monetary and in-kind transfers between households, as well as parental transfers to children taking the form of educational investments, tuition fees and other non-taxable gifts (which ideally should also be included in the analysis).[46]

4. The U-shaped pattern of inheritance: a simple decomposition

The accounting equation $B_t/Y_t=\mu_t^* m_t W_t/Y_t$ allows for a simple and transparent decomposition of changes in the aggregate inheritance flow. Here the important finding is that the long-run U-shaped pattern of B_t/Y_t is the product of three U-shaped curves, which explains why it was so pronounced. We take these three effects in turn: the aggregate wealth-income effect $\beta_t = W_t/Y_t$, the mortality rate effect m_t, and the μ_t^* ratio effect.

4.1. The aggregate wealth-income ratio effect W_t/Y_t

We already described the U-shaped pattern of the aggregate wealth-income ratio β_t (see Figure 2). By comparing this pattern with that of the inheritance flow b_{yt} (see Figure 1), one can see that the 1913-1949 decline in the aggregate wealth-income ratio explains about half of the decline in the inheritance-income ratio. Between 1913 and 1949, β_t dropped from 650%-700% to 200%-250%. I.e. it was divided by a factor of about 2.5-3. In the meantime, b_{yt} dropped from 20%-25% to 4%. I.e. it was divided by a factor of about 5-6.

4.2. The mortality rate effect m_t

Where does the other half of the decline come from? By construction, it comes from a combination of μ_t^* and m_t effects. The easiest term to analyze is the mortality rate m_t. The demographic history of France since 1820 is simple. Population was growing at a small rate during the 19th century (less than 0.5% per year), and was quasi-stationary around 1900 (0.1%). The only time of sustained population growth corresponds to the postwar baby-boom, with growth rates around 1% in the 1950s-1960s. Population growth has been declining since then, and in the 1990s-2000s it was approximately 0.5% per year (about a third of which comes from net migration flows). According to official projections, population growth will be less than 0.1% by 2040-2050, with a quasi-stationary population after 2050.

The evolution of mortality rates follows directly from this and from the evolution of life expectancy. Between 1820 and 1910, the mortality rate was relatively stable around 2.2%-2.3% per year (see Figure 3). This corresponds to the fact that the population was growing at a very small rate, and that life expectancy was stable around 60, with a slight upward trend. In a world with a fully stationary population and a fixed adult life expectancy equal to 60, then the adult mortality rate (i.e. the mortality rate for individuals aged 20-year-old and above)

---

[46] Parental transfers to non-adult children and educational investments raise complicated empirical and conceptual issues, however. One would also need to look at the financing of education as a whole.

should indeed be exactly equal to 1/40 = 2.5%. Since population was rising a little bit, the mortality rate was a bit below that.

Mortality rates rose in the 1910s and 1940s due to the wars. Ignoring this, we have a regular downward trend in the mortality rate during the 20th century, with a decline from about 2.2%-2.3% in 1910 to about 1.6% in the 1950s-1960s and 1.1%-1.2% in the 2000s. According to official projections, this downward trend is now over, and the mortality rate is bound to rise in the coming decades, and to stabilize around 1.4%-1.5% after 2050 (see Figure 3). This corresponds to the fact that the French population is expected to stabilize by 2050, with an age expectancy of about 85, which implies a stationary mortality rate equal to 1/65 = 1.5%. The reason why the mortality rate is currently much below this steady-state level is because the large baby-boom cohorts are not dead yet. When they die, i.e. around 2020-2030, then the mortality rate will mechanically increase, and so will the inheritance flow. This simple demographic arithmetic is obvious, but important. In the coming decades, this is likely to be a very big effect in countries with negative population growth. However the large inheritance flows observed in the 2000s are not due to the U-shaped mortality effect, which will start operating only in future decades. The 2000-2010 period actually corresponds to the lowest historical mortality ever observed. On the basis of mortality rates alone, the inheritance flow in the 1990s-2000s should have been much smaller than what we actually observe.

4.3. The μ_t* ratio effect

So why has there been such a strong recovery in the inheritance flow since the 1950s-1960s, and why is the inheritance flow so large in the 1990s-2000s? We now come to the most interesting part, namely the μ_t* ratio effect. Here it is important to distinguish between the raw ratio μ_t and the gift-corrected ratio $\mu_t^* = (1+v_t)\ \mu_t$. We plot on Figure 4 the historical evolution of the μ_t and μ_t* ratios, as estimated using observed age-wealth-at-death profiles and differential mortality parameters. We plot on Figure 5 the inheritance flow-private wealth ratio $b_{wt}= m_t\ \mu_t^*$ and compare it to the mortality rate m_t.

Between 1820 and 1910, the μ_t ratio was around 130%. I.e. on average decedents' wealth was about 30% bigger than the average wealth of the living. There was actually a slight upward trend, from about 120% in the 1820s to about 130%-140% in 1900-1910. But this upward trend disappears once one takes inter vivos gifts into account: the gift-bequest ratio v_t was as high as 30%-40% during the 1820s-1850s, and then gradually declined, before stabilizing at about 20% between the 1870s and 1900-1910.[47] When we add this gift effect, then we find that the gift-corrected μ_t* ratio was stable at about 160% during the 1820-1913 period (see Figure 4). During this entire period, cross-sectional age-wealth profiles were steeply increasing up until the very old, and were becoming more and more steeply increasing over time.[48]

[47] We know little as to why inter vivos gifts were so high in the early 19th century. This seems to correspond to the fact that dowries (i.e. large inter-vivos gifts at the time of wedding) were more common at that time.
[48] See Piketty (2010, Table 2) and Appendix B2, Tables B3-B5 for detailed computations and results.

The 1913-1949 capital shocks clearly had a strong disturbing impact on age-wealth profiles. Observed profiles gradually become less and less steeply-increasing at old age after World War 1, and shortly become hump-shaped in the aftermath of World War 2. Consequently, our μ_t ratio estimates declined from about 140% at the eve of World War 1 to about 90% in the 1940s (see Figure 4). One possible explanation for this change in pattern is that it was too late for the elderly to recover from the capital shocks (war destruction, capital losses), while active and younger cohorts could earn labour income and accumulate new wealth. It could also be that elderly wealth holders were hit by proportionally larger shocks, e.g. because they held a larger fraction of their assets in nominal assets such as public bonds.

The most interesting fact is the strong recovery of the μ_t and μ_t^* ratios which took place since the 1950s. The raw age-wealth-at-death profiles gradually became upward sloping again. In the 1900s-2000s, decedents aged 70 and over are about 20%-30% richer than the 50-to-59-year-old decedents.[49] As a consequence, the μ_t ratio gradually rose from about 90% in the 1940s-1950s to over 120% in the 2000s (see Figure 4).

Next, the gift-bequest ratio v_t rose enormously since the 1950s. The gift-bequest ratio was about 20%-30% in the 1950s-1960s, and then gradually increased to about 40% in the 1980s, 60% in the 1990s and over 80% in the 2000s. This is the highest historical level ever observed. Gifts currently represent almost 50% of total wealth transmission (bequests plus gifts) in France.[50] That is, when we observe wealth at death, or wealth among the elderly, we are actually observing the wealth of individuals who have already given away almost half of their wealth. So it would make little sense to study age-wealth profiles without taking gifts into account, in France and elsewhere.[51] There is an issue as to whether such a high gift-bequest ratio is sustainable, which we address in the simulations. For the time being, it is legitimate to add the gift flow to the bequest flow, especially given the relatively small and stable age differential between decedents and donors (around 7-8 years). We find that the gift-corrected μ_t^* ratio has increased enormously since World War 2, from 120% in the 1940s-1950s to 150%-180% in the 1980s-1990s and over 220% in the 2000s (see Figure 4).

[49] Differential-mortality-corrected profiles are basically flat above age 50 (see Appendix B2). Using the 1998 and 2004 Insee wealth surveys, we find age-wealth profiles which are slightly declining after age 50 (the 70-to-79 and 80-to-89-year-old own about 90% of the 50-to-59-year-old level). However this seems to be largely due to top-wealth under-reporting in surveys. Using wealth tax data (see Zucman (2008, p.68)), we find that the population fraction subject to the wealth tax (i.e. with wealth above 1 million €) is 2-3 times larger for the 70-to-79 and 80-to-89 than for the 50-to-59-year-old. This steeply rising profile does not show up at all in wealth surveys, and might also be under-estimated in estate tax data (e.g. because the elderly hold more tax-exempt assets).

[50] The upward trend in gifts started before new tax incentives in favour of gifts were put in place in the late 1990s and 2000s, so it is hard to identify the tax incentive effect per se. The most plausible interpretation for the large rise of gifts seems to be the rise of life expectancy (parents realize that they are not going to die very soon, and decide that should help their children more before they die). In any case, gifts are probably less well reported than bequests to the tax administration, so it is hard to see how our tax-data-measured v_t ratio can be over-estimated. For additional details on gifts and their tax treatment in France, see Appendix B.

[51] We do not know whether such a large rise in gifts also occurred in other countries. According to on-line IRS data, the U.S. gift-bequest ratio is about 20% in 2008 (45 billions $ in gifts and 230 billions $ in bequests were reported to the IRS). Unfortunately, the bequest data relates to less than 2% of U.S. decedents (less than 40,000 decedents, out of a total of 2.5 millions), and we do not really know what fraction of gifts was actually reported to the IRS. On-line IRS tables also indicate steeply rising age-wealth-at-death profiles. This is consistent with the findings of Kopczuk (2007) and Kopczuk and Luton (2007).

To summarize: the historical decline in the mortality m_t seems to have been (partially) compensated by an increase in the μ_t^* ratio. Consequently, the product of the two, i.e. the inheritance-wealth ratio $b_{wt}= m_t\ \mu_t^*$, declined much less than the mortality rate (see Figure 5). This is the central fact which needs to be explained.

5. Wealth accumulation, inheritance & growth: a simple steady-state model

Why is it that the long-run decline in mortality rate m_t seems to be compensated by a corresponding increase in the μ_t ratio? I.e. why does the relative wealth of the old seem to rise with life expectancy? What are the economic forces that seem to be pushing for a constant inheritance-income steady-state ratio b_{yt} (around 20% of national income), independently from life expectancy and other parameters?

One obvious explanation as to why wealth tends to get older in aging societies is because individuals wait longer before they inherit. Since there are other effects going on, it is useful to clarify this central intuition with a stylized model, before moving to full-fledged simulations.

We consider a standard wealth accumulation model with exogenous growth. National income Y_t is given by a (net-of-depreciation) production function $F(K_t,H_t)$, where K_t is (non-human) capital, $H_t=L_te^{gt}$ is human capital (efficient labor), g is the exogenous rate of productivity growth, and L_t is labor supply (raw labor). Assuming away government and foreign assets and liabilities (closed economy), private wealth $W_t=K_t$, so the wealth-income ratio is equal to the domestic capital-output ratio: $\beta_t=W_t/Y_t=K_t/Y_t$. With a Cobb-Douglas production function $F(K,H)=K^{\alpha}H^{1-\alpha}$, we have constant factor shares: $Y_{Kt}=\alpha Y_t$, $Y_{Lt}=(1-\alpha)Y_t$ and $r_t=\alpha/\beta_t$.

We assume the following deterministic, stationary demographic structure. Everybody becomes adult at age a=A, has exactly one kid at age a=H>A, and dies at age D>H. As a consequence everybody inherits at age a=I=D-H>A. This is a gender free population. There is no inter vivos gift: all wealth is transmitted at death. Total adult population N_t includes a mass $N_t(a)=1$ of individuals of age a (A≤a≤D) and is permanently equal to D-A. The adult mortality rate m_t is also stationary and is given by $m_t=m^*=1/(D-A)$.

Why do real world, finite-life individuals choose to accumulate wealth and to die with positive wealth? On this interesting and difficult question, the present paper has nothing new to say. Presumably, the exact combination of saving motives (dynastic altruism; precautionary savings with imperfect insurance and annuity markets; direct utility for the prestige, power and social status conferred by wealth; etc.) varies a lot across individuals, just like other tastes – and is often hard to disentangle within a single self.[52]

---

[52] On the distribution of bequest motives, see e.g. Kopczuk and Lupton (2007). According to Carroll (2000), the wealth-loving model is the best explanation as to why saving rates increase so much with the level of lifetime income. See also Dynan et al (2002, 2004) and Kopczuk (2007).

Our purpose here is more modest. First, we show that in a simple "class saving" model where all savings come from the returns to inherited wealth (which is consistent with a standard dynastic model, but could also be rationalized by other models), then the m_t and μ_t effects exactly compensate one another, so that the steady-state ratio b_{yt} is equal to β/H. Next, we show that this basic result and intuition can be extended to more general demographic structures and saving models. Namely, as long as the growth rate g is sufficiently small, and the rate of return r>g is sufficiently large, then b_{yt} tends to be close to β/H – quite independently from the exact nature of the saving motives.[53]

5.1. Basic result: class saving/dynastic model

We start with the pure "class saving" case, whereby all wealth derives from inheritance. That is, we assume that there is no saving out of labor income ($s_L=0$), and that all savings come from the returns to inherited wealth ($s_K>0$).

One standard way to rationalize class saving behaviour is the dynastic model. Take an individual i born in year x_i. He will die in year x_i+D, but cares about the consumption flow of his descendants. So individual i maximizes an infinite-horizon utility function $U_i = \int_{t\geq s} e^{-\theta t} u(c_{ti})dt$, with $s=x_i+A$, $u(c)=c^{1-\sigma}/(1-\sigma)$ and where:
For $t\in[x_i+A;x_i+D]$, c_{ti} = consumption flow enjoyed by individual i during his adult life
For $t\in[x_i+D;x_i+D+H]$, c_{ti} = consumption flow enjoyed by his child (after his death)
For $t\in[x_i+D+H;x_i+D+2H]$, c_{ti} = consumption flow enjoyed by his grand child. And so on.[54]

In the steady-state of the dynastic model, the consumption path of every dynasty (rich or poor) must be growing at rate g. The rate of return r* and wealth-income ratio β* are given by the Ramsey-Cass golden rule of capital accumulation: $r^*=\theta+\sigma g$ (>g), $\beta^*=\alpha/r^*$. Every dynasty consumes 100% of its labor income ($s_L=0$), but saves a fraction $s_K=g/r$ of the return to inherited wealth, so that dynastic wealth grows at rate g and future generations can enjoy a growing consumption path.[55] It is also well-known that any wealth distribution can be a steady-state of the dynastic model, as long as the aggregate wealth-income ratio equals β*.[56]

Whether class saving behaviour originates from the dynastic model or from any other model, the steady-state, cross-sectional age-wealth profile $w_t(a)$ takes a simple form (see Figure 6):

---

[53] Here we report only the main theoretical results and steady-state formulas. See the working paper version for complete results and omitted proofs. See Piketty (2010, Section 7) and Appendix E.

[54] For simplicity we assume that individuals start consuming only when they become adult, and start caring about their children's consumption only after they die. Here we also assume that young adults cannot borrow against their future inheritance (so until age I they can only consume their labor income). In the working paper, we also solve the model in the (not-too-realistic) case where they can borrow. As a consequence, the steady-state inheritance flow b_y* is even larger than the class-saving level β/H. See Piketty (2010, Section 7, Proposition 6).

[55] So for instance if α=30%, θ=2%, σ=3, g=1%, then r*=5%, β*=600%, s_L=0%, s_K=g/r*=20%. I.e. wealth holders get a 5% return, consume 80% and save 20%, so that W_t grows at 1%, just like Y_t.

[56] See e.g. Bertola et al (2006, Chapter 3). All results presented here also hold for any labor productivity distribution (and any correlation between the two distributions), as long as the cross-sectional age-labor income distribution is flat. In the working paper, we extend the results to the case where individuals get a replacement rate ρ<100% above retirement age, so as to study the interplay between the generosity of public pension system and the magnitude of inheritance flows (in France, ρ is close to 80%, so this has little impact).

If $a \in [A,I[$, then $w_t(a) = 0$
If $a \in [I,D]$, then $w_t(a) = \overline{w}_t$

Since s_L=0, young adults have zero wealth until the time they inherit. Then, at age a=I, everybody inherits: some inherit very little or nothing at all, some inherit a lot, depending on the wealth distribution, and on average they inherit $b_t=w_t(I)=w_t(D)$. So at age a=I average wealth $w_t(a)$ jumps to some positive level $\overline{w}_t=b_t$. The interesting point is that in the cross-section all age groups with age a between I and D have the same average wealth $w_t(a)=\overline{w}_t$. This is because in steady-state the growth effect and the saving effect exactly compensate each other. Take the group of individuals with age a>I at time t. They inherited a-I years ago, at time s=t-a+I. They received average bequests $b_s=w_s(I)$ that are smaller than the average bequests $b_t=w_t(I)$ inherited at time t by the I-year-old. Since everything grows at rate g in steady-state, we simply have: $b_s= e^{-g(a-I)}\, b_t$. But although they received smaller bequests, they saved a fraction $s_K=g/r^*$ of the corresponding return, so at time t their inherited wealth is now equal to: $w_t(a) = e^{s_K r^*(a-I)}\; e^{-g(a-I)}\, b_t = b_t = w_t(I) = \overline{w}_t$.

Given this age-wealth profile, the average wealth w_t over all age groups $a \in [A,D]$ is given by: $w_t=(D-I)\overline{w}_t/(D-A)=H\overline{w}_t/(D-A)$. It follows that the steady-state relative wealth of decedents $\mu_t=w_t(D)/w_t=\overline{w}_t/w_t$ is entirely determined by demographic parameters:

$$\mu^* = \frac{w_t(D)}{w_t} = \frac{D-A}{H} \qquad \textbf{(5.1)}$$

Once we know μ*, we can compute steady-state inheritance flow ratios $b_w^*=B_t/W_t=m^*\mu^*$ and $b_y^*=B_t/Y_t= m^*\mu^*\beta^*$ using equations (3.1)-(3.3). Since the mortality rate $m^*=1/(D-A)$, the product $m^*\mu^*$ is simply equal to one divided by generation length H, and does not depend on adult life length D-A. We summarize these observations in the following proposition:

<u>Proposition 1</u>. Assume pure class savings: $s_L=0$ & $s_K>0$ (dynastic model). As $t\to+\infty$, $\mu_t\to\mu^*$, $b_{wt}\to b_w^*$ and $b_{yt}\to b_y^*$. Steady-state ratios μ*, b_w^* and b_y^* are uniquely determined as follows:
(1) The ratio μ* between average wealth of decedents and average adult wealth depends solely on demographic parameters: $\boldsymbol{\mu^* = \overline{\mu} = (D-A)/H}$ (>1).
(2) The inheritance flow-private wealth ratio $b_w^*=\mu^*m^*$ and the estate multiplier $e^*=1/b_w^*$ depend solely on generation length H: $\boldsymbol{b_w^* = 1/H}$ and $\boldsymbol{e^* = H}$
(3) The inheritance flow-national income ratio $b_y^*=\mu^*m^*\beta^*$ depends solely on the aggregate wealth-income ratio β* and on generation length H: $\boldsymbol{b_y^* = \beta^*/H}$

Proposition 1 is simple, but powerful. It holds for any growth rate g, saving rate s_K, and life expectancy D. It says that societies with a higher life expectancy D have both lower mortality rates m_t and higher μ_t ratios. In steady state both effects exactly compensate each other, so that the product $b_{wt}=m_t\mu_t$ does not depend at all on life expectancy. It only depends on generation length H, i.e. the average age at which people have children – a parameter which has been relatively constant over the development process (around H=30). If the wealth-income ratio β^* also tends to be constant in the long run (around β^*=600%), then we have a simple explanation as to why the aggregate inheritance flow $b_y^*=\beta^*/H$ always seems to return to approximately 20% of national income.

The intuition is the following: in aging societies with higher life expectancy, people die less often, but they die with higher relative wealth, so that the aggregate inheritance flow is unchanged. In effect, the entire wealth profile is simply shifted towards older age groups: one has to wait longer before inheritance, but one inherits bigger amounts, so that from a lifetime perspective inheritance is just as important as before.

Example. Assume β^* = 600% and H=30. Then b_w^* = 1/H = 3.3% and $b_y^*= \beta^*/H$ = 20%.
I.e. the aggregate inheritance flow equals 20% of national income, irrespective of other parameter values, and in particular irrespective of growth rate g and life expectancy D.
- Around 1900, we have A=20, H=30 and D=60, so that people inherit at age I=D-H=30. In steady-state, $m^*=1/(D-A)$=2.5% and $\mu^*=(D-A)/H$=133%. Then $b_w^*=m^*\mu^*$ equals 3.3% of private wealth and $b_y^*=m^*\mu^*\beta^*$ equals 20% of national income.
- Around 2020, we have A=20, H=30 and D=80, so that people inherit at age I=D-H=50. In steady-state, $m^*=1/(D-A)$=1.7%, $\mu^*=(D-A)/H$=200%. Then $b_w^*=m^*\mu^*$ again equals 3.3% of private wealth and $b_y^*=m^*\mu^*\beta^*$ again equals 20% of national income.

Although this is a very crude model, we believe that this simple result provides the right intuition as to why the historical decline in mortality rates was to a large extent compensated by an historical rise in the relative wealth of decedents, and why the French inheritance flow seems to be returning towards a high steady-state value around 20% of national income. Moreover, this basic intuition can be generalized to more general demographic structures and saving models, as we now show.

5.2. Extensions

5.2.1. Demographic noise

First, the discontinuous age-wealth profile obtained in this model (see Figure 6) is an artefact due to the deterministic demographic structure, and would immediately disappear once one introduces demographic noise (as there is in the real world), without affecting the results. E.g. assume that individuals, instead of dying with certainty at age a=D, die at any age on the interval [D-d;D+d], with uniform distribution. Then individuals will inherit at any age on the interval [I-d;I+d]. To fix ideas, say that A=20, H=30, D=70 and d=10, i.e. individuals die at any age between 60 and 80, with uniform probability, and therefore inherit at any age between 30 and 50, with uniform probability. Then one can show that the steady-state age-wealth profile has a simple linear shape (see Figure 7), and that the theoretical results of proposition 1 are left unchanged. In the real world, there are several other types of demographic noise (age at parenthood is not the same for everybody, fathers and mothers usually do not die at the same time, there is differential mortality, there are inter vivos gifts, etc.), and we take all of these into account in the full fledged simulated model. The important point, however, is that the basic intuition provided by proposition 1 is essentially unaffected by demographic noise.

5.2.2. Population growth

Next, proposition 1 is unaffected by the introduction of population growth. Generally speaking, the impact of population growth on inheritance flows is similar to the impact of productivity growth, and for the most part one simply needs to replace g by g+n (where g is productivity growth and n is population growth) in the various steady-state results and formulas.[57]

5.2.3. Exogenous saving rates coming from both labor and capital income

Next, and most importantly, the intuition captured by proposition 1 can be generalized to large classes of saving models, well beyond the class saving/dynastic model. Consider first a model with exogenous saving rates coming from both labor and capital income: $s_L>0$, $s_K>0$. The aggregate saving rate is $s=\alpha s_K+(1-\alpha)s_L$. Long-run aggregate variables are given by the Harrod-Domar-Solow formula: as $t\to+\infty$, $\beta_t\to\beta^*$ and $r_t\to r^*$, with $\beta^*= s/g$ and $r^*=\alpha/\beta^*=\alpha g/s$.[58] One can easily show that steady-state inheritance flows depend negatively on the growth rate, and converge towards class saving levels as $g\to0$:

Proposition 2. Assume exogenous saving rates $s_L>0$, $s_K\geq0$. As $t\to+\infty$, $\mu_t\to\mu^*=\mu(g) < \overline{\mu}$
Higher growth reduces the relative importance of inheritance: $\boldsymbol{\mu'(g)<0}$
With low growth, inheritance ratios converge to class saving levels: $\boldsymbol{\lim_{g\to0} \mu(g) = \overline{\mu}}$

The general formula for steady-state $\mu^*=\mu(g)$ turns out to be reasonably simple:

$$\mu(g) = \frac{1-e^{-(g-s_K r^*)(D-A)}}{1-e^{-(g-s_K r^*)H}} \qquad (5.2)$$

With $s_L>0$, the steady-state rate of wealth reproduction $s_K r^*$ is strictly less than the growth rate g, and $g-s_K r^*=g(1-\alpha)s_L/s>0$. If $s_L\to0$, then $g-s_K r^*\to0$. Simple first order approximation using the formula $\mu(g)$ shows that steady-state μ^* then tends toward $\overline{\mu}=(D-A)/H$.[59] This is just a continuity result: as we get closer to class savings, we converge toward the same age-wealth profile and inheritance ratios, whatever the growth rate might be.

The more interesting part is that for any saving behaviour ($s_L>0$, $s_K\geq0$), steady-state μ^* also tends toward the same class-saving level $\overline{\mu}$ when the growth rate g tends toward 0. In the uniform savings case ($s_L=s_K=s$), $g-s_K r^*=(1-\alpha)g$, so we simply have:

$$\mu(g) = \frac{1-e^{-(1-\alpha)g(D-A)}}{1-e^{-(1-\alpha)gH}} \qquad (5.3)$$

[57] See working paper version, appendix E2, propositions 12-13.
[58] In case $s_L=0$, then $s=\alpha s_K$ and $r^*=g/s_K$, i.e. we are back to the class saving/dynastic model ($s_K=g/r^*$).
[59] For $g-s_K r^*$ small, $\mu(g) \approx \overline{\mu}[1- (g-s_K r^*)(D-A-H)/2]$. See Piketty (2010), Section 3 and Appendix E.

First-order approximations again show that $\mu(g) \to \bar{\mu}$ as $g \to 0$. Steady-state inheritance ratios b_w^* and b_y^* also tend toward their class saving levels $b_w=1/H$ and $b_y=\beta^*/H$ when growth rates go to zero. Conversely, the higher the growth rate g, the lower the steady-state inheritance ratios $\mu^*=\mu(g)$, b_w^* and b_y^*.

The intuition is the following. With $s_L>0$, the cross-sectional age-wealth profile is less extreme than the class saving profile depicted on Figure 6. Young workers now accumulate positive wealth before they inherit (and accumulate positive wealth even if they never inherit). So the relative wealth of the elderly μ_t will always be lower than under class savings. Since labor income grows at rate g, this effect will be stronger for higher growth rates. With large growth, young workers earn a lot more than their parents did in the past. This reduces the relative importance of inheritance. But with low growth, the inheritance effect increasingly dominates, and the steady-state age-wealth profile looks closer and closer to the class saving profile. So inheritance flows converge towards class saving levels, irrespective of saving behavior.[60]

Formulas (5.2)-(5.3) can be used to quantify the magnitude of the effects at play. The point is that convergence towards class saving levels happens very fast. That is, for low but realistic growth rates (typically, g=1% or 2%), we find that $\mu(g)$ is already very close to $\bar{\mu}$. That is, inheritance-wise, a growth rate of g=1% or 2% is not very different from a growth rate g=0%.

Example. Assume g=1% and uniform savings ($s=s_K=s_L$). Then for A=20, H=30, D=60, i.e. I=D-H=30, we have $\mu(g)$=129%. This is lower than $\bar{\mu}$=(D-A)/H=133% obtained under class savings, but not very much lower. With β^*=600%, this corresponds to b_y^*=19% instead of b_y^*=20% under class savings. With A=20, H=30, D=80, i.e. I=D-H=50, we get $\mu(g)$=181% under uniform savings instead of $\bar{\mu}$=200% with class savings, and again b_y^*=19% instead of b_y^*=20%. Assuming g=2%, we still get b_y^*=19% with D=60, and b_y^*=17% with D=80, instead of b_y^*=20% in both cases under class savings.[61]

In order to obtain more substantial declines in μ^* and b_y^*, one needs to assume much larger growth rates, such as those prevailing in France during the 1950s-1970s (over 5%). As $g \to +\infty$, then $\mu^*=\mu(g) \to 1$, $b_w^* \to 1/(D-A)$ and $b_y^* \to \beta^*/(D-A)$. With infinite growth, then $b_w^* \to 0$ and $b_y^* \to 0$ as $D \to +\infty$. That is, societies where people die later and later resemble societies where one never dies, and inheritance effectively vanishes. The key point, however, is that this naive intuition only applies to the case with infinite growth. With plausible growth rates, then the inheritance flow b_y^* depends almost exclusively on generation length H, and is little affected by the rise of life expectancy D.

[60] See Appendix E, Figures E1-E2. For a given s, steady-state β^* (and not only μ^*) rises as g decreases, which also pushes towards higher b_y^*. If $s \to 0$ as $g \to 0$, so as to keep $\beta^*=s/g$ and $r^*=\alpha/\beta^*$ constant, then in effect $g/r^* \to 0$ as $g \to 0$, i.e. with low growth the capitalization effect is infinitely large as compared to the growth effect. The extreme case g=0 is indeterminate in the exogenous savings model: if g=0 and s>0, then as $t \to +\infty$, $\beta_t \to +\infty$ and $r_t \to 0$; if g=0 and s=0, then β^* and r^* are entirely determined by initial conditions; in both cases, $\mu_t \to \bar{\mu}$ as $t \to +\infty$.
[61] See Appendix E, Table E1 for detailed computations using formulas (5.2)-(5.3).

5.2.4. Open economy

These results can also be extended to the open economy case. One simply needs to replace r* by the world rate of return r in the steady-state formula (5.2):

Proposition 3. Assume exogenous saving rates $s_L \geq 0$, $s_K \geq 0$, and a world rate of return $r \geq 0$.
As $t \to +\infty$, $\mu_t \to \mu^* = \mu(g,r)$. If $r > \bar{r} = g/s_K$, then $\mu(g,r) = \bar{\mu}$. If $r < \bar{r}$, then $\mu(g,r) < \bar{\mu}$.
Lower growth and/or higher rates of return raise the relative importance of inheritance: **$\mu'(g) < 0$, $\mu'(r) > 0$**.
With low growth and/or high rates of return, inheritance ratios converge to class saving levels: $\lim_{g\to 0}$ **$\mu(g,r)$ =** $\lim_{r\to\bar{r}}$ **$\mu(g,r)$ =** $\bar{\mu}$

The case $r > \bar{r}$ is particularly likely to prevail in environments with low growth and high wealth concentration (so that wealth holders can afford re-investing a large fraction s_K of their asset returns), such as in France 1820-1910. E.g. with g=1% and s_K=25%, the world rate of return r simply needs to be larger than $\bar{r} = g/s_K$ =4%. So if r=5%, then $s_K r$=1.25%, i.e. private wealth grows 25% faster than domestic output, which over a few decades makes a big difference. What we add to these well-known open economy insights is the inheritance dimension. In case $r > \bar{r}$ then μ_t always converges towards its maximum class-saving level $\bar{\mu}$, whatever the growth rate g and the labor saving rate s_L. Intuitively, labor income matters less and less along such explosive paths, and the age-wealth profile becomes almost exclusively determined by inheritance receipts.

In case $r < \bar{r}$, then steady-state foreign assets (positive or negative) are a constant fraction of domestic output and assets, and $\mu^* = \mu(g,r) < \bar{\mu}$. The intuition for $\mu'(g) < 0$ is the same as before: higher growth raises the relative wealth of the young and reduces the relative wealth of elderly (and therefore the relative importance of inheritance). The intuition for $\mu'(r) > 0$ is the opposite: a higher rate of return gives more weight to past inheritance and raises the relative wealth of the elderly. In the same way as in the closed economy case, the important point about this formula is that it converges very fast to class saving levels as $g \to 0$ and/or as $r \to \bar{r}$.

5.2.5. Finite-horizon, wealth-in-the-utility saving model

Consider now a finite-horizon, wealth-in-the-utilty saving model. Each individual i is assumed to maximize a utility function of the form $V[U_{Ci}, w_i(D)]$, with:

$U_{Ci} = [\int_{A\leq a\leq D} e^{-\theta(a-A)} c_i(a)^{1-\sigma} da]^{\frac{1}{1-\sigma}}$ = utility derived from lifetime consumption

$w_i(D)$ = end-of-life wealth
$V[U,w] = (1-s_B)\log(U) + s_B \log(w)$

This flexible formulation can be interpreted in different ways. One standard interpretation is that agents care about the bequest b=w(D) which they leave to the next generation. People might also care about their wealth per se, i.e. they derive direct utility from the prestige, power and social status conferred by wealth. This utility function can also be interpreted as a reduced form for precautionary savings. Whatever the interpretation, we again have a relatively simple closed-form formula for steady-state inheritance flow b_y*:

$$b_y^* = b_y(g,r) = \frac{s_B \lambda (1-\alpha) e^{(r-g)H}}{1 - s_B e^{(r-g)H}} \qquad (5.4)$$

This formula follows directly from the transition equation and from the fact that agents devote a fraction s_B of their capitalized, end-of-life lifetime resources (labor income and inherited wealth) to their end-of-life wealth.[62] It holds both in the closed and open economy cases, and for any structure of intra-cohort labor income or preference shocks. The intuition as to why the inheritance-income ratio b_y* is a rising function of r-g is straightforward. The excess of the rate of return over the growth rate exactly measures the extent to which wealth coming from the past is being capitalized at a faster pace than the growth rate of current income. Moreover, numerical solutions again show that for plausible parameter values and low growth b_y* is close to β*/H, in the same way as in the exogenous saving and dynastic models.

Proposition 4 Assume a wealth-in-the-utility model: $V[U,w]=(1-s_B)\log(U)+s_B\log(w)$
As $t\to+\infty$, $\mu_t \to \mu^*=\mu(g,r)$, $b_{wt}\to b_w^*=\mu^* m^*$, and $b_{yt}\to b_y^*=\mu^* m^* \beta^*$
Lower growth and/or higher rates of return raise inheritance: **$\mu'(g)<0$, $\mu'(r)>0$**.
With reasonable parameter values, and low growth and/or high rates of return, inheritance ratios are very close to class saving levels: **μ^* close to $\bar{\mu}$ and b_y^* close to β/H**

Example. Assume A=20, H=30, D=80, s_B=10%, and g=1%. Then in the closed-economy case we get r*=4% and b_y*=22%. If life expectancy was instead D=60, we would get instead b_y*=21%. I.e. inheritance ratios are almost exclusively determined by generation length H, and depend very little on life expectancy. With g=2%, we get r*=5% and b_y*=18% (both for D=60 and D=80). One needs to assume much larger growth rates to obtain more significant declines. In the open-economy case, inheritance can reach higher levels. E.g. with D=80, s_B=10%, g=1% and r=5%, then b_y*=30%.[63]

To summarize: we have learned from the theory that in a large class of saving models, steady-state inheritance flows appear to be close to class-saving level b_y*=β/H – as long as the growth rate g is sufficiently small. This provides a plausible explanation as to why the French inheritance flow seems to be returning toward a steady-state value around 20% of national income. However the theoretical models used so far are highly stylized, and ignore many important aspects of the real world, including demographic and economic shocks. So we now need to come to a full-fledged, out-of-steady-state simulated model.

[62] The factor λ corrects for the differences between the lifetime profile of labor income and inheritance flows, and is typically close to 1. See section 7 below.
[63] See Piketty (2010), Section 7 and Appendix E, Tables E5-E11 for detailed results.

6. Simulations

Our simulated model works as follows. We start from demographic data. We also take as given national-accounts aggregate values for all macroeconomic variables (growth rates, factor shares, tax rates, rates of return, saving rates). We then make different assumptions about saving behaviour in order to see whether we can replicate observed age-wealth profiles, μ_t ratios and the resulting inheritance flows.

More precisely, we constructed an exhaustive, annual demographic database on the age structure of the living population and of decedents, heirs, donors and donees in France over the 1820-2008 period. In practice, bequest and gift flows accrue to individuals in several different payments during their lifetime: usually both parents do not die in the same year, sometime individuals receive gifts from their parents, and sometime they receive bequests and gifts from individuals other than their parents. We use the estate tax returns micro-files available since the 1970s (and the historical tabulations broken by decedent and donor age group available for the earlier period), as well as historical demographic data on age at parenthood, in order to compute the exact fraction of bequest and gift flow accruing to each cohort and transmitted by each cohort during each year of the 1820-2008 period. In the simulated model, the value of bequests is endogenous: it depends on the wealth at death of the relevant cohorts, as determined by the endogenous dynamics of the age-wealth profile. But the fraction of the aggregate bequest flow going to each cohort is taken from observed data. Regarding gifts, in some variants we take the observed gift-bequet ratio v_t as given, and in some other variants we assume other gift-bequest ratios (so as to check whether long run patterns are affected by v_t). In all variants, the age structure of donors and donees is exogenously given by our demographic data base.

Regarding the economic side of the model, we proceed as follows. We start from observed factor shares in national income, as measured by national accounts: $Y_t = Y_{Kt} + Y_{Lt}$. We use national accounts tax and transfer series to compute aggregate, net-of-tax labor and pension income $(1-\tau_{Lt})Y_{Lt}$ (where τ_{Lt} is the aggregate labor tax rate). We use income tax micro data to estimate the age-labor income profile $Y_{Lt}(a)$, which we take as given. On this basis we attribute an average net-of-tax labor and pension income $(1-\tau_{Lt})y_{Lt}(a)$ to each cohort for each year of the 1820-2008 period. Because we use linear saving models, we do not need to model intra-cohort distributions of labor income or wealth.

We also take as given the average pre-tax rate of return r_t, which we compute by dividing capital income Y_{Kt} by aggregate private wealth W_t, and the average after-tax rate of return $r_{dt}=(1-\tau_{Kt})r_t$ (where τ_{Kt} is the aggregate capital tax rate). We assume that wealth holders from all age groups get the same average after-tax rate of return r_{dt} on their wealth $W_t(a)$. This is very much a simplifying assumption. In the real world, rates of return vary widely across assets: typically, returns on stock and real estate are much larger than returns on bonds.[64]

[64] E.g. according to Barro (2009, Table 1), the average real rate of return on stocks has been as large as 7.5% over the 1880-2005 period, vs. 1.0% for bonds (averages over 11 Oecd countries).

This might possibly entail systematic differences across age groups. However we know very little about such systematic variations, so as a first approximation attributing the same average return to all age groups seems like the most reasonable assumption.

Our national-accounts approach to average rates of return r_t and r_{dt} also appears to be the most appropriate option. To the extent that national accounts correctly measure annual flows of capital income Y_{Kt} (rental income, interest, dividend, etc.), then r_t and r_{dt} indeed measure the true average rate of return received by holders of private wealth W_t in France over the past two centuries. National accounts are not perfect. But this is arguably the most comprehensive data source that we have, and one ought to start from there.

We present two main series of simulations: one for the 1820-1913 quasi-steady-state period, and one for the 1900-2008 U-shaped period (which we then extend to the future). In the first one, we start from the observed age-wealth profile in 1820, and attempt to simulate the evolution of the profile during the 1820-1913 period. In the second one, we start from the observed age-wealth profile in 1900, and attempt to simulate the evolution of the age-wealth profile during the 1900-2008 period. In both cases, the cohort level transition equation for wealth is the following:[65]

$$\mathbf{W_{t+1}(a+1) = (1+q_{t+1})\ [W_t(a) + s_{Lt}Y_{Lt}(a) + s_{Kt}r_{dt}W_t(a)]} \qquad \mathbf{(6.1)}$$

(+ bequests and gifts received – bequests and gifts transmitted)

The real rates of capital gains q_t come from our aggregate wealth accumulation equation. The only parameters on which we need to make assumptions are the savings rates s_{Lt} and s_{Kt}. We do not attempt to generate saving rates out of a forward looking, utility maximizing model. Rather we make simple assumptions on s_{Lt} and s_{Kt}, and we make sure that the aggregate savings $s_t=(1-\alpha_t)s_{Lt}+\alpha_t s_{Kt}$ (where α_t is the after-tax capital share) is equal to the observed private savings rate s_t, which according to national accounts has been relatively stable around 8%-10% in France in the long run (see Figure 8).

By construction, the simulated model always perfectly replicates the aggregate wealth-income ratio $\beta_t=W_t/Y_t$. The name of the game is the following: what assumptions on saving behaviour also allow us to replicate the observed dynamics of age-wealth profiles, the μ_t ratio and the inheritance flow-national income ratio b_{yt}?

Our main conclusion is summarized on Figure 9. By making simple assumptions on savings behaviour (namely, class saving for the 1820-1913 period, and uniform saving for the 1913-2008 period), we are able to reproduce remarkably well the observed evolution of the aggregate inheritance flow over almost two centuries. If we then use the model to predict the future, we find that the inheritance flow should stabilize around 15%-20% or keep rising over 20%, depending on the future evolutions of growth rates and after-tax rates of return.

[65] The full transition equations, and detailed simulation results, are given in Appendix D.

6.1. Simulating the 1820-1913 quasi-steady-state

The most interesting period to simulate and investigate is maybe the 1820-1913 period. As was already stressed, this is because this time period looks very close to the theoretical steady-state associated to the class saving model, with s_K close to g/r, and s_L close to 0.

The first thing to notice is that the 1820-1913 period was a time when the gap r-g was particularly large, first because g was very low, but also because r was unusually high. Generally speaking, factor shares appear to have been fairly stable in France over the past two centuries, with a capital share usually around 30% (see Figure 10). However the capital share during the 19th century (30%-40%) was apparently somewhat higher than during the 20th century (20%-30%). Dividing capital shares by aggregate wealth-income ratios, we get average rates of returns to private wealth r_t of about 5%-6% in 1820-1913, much larger than the growth rate, which on average was only 1.0% at that time (see Table 2).

We run several simulations. If we assume uniform saving rates, then we under-predict somewhat the aggregate evolution of inheritance. Most importantly, we predict an age-wealth profile in 1900-1910 that is flat after age 60 (or even slightly declining after age 70), while the observed profile is steeply increasing, including for the very old. This has a limited impact on the aggregate μ_t and b_{yt} ratios, because at that time few people died after age 70. But this is an important part of the observed data. This shows that uniform saving is an inadequate description of actual savings behaviour at that time. If we assume that all savings came from capital income, which implies s_K≈25%-30% and s_L≈0% (instead of $s=s_K=s_L$≈8%-10%), then we can predict adequately both the evolution of the inheritance-income ratio b_{yt} and the evolution of the age-wealth profiles $w_t(a)$.

Given the very large wealth concentration prevailing at that time, class saving behavior seems highly plausible. The income levels and living standards attained by wealth holders were so much higher than those of the rest of the population that is was not too difficult for them to save 25%-30% of their capital income annually. In order to fully account for the steepness of the age-wealth profile around 1900-1910, one would actually need to assume not only that (most) savings come from capital income, but also that the average saving rate $s_K(a)$ actually rises with age. This could be explained by a micro model involving a simple consumption satiation effect among elderly wealth holders. To properly study this issue, one would need however to model explicitly intra-cohort distributions of wealth and saving motives, and to use micro data. This is well beyond the scope of the present paper.

We also did various sensitivity checks by varying the gift-bequest ratio v_t. In one variant, we set v_t=0% for the entire 1820-1913 period, i.e. we assume that 19th century wealth holders make no inter vivos gifts and hold on their wealth until they die. Of course, this leads us to under-predict the inheritance (bequests plus gifts) flow at the beginning of the period. The interesting finding, however, is that we get approximately the same inheritance-income ratio at the end of the period (about 20%) as the observed ratio with gifts (but with an even more steeply increasing age-wealth profile). This validates our methodological choice of adding gifts to bequests. Inter-vivos gifts have an impact on the timing of inheritance receipts, but very little impact on the long run aggregate flow of aggregate wealth transmission.

6.2. Simulating the 20th century chaotic U-shaped pattern

We proceed in the same way for the 20th century. Whether we assume uniform savings or class savings, the model predicts a decline in the μ_t ratio during the 1913-1949 period. The channel through which this effect operates is the one that we already described, i.e. it was too late for the elderly to start re-accumulating wealth again after the shocks. However we get a significantly better fit by assuming that aggregate saving behaviour has shifted from class savings to uniform savings during the 1913-1949 period. For instance, if we look at the inheritance-income ratio at its lowest point, i.e. during the 1950s (4.3%), we predict 5.3% with uniform saving and 6.0% with class saving.

Intuitively, this structural change in saving behaviour could come from the large decline in wealth concentration that occurred during that time: top wealth holders were much less prosperous than they used to be, and they were not able to save as much. It could even be that they saved even less than labor earners, for instance if they tried to maintain their living standards for too long. The other possible interpretation as to why we slightly over predict the observed 1950s inheritance flow (even with uniform saving) is because the capital shocks of the 1913-1949 disproportionally hit elderly wealth holders, e.g. because they held a larger fraction of their wealth in bonds and other nominal assets. In the simulated model, we assume that the shocks (both the destruction shocks and the capital losses) hit all wealth holders in a proportional manner. It is also likely that the rise of estate and income tax progressivity which occurred during this very same period contributed to the decline in wealth concentration and the equalization of saving propensities. Finally, it is possible that the gradual rise in life expectancy that occurred during this period led to a rise in lifecycle savings out of labor income. The data we use in this paper is insufficient to settle these issues. Our aggregate approach allows us to replicate the general pattern of inheritance flows over a two century period, and to identify the remaining issues that need to be addressed. But a purely aggregate approach is insufficient to explain the changes in saving behaviour. In order to better understand the micro processes at work, one would need to model explicitly distributional issues and to use micro data. We leave this to future research.

The post 1949 simulations also confirm the view that a structural shift from class saving to uniform saving occurred during the 20th century. All saving models predict a strong recovery of μ_t and b_{yt} between the 1950s and the 2000s (especially since the 1970s, due to lower growth rates). But class saving would lead us to over predict the recovery, with an inheritance flow of 16.8% in 2010, vs 14.4% with uniform savings, vs 13.8% with reverse class savings (i.e. zero saving from capital income), vs 14.5% in the observed data. We interpret this as evidence in favour of the uniform saving assumption as an adequate way to describe postwar aggregate savings behaviour (as a first approximation). This interpretation seems to be consistent with micro evidence from French household budget surveys: aggregate age-saving rates profiles have been quasi-flat during the 1978-2006 period, and do not appear to vary systematically with factor income composition.[66] This is imperfect data, however, and this issue would need to be better addressed in future research.

The simulations as a whole also confirm the critical importance of the r>g logic. As predicted by the theoretical formulas, the absolute level of g appears to have a stronger quantitative impact than the differential r-g. This is exemplified by the 1949-1979 period. Growth rates were above 5%, which slowed down considerably the rise of the μ_t ratio. During the 1979-2009 period, growth slowed down to 1%-2%, the rise of the μ_t ratio was more rapid, and so was the recovery of the inheritance-income ratio b_{yt}. This simple growth effect also plays a much bigger role than saving behaviour (uniform vs class saving), as predicted by the theory.

Finally, capital taxes play an important role in our simulations. The average rate of return on private wealth $r_t=\alpha_t/\beta_t$ has always been much larger than the growth rate g_t in France, both during the 19th and the 20th centuries (see Table 2). The major change is that the effective capital tax rate τ_{Kt} was less than 10% prior to World War 1, then rose to about 20% in the interwar period, and finally grew to 30%-40% in the postwar period.[67] This had a large impact on the differential between $r_{dt}=(1-\tau_{Kt})r_t$ and g_t. In particular, capital taxes largely explain why the differential was relatively small (but still positive) during the 1949-1979 period, in spite of positive capital gains. In our simulations, this differential has a smaller impact on μ_t and b_{yt} than the absolute growth rate level, but the effect is still significant.

6.3. Simulating the 21st century: towards a new steady-state?

In our baseline scenario, we assume that growth rates in 2010-2100 will be the same as the 1979-2009 average (1.7%), that the aggregate saving rate will be the same as the 1979-2009 average (9.4%), and that the capital share will be the same as the 2008 value (26%).[68] On the basis of the historical evolutions described in section 3.2 above, we assume that asset prices remain the same (relatively to consumer prices) after 2010.

In this scenario, we predict that the inheritance-income ratio b_{yt} will keep increasing somewhat after 2010, but will soon stabilize at about 16% (see Figure 9). There are several reasons why this new steady-state level is substantially below the 20%-25% quasi-steady-state level prevailing in 1820-1913. First, our projected growth rate (1.7%) is small, but bigger than the

[66] Using Insee household budget surveys for 1978, 1984, 1989, 1994, 2000 and 2006, one finds aggregate age-saving rates profiles that are rising somewhat until age 40-49, and almost flat above age 40-49: sligltly declining in 1978-1984-1989, flat in 1994-2000, slightly rising in 2006.

[67] Inheritance taxes are included, but have always been a small fraction of the total capital taxes, which mostly consist of flow taxes such as the corporate tax, personal capital income taxes, and housing taxes. See Appendix A, Tables A9-A11 for detailed series. There are approximate estimates, based on simplifying assumptions (especially regarding product taxes incidence). But the orders of magnitude seem to be right.

[68] The capital share that has been approximately constant since the late 1980s, but is significantly larger than the level observed in the late 1970s-early 1980s.

19th century growth rate (1.0%). Next, our projected after-tax rate of return (3.0%) is substantially smaller than the 19th century level (5.3%).

We then consider an alternative scenario with a growth slowdown after 2010 (1.0%), and a rise of the after-tax rate of return to 5.0%. This could be due either to a large rise in the capital share (say, because of increased international competition to attract capital), or to a complete elimination of capital taxes (which could also be triggered by international competition), or to a combination of the two. Under these assumptions, the inheritance-income ratio converges towards a new steady-state around 22%-23% by 2050-2060, i.e. approximately the same level as that prevailing in the early 20th century (see Figure 9).

This finding confirms that the rise in life expectancy has little effect on the long run level of inheritance. With low growth and high returns, the inheritance-income ratio depends almost exclusively on generation length H and the aggregate wealth-income ratio. Detailed results also show that the largest part of the effect (about two thirds) comes from the growth slowdown, versus about one third for the rise in the net-of-tax rate of return. This decomposition is relatively sensitive to assumptions about saving behaviour, however.

We also explored various alternative scenarios. With a 5% growth rate after 2010, and a rise in saving rate to 25%, so as to preserve a plausible wealth-income ratio, inheritance flows converge towards about 12% of national income by 2050-2060. With no rise in savings, inheritance flows converge to about 5%-6% of national income (i.e. approximately the same level as in the 1950s-1960s). But this is largely due to the fall in the wealth-income ratio. Another equivalent scenario would involve large scale capital shocks similar to those of the 1913-1949 period, with capital destructions, and/or a prolonged fall in asset prices, due to rent control, nationalization, high capital taxes or other anti-capital policies. Given the chaotic 20th century political record, one certainly cannot exclude such a radical scenario. The bottom line, however, is that a return to the low inheritance flows of the 1950s-1960s can occur only under fairly extreme assumptions. One needs a combination of exceptionally high growth rates during several decades and a large fall in aggregate wealth-income ratio.

Finally, we made simulations assuming that the gift-bequest ratio v_t did not rise after 1980. This is an important sensitivity check, because the large rise in gifts in recent decades played an important role in the overall analysis. We find a predicted inheritance-income ratio of 15% by 2050, instead of 16% in the baseline scenario. This suggests that the current gift levels are almost fully sustainable. We also simulated the entire 1900-2100 period assuming there was no gift at all. In the same way as for the 1820-1913 period, this has little effect on long run patterns, which again validates the way we treated gifts.

7. Applications to distributional analysis

7.1. The share of inheritance in total lifetime resources by cohort

In this paper, we mostly focus on the cross-sectional inheritance flow-national income ratio $b_{yt}=B_t/Y_t$. However this ratio is closely related to another ratio: namely the share of inheritance in the lifetime resources of the currently inheriting cohort, which we note $\hat{\alpha}_t$.

To see why, consider again the deterministic, stationary demographic structure introduced in section 5. Everybody becomes adult at age A, has one kid at age H, inherits at age I=D-H>A, and dies at age D. Each cohort size is normalized to 1, so that total (adult) population N_t is equal to (adult) life length D-A. Per decedent inheritance is equal to $b_t=B_t=b_{yt}Y_t$ and per adult income is equal to $y_t=Y_t/(D-A)$. At time t, the cohort receiving average inheritance b_t is the cohort born at time x=t-I. We note $\tilde{y}_t = \tilde{b}_t + \tilde{y}_{Lt}$ the total lifetime resources received by cohort x, where $\tilde{b}_t = b_t e^{rH}$ is the end-of-life capitalized value of their inheritance resources, and $\tilde{y}_{Lt}$ is the end-of-life capitalized value of their labor income resources. We define $\hat{\alpha}_t = \tilde{b}_t / \tilde{y}_t$ the share of inheritance in total lifetime resources of this cohort. We have:

$$\tilde{y}_{Lt} = \int_{A\leq a\leq D} e^{r(D-a)} y_L{}^x(a)\, da = \int_{A\leq a\leq D} e^{r(D-a)} y_{Lt}\, e^{g(a-I)}\, da$$

$$\text{I.e.}\quad \tilde{y}_{Lt} = \lambda(D-A)y_{Lt}\, e^{rH} = \lambda Y_{Lt}\, e^{rH} = \lambda(1-\alpha)Y_t\, e^{rH}$$

$$\text{With:}\quad \lambda = \frac{e^{(r-g)(I-A)} - e^{-(r-g)(D-I)}}{(r-g)(D-A)} \qquad (7.1)$$

We therefore have a simple formula for $\hat{\alpha}_t$ as a function of b_{yt}:

Proposition 5. Define $\hat{\alpha}_t$ the share of inheritance in the total lifetime resources of the cohort inheriting at time t. Then we have: $\hat{\alpha}_t = \dfrac{b_{yt}}{b_{yt} + \lambda(1-\alpha)}$ (7.2)

With: b_{yt} = inheritance flow-national income ratio

1-α = labor share in national income

λ = factor correcting for differences in lifetime profile

The inheritance share $\hat{\alpha}_t$ can be viewed as an indicator of the functional distribution of resources accruing to individuals. During their lifetime, individuals from cohort x receive on average a fraction $\hat{\alpha}_t$ of their resources through inheritance, and a fraction $1-\hat{\alpha}_t$ through their labor income. $\hat{\alpha}_t$ is simply related to the standard cross-sectional capital share α. If λ≈1, which in practice is typically the case,[69] then $\hat{\alpha}_t > \alpha$ iff $b_{yt} > \alpha$. That is, the share of inheritance in

[69] Intuitively, λ corrects for differences between the lifetime profile of labor income flows and the lifetime profile of inheritance flows. If r-g is small and/or if inheritance happens around mid-life, then λ tends to be close to 100%. See Appendix E, Table E5. We also used our simulated model in order to compute the correcting factor λ^x for all cohorts born in France between x=1800 and x=2030. We find that λ^x has been remarkably constant around 90%-110% over two centuries, with no long run trend. See Appendix D, Tables D7-D8 for detailed simulation results.

lifetime resources is larger than the capital share in national income if and only if the inheritance flow is larger than the capital share. In theory, both cases can happen: there can be societies where the capital share is large but the inheritance share is low (say, because most wealth comes from lifecycle accumulation), and conversely there can be societies where the inheritance is large but where the capital share is low (say, because capital serves mostly as storage of value and produces little flow returns).

It is interesting to see that in practice the inheritance share $\hat{\alpha}$ and the capital share α happen to have the same order of magnitude (typically around 20%-30%) – mostly by coincidence, as far as we can see. Proposition 5 is pure accounting, and it holds for any saving model, both in and out of steady-state. If we now apply Proposition 5 to the steady-state models analyzed in section 5, then we just need to replace b_{yt} by the relevant steady-state value. So for instance in the class saving/dynastic model, we have $b_y=\beta/H$, so that:

$$\hat{\alpha} = \frac{b_y}{b_y + \lambda(1-\alpha)} = \frac{\beta}{\beta + \lambda(1-\alpha)H} \qquad (7.3)$$

Example. With benchmark values β=600%, H=30, 1-α=70%, λ=1, we have b_y=20%, and $\hat{\alpha}=b_y/(b_y+1-\alpha)$=22%. That is, in steady-state each cohort derives $\hat{\alpha}$=22% of its lifetime resources through inheritance, and $1-\hat{\alpha}$=78% through labor. To put it differently, inheritance resources represents $\psi=b_y/(1-\alpha)$=29% of their labor resources.

We used our full fledged simulated model (based upon observed demographic data and age profiles of labor income and inheritance receipts) in order to compute the capitalized value of lifetime resources $\tilde{y}^x = \tilde{b}^x + \tilde{y}_L{}^x$ for all French cohorts born between x=1800 and x=2030. We find that the inheritance-labor resources ratio $\psi^x = \tilde{b}^x / \tilde{y}_L{}^x$ was about 30% for 19th century cohorts, then dropped to little more than 10% for cohorts born in the 1900s-1930s, and is projected to be again about 30% for cohorts born in the 1970s-2030s (see Figure 11).[70]

As predicted by the theoretical model (Proposition 5), the historical evolution of the cohort-level inheritance-labor income ratio ψ^x (Figure 11) is the mirror image of the pattern found for the cross-sectional inheritance flow-national income ratio b_{yt} (Figure 9). There are two interesting differences, however. First, the U-shaped pattern is less marked for ψ^x than for b_{yt}. At its lowest point, i.e. in the 1950s, the inheritance flow b_{yt} was less than 5% of national income. In comparison, the lowest point of ψ^x, which was attained for cohorts born in the 1900s-1930s, is somewhat above 10%. This is because all members of a given cohort do not inherit exactly at the same time. E.g. cohorts born in the 1900s-1930s inherited everywhere between the 1940s and 1970s. So when we compute cohort level averages of inheritance resources, we tend to smooth cross-sectional evolutions of the inheritance flow-national income ratio. The cohort level pattern is nevertheless quite spectacular. As compared to earlier and later cohorts, individuals born in the 1900s-1930s (and to a lesser extent those

[70] E.g. we find that cohorts born in the 1970s will on average receive 440,000€ in inheritance and 1.58 millions € in labor resources, so that ψ=28%. See Appendix D, Table D7. We capitalize resources at age 50, but of course this does not affect the ratios, since we use the same age and rates of return for inheritance and labor income.

born in the 1940s-1950s) had to rely a lot on themselves in order to accumulate wealth. Maybe it is not too surprising if they happen to be strong believers in lifecycle theory.

Next, it is striking to see that in our benchmark simulations ψ^x attains approximately the same levels for cohorts born in the 1970s and after as for 19th century cohorts ($\psi^x \approx 30\%$), in spite of the fact that we project b_{yt} to stabilize below 19th century levels (15%-16% instead of 20%-25%). This is due to a differential tax effect. Lifetime resources $\tilde{b}^x$ and $\tilde{y}_L{}^x$ were computed from the simulated model, which uses observed after-tax resources, so ψ^x is effectively an after-tax ratio. The aggregate labor income tax rate τ_L rose from less than 10% in the 19th-early 20th century to about 30% in the late 20th-early 21st century.[71] The aggregate inheritance tax rate has remained relatively small throughout the 19th-20th centuries (about 5%).[72] This mechanically raises the after-tax value of inheritance resources relatively to labor resources. That is, since modern fiscal systems tax labor much more heavily than inherited wealth, the inheritance flow-national income ratio does not need to be as large as during the 19th century in order to generate the same share of inheritance in disposable lifetime resources.

For illustrative purposes, we did the same computations with the growth slowdown-rising wealth returns scenario (g=1.0%, $(1-\tau_K)r=5.0\%$), under which b_{yt} is projected to return to the 19th century levels (see Figure 9). Because of the differential tax effect, we project that ψ^x will be about 35%-40% for cohorts born in the 1970s-1980s, and as large as 50%-60% for cohorts born in the 2010s-2020s. That is, we project that cohorts born in the coming years will receive in inheritance the equivalent of 50%-60% of what they will receive in labor income during their entire lifetime, far above 19th century levels (see Figure 11). This shows that taxes can have a strong impact on the balance between inheritance and labor resources.

7.2. Labor-based vs inheritance-based inequality

Now that we have computed the inheritance share in average lifetime resources, we are in a position to put inequality back into the picture. Changes in the aggregate ratio ψ^x appear matter a great deal for the study of inequality.

We illustrate this point by making simple assumptions about the intra-cohort distributions of labor income and inheritance (see Table 3). The inequality of labor income has been relatively stable in France throughout the 20th century. So we assume constant shares for the bottom 50%, the middle 40%, and the top 10% of the intra-cohort distribution of labor income for all cohorts born in 1820-2020. Wealth concentration has always been much larger than that of labor income. It was particularly high during the 1820-1913 period, when the top 10% (the "upper class") owned over 90% of aggregate wealth, with little left for the middle 40% (the "middle class") and the bottom 50% (the "poor"). Today, the poor still own less than 5% of

[71] See Appendix A, Table A11, col.(11). Here we exclude pension-related payroll taxes from labor income taxes This follows from the fact that we include pension income into labor ressources. Otherwise the aggregate labor tax rate would exceed 50% (see col.(9)), and the inheritance/labor ressources ratio would be even larger.
[72] See Appendix A, Table A9, col.(15). Inheritance taxes were included in capital income flow taxes τ_K, which can be questioned. Given their low level, a direct imputation method would not make a big difference.

aggregate wealth. But the middle class share rose from 5% to 35%, while the upper class share dropped from 90% to 60%. Wealth concentration declined mostly during the 1914-1945 period, and seems to have stabilized since the 1950s-1960s (as a first approximation).[73]

By applying these assumptions to the lifetime inheritance-labor income resources ratio ψ^x plotted on Figure 11, we obtain the inequality indicators plotted on Figures 12-15. Consider first the ratio between the lifetime resources available for the top 50% successors and those available for the bottom 50% labor earners. In the 19th century, the top 50% successors received in inheritance about 100% of what the bottom 50% labor earners received in labor income throughout their lifetime. Then this ratio dropped to 30%-40% for cohorts born in the 1900s-1930s. According to our computations, this ratio has now well recovered, and is about 90% for cohorts born in the 1970s-1980s (see Figure 12).

Take again the example of the cohorts born in the 1970s. On average they will receive 450,000€ in inheritance. But the bottom half will receive almost no inheritance (40,000€), while the upper half will receive almost twice this amount (840,000€). This is roughly what the bottom 50% labor earners will receive in labor income during their entire lifetime (950,000€).[74] So we get the ratio of 88% plotted for the 1970s on Figure 12.

Consider now the ratios between what top 10% and top 1% successors receive in inheritance and what bottom 50% workers receive in labor income (see Figures 13-14). Due to the decline in wealth concentration, these inequality indicators are still lower for current generations than what they used to be in the 19th century. But they are much higher than what they used for cohorts born in 1900-1940, in spite of the fact that intra cohort distributions have remained the same. This illustrates the importance of changes in the aggregate ratio ψ^x.

For cohorts born between the 1900s and the 1950s, it was almost impossible to become rich through inheritance. Even if you belong to the top 10% or top 1% successors, or if you marry with such a person, the corresponding lifetime resources would be a lot smaller than those you can attain by making your way to the top 10% or top 1% of the labor income hierarchy of your time. This is what most people would describe as a "meritocratic society". Material well-being required high labor income. For the first time maybe in history, it was difficult to live as well by simply receiving inheritance.

In the 19th century, the world looked very different. Top 10% inheritance resources were roughly equivalent to top 10% labor resources. Top 1% inheritance resources were almost three times as large as top 1% labor resources. I.e. top rentiers vastly dominated top labor earners. If you want to attain high living standards in the 19th century, then inheriting from

[73] For a detailed analysis of historical changes in wealth concentration in France, see Piketty et al (2006). For simplicity, we apply 1910 inherited wealth shares by fractiles to all cohorts born in 1820-1870, we apply 2010 shares to all cohorts born in 1920-2020, and we assume linear trends for cohorts born between 1870 and 1920.
[74] On average, the bottom 50% labor earners earn little more than the minimum wage: their lifetime labor income roughly corresponds to the product of about 15,000€ by adult life length (about 60 years). For the sake of concreteness they can be thought of as minimum wage workers.

your parents or your spouse's family is a much better strategy than work. This looks very much like a "rentier society".

Life opportunities open to today's generations are intermediate between the meritocratic society of the 1900-1950 cohorts and the rentier society of the 19th century. For cohorts born in the 1970s, we find that the lifetime resources attained by the 1% successors and top 1% labor earners will be roughly equivalent. I.e. finding a top 1% job or a top 1% spouse will get you to the same living standards: you obtain about 10 millions € in both cases.[75] In the 19th century, the spouse strategy was three times more profitable. For early 20th century cohorts, the job strategy was twice more profitable.

The decline in wealth concentration makes it less likely to inherit sufficiently large amounts to sustain high living standards with zero labor income. But it makes it more likely – for a given aggregate inheritance-labor ratio ψ^x – to receive amounts which are not enough to be a rentier, but which still make a big difference in life, at least as compared to what most people earn. Using standard Pareto assumptions on the shape of the intra cohort distribution of inherited wealth, we find that the cohort fraction inheriting more than bottom 50% lifetime labor income was less than 10% in the 19th century, and will be as large as 12%-14% for cohorts born in the 1970s-2000s. Among cohorts born in the 1900s-1930s, this almost never happened: only 2%-3% of each cohort inherited that much (see Figure 15).

We did the same computations under the low-growth, high-return scenario (see Figures 12-15). Unsurprisingly, given that we project the aggregate inheritance-labor ratio ψ^x to rise well above 19th century values, we also find that our lifetime inequality indicators reach unheard of levels. At the top 1% level, the spouse strategy again becomes almost three times more profitable: the aggregate effect entirely compensates the distribution effect.

These computations should be viewed as illustrative and exploratory. They ought to be improved in many ways. First, progressive taxation of inheritance and labor income can obviously have a strong impact on such inequality indicators, both in the short run (mechanical effect) and in the long run (endogenous distribution effect). Here we ignored progressive taxes and behavioral responses altogether. I.e. in our aggregate computations we simply assumed that inheritance and labor income taxes were purely proportional, and we did not consider any effect of taxes other than the aggregate effect on inheritance flows.

Next, we made no assumption about the individual-level rank correlation between inheritance and labor income. Our inequality indicators hold for any joint distribution $G(\tilde{b}_i^{\,x}, \tilde{y}_{Li}^{\,x})$. In practice, this correlation might be endogenous. With publicly financed education and the lessening of credit constraints, one might expect it to decline over time. But this could be counterbalanced by the fact that top heirs now need to work in order to reach the same relative living standards as in the past. So the correlation might have increased. It could also

[75] See Piketty (2010, Table 4) for detailed results.

be that the moral value attached to work has risen somewhat, so that top successors work more than they used to. We do not know of any evidence on this issue.

Finally, we looked at a country with a relatively stable distribution of labor income. If we were to make the same computations for the U.S., where the top 1% labor income share rose a lot since the 1970s, we would find different results. The rise of the working rich reduces the inequality between top successors and top labor earners. But it increases the inequality between the working poor and successors as a whole. It also has dynamic effects on the future intra-cohort distributions of inherited wealth.

8. Concluding comments

What have we learned from this paper? In our view, the main contribution of this paper is to demonstrate empirically and theoretically that there is nothing inherent in the structure of modern economic growth that should lead a long run decline of inherited (non-human) wealth relatively to labor income.

The fact that the "rise of human capital" is to a large extent an illusion should not come as a surprise to macroeconomists. With stable capital shares and wealth-income ratios, the simple arithmetic of growth and wealth accumulation is likely to operate pretty much in the same way in the future as it did in the past. In particular, the $r>g$ logic implies that past wealth and inheritance are bound to play a key role in the future.

As we have shown, there is no reason to expect demographic changes per se to lead to a decline in the relative importance of inheritance. Rising life expectancy implies that heirs inherit later in life. But this is compensated by the rise of inter vivos gifts, and by the fact that wealth also tends to get older in aging societies – so that heirs inherit bigger amounts.

Now, does this mean that the rise of human capital did not happen at all? No. It did happen, in the sense that human capital is what made long run productivity growth and self sustained economic growth possible. We know from the works of Solow and the modern endogenous growth literature that (non-human) capital accumulation alone cannot deliver self-sustained growth. I.e. human capital is what made $g>0$. The point, however, is that a world with g positive but small (say, $g=1\%$-2%) is not very different from a world with $g=0\%$.

If the world rates of productivity and demographic growth are small in the very long run (say, by 2050-2100), then the $r>g$ logic implies that inheritance will eventually matter a lot pretty much everywhere – as it did in ancient societies. Past wealth will tend to dominate new wealth, and successors will tend to dominate labor earners. This is less apocalyptic than Karl Marx: with $g=0\%$, the wealth-income ratio rises indefinitely, leading either to a rising capital share, or to a fall in the rate of return, and in any case to non sustainable political or economic outcomes. With $g>0$, at least we have a steady-state. But this is a rather gloom steady-state.

The main limitation of this paper is that we did not attempt to analyze socially optimal tax policy. We have seen in our simulations that capital taxes, by reducing the differential between $(1-\tau_K)r$ and g, can and did have a significant impact on the steady-state magnitude of inheritance flows, i.e. on the extent to which wealth perpetuates itself over time and across generations. In order to properly address these issues, one would need however to explicitly introduce inequality and normative concerns into the model, which we did not do in this paper, and which we plan to do in future research. We hope that our results will be useful for other scholars interested in capital and inheritance taxation.

The other important – and closely related – limitation of this paper is that we constantly assumed a common rate of return r on private wealth for all individuals. In the real world, the average r is larger than g, but the effective r varies enormously across individuals, over time and over assets. Available data and anecdotal evidence suggest that higher wealth individuals tend to get higher average returns (e.g. because of fixed costs in portfolio management, or risk aversion effects, or both).[76] By assuming a common rate of return, we almost certainly underestimate the inheritance share and overestimate the labor share in capitalized lifetime resources – possibly by large amounts.

In some cases, inherited wealth might also require human skills and effort in order to deliver high returns. That is, it sometimes takes labor input to get high capital income. If anything, the empirical relevance of the theoretical distinction between labor and capital income has probably increased over the development process, following the rise of financial intermediation and the separation of ownership and control. I.e. with perfect capital markets, any dull successor should be able to get a high return. But the hererogeneity and potential endogeneity of asset returns are important issues which should be taken into account in a unified positive and normative analysis of inheritance. This raises major conceptual and empirical challenges for future research.

[76] See e.g. Calvet, Campbell and Sodini (2009).

References

A. Ando & F. Modigliani, “The Life-Cycle Hypothesis of Saving: Aggregate Implications and Tests”, *American Economic Review*, 1963, n°63

A. Atkinson, *Unequal Shares – Wealth in Britain*, London: Allen Lane, 1972, 322p.

A. Atkinson & A.J. Harrison, *Distribution of Personal Wealth in Britain, 1923-1972*, Cambridge University Press, 1978, 330p.

A. Atkinson, *The Economics of Inequality*, Clarendon Press, 1983, 330p.

A. Atkinson, “Top Incomes in the UK over the Twentieth Century”, *Journal of the Royal Statistical Society*, 2005, n°168(2), pp.325-343

A. Atkinson & T. Piketty (eds.), *Top Incomes Over the Twentieth Century*, vol.1, Oxford University Press, 2007, 585p.

A. Atkinson & T. Piketty (eds.), *Top Incomes – A Global Perspective*, vol.2, Oxford University Press, 2010, 776p.

A. Atkinson, T. Piketty & E. Saez, “Top Incomes in the Long-Run of History”, *Journal of Economic Literature*, 2010, forthcoming

O. Attanasio & H. Hoynes, "Differential Mortality and Wealth Accumulation", *Journal of Human Resources*, 2000, n°35, pp.1-29

R.J. Barro, “Rare Disasters, Asset Prices and Welfare Costs”, *American Economic Review*, 2009, n°99, pp.243-264

J. Benhabib & A. Bisin, “The Distribution of Wealth and Fiscal Policy in Economies with Finitely Lived Agents”, mimeo, NYU, 2009

J. Benhabib & S. Zhu, “Age, Luck and Inheritance”, mimeo, NYU, 2009

G. Bertola, R. Foellmi & J. Zweimuller, *Income Distribution in Macroeconomic Models*, Cambridge University Press, 2006, 417p.

A. Blinder, « Comments on Modigliani and Kotlikoff-Summers », in *Modelling the Accumulation and Distribution of Wealth*, D. Kessler & A. Masson eds., pp.68-76, Oxford University Press, 1988

F. Bourguignon & L. Lévy-Leboyer, *L’économie française au 19ème siècle – Analyse macroéconomique*, Economica, 1985, 362p.

R. Brumberg & F. Modigliani, « Utility Analysis and the Consumption Function : An Interpretation of Cross-Section Data », in *Post Keynesian Economics*, K. Kurihara ed., Rutgers University Press, 1954

A. Bowley, *The Change in the Distribution of National Income, 1880-1913*, Clarendon Press, 1920, 36p.

M. Cagetti & M. De Nardi, “Wealth inequality: data and models”, *Macroeconomic Dynamics*, 2008, vol. 12 (sup. S2), pp. 285-313

L. Calvet, J. Campbell & P. Sodini, “Fight Or Flight? Portfolio Rebalancing by Individual Investors”, *Quarterly Journal of Economics*, 2009, n°124, pp.301–348.

C.D. Carroll, « Why Do the Rich Save So Much? », in J. Slemrod ed., *Does Atlas Shrug? The Economic Consequences of Taxing the Rich*, Harvard Universty Press, 2000

A. Castaneda, J. Dias-Gimenes & V. Rios-Rull, “Accounting for the U.S. Earnings and Wealth Inequality”, *Journal of Political Economy*, 2003, 111(4), 818-857

C. Colson, *Cours d’économie politique*, Paris : Gauthier-Villars, 1903, 1918, 1927 (several editions), 774p.

E.S. Danysz, « Contribution à l’étude des fortunes privées d’après les déclarations de successions », *Bulletin de la Statistique Générale de France*, 1934, pp.5-171

J. B. DeLong, "Bequests: An Historical Perspective," in A. Munnell, ed., *The Role and Impact of Gifts and Estates*, Brookings Institution, 2003

M. DeNardi, « Wealth Inequality and Intergenerational Links », *Review of Economic Studies*, 2004, 71(), 743-768

F. Divisia, J. Dupin and R. Roy, *A la recherche du franc perdu* (volume 3 : *Fortune de la France*), Paris : Serp, 1956, 122p.

L. Dugé de Bernonville, « Les revenus privés », *Revue d’Economie Politique*, 1933-1939 (yearly publication ; see Piketty, 2001, p.781 for full references)

K. Dynan, J. Skinner & S. Zeldes, “The Importance of Bequests and Lifecycle Savings in Capital Accumulation: A New Answer”, *American Economic Review*, 2002, n°92(2), 274-278

K. Dynan, J. Skinner & S. Zeldes, “Do the Rich Save More?”, *Journal of Political Economy*, 2004, n°112(2), pp.397-444

L. Edlund & W. Kopczuk, "Women, Wealth and Mobility", *American Economic Review*, 2009, n°99(1), pp.146-78

D. Fiaschi & M. Marsili, “Distribution of Wealth and Incomplete Markets: Theory and Empirical Evidence”, mimeo, Pisa, 2009

A. Fouquet, « Les comptes de patrimoines : quelques aspects méthodologiques », in *Accumulation et répartition des patrimoines*, D. Kessler, A. Masson & D. Strauss-Kahn eds., pp.97-116, Economica, 1982

A. Foville, « The Wealth of France and of Other Countries », *Journal of the Royal Statistical Society*, 1893, n°56(4), pp. 597-626

W. Gale & J. Scholtz, “Intergenerational Transfers and the Accumulation of Wealth”, *Journal of Economic Perspectives*, 1994, n°8(4), pp.145-160

O. Galor & O. Moav, “Das Human Kapital: A Theory of the Demise of the Class Structure”, *Review of Economic Studies*, 2006, n°73, pp.85-117

R. Giffen, “Recent Accumulations of Capital in the United Kingdom”, *Journal of the Royal Statistical Society*, 1878, n°41(1), pp. 1-39

J. Gokhale, L. Kotlikoff, J. Sefton & M. Weale, “Simulating the Transmission of Wealth Inequality via Bequests”, *Journal of Public Economics*, 2001, n°79, pp.93-128

A.B. Kennickell, “Ponds and Streams: Wealth and Income in the U.S., 1989-2007”, Federal Reserve Board, Discussion Paper 2009-13, 87p.

D. Kessler & A. Masson, “Bequest and Wealth Accumulation: Are Some Pieces of the Puzzle Missing?”, *Journal of Economic Perspectives*, 1989, 3(3), pp.141-152

W. Kopczuk, "Bequest and Tax Planning: Evidence from Estate Tax Returns", *Quarterly Journal of Economics*, 2007, n°122(4), pp.1801-1854

W. Kopczuk & J. Lupton, "To Leave or Not to Leave: The Distribution of Bequest Motives", *Review of Economic Studies*, 2007, n°74(1), pp.207-235.

W. Kopczuk & E. Saez, “Top Wealth Shares in the United States, 1916-2000: Evidence from Estate Tax Returns", *National Tax Journal*, 2004, n°57(2), pp.445-487

L. Kotlikoff, “Intergenerational Transfers and Savings”, *Journal of Economic Perspectives*, 1988, n°2(2), pp.41-58

L. Kotlikoff & L. Summers, “The Role of Intergenerational Transfers in Aggregate Capital Accumulation”, *Journal of Political Economy*, 1981, n°89, pp.706-732

S. Kuznets, *Shares of Upper Income Groups in Income and Savings, 1913-1948*, National Bureau of Economic Research, 1953, 707p.

R.J. Lampman, *The share of top wealth-holders in national wealth 1922-1956*, Princeton University Press, 1962

E. Levasseur, *Questions ouvrières et industrielles en France sous la Troisième République*, Paris : Arthur Rousseau, 1907, 968p.

B. Mallet, « A Method of Estimating Capital Wealth from the Estate Duty Statistics », *Journal of the Royal Statistical Society*, 1908, n°71(1), pp.65-101

B. Mallet & H.C. Strutt, “The Multiplier and Capital Wealth”, *Journal of the Royal Statistical Society*, 1915, n°78(4), pp.555-599

F. Modigliani, “Life Cycle, Individual Thrift and the Wealth of Nations”, *American Economic Review*, 1986, n°76(3), pp.297-313

F. Modigliani, « The Role of Intergenerational Transfers and Lifecyle Savings in the Accumulation of Wealth », *Journal of Economic Perspectives*, 1988, n°2(2), pp.15-40

M. Nirei & W. Souma, “A Two Factor Model of Income Distribution Dynamics”, *Review of Income and Wealth*, 2007, n°53(3), pp.440-459

T. Piketty, *Les hauts revenus en France au 20ème siècle – Inégalités et redistributions, 1901-1998*, Paris : Grasset, 2001, 807p.

T. Piketty, « Income Inequality in France, 1901-1998 », *Journal of Political Economy*, 2003, n°111(5), pp.1004-1042

T. Piketty & E. Saez, “Income Inequality in the United States, 1913-1998”, *Quarterly Journal of Economics*, 2003, n°118(1), pp.1-39

T. Piketty, G. Postel-Vinay & J.L. Rosenthal, “Wealth Concentration in a Developing Economy: Paris and France,1807-1994”, *American Economic Review*, 2006, 96(1), 236-256

T. Piketty, “On the Long Run Evolution of Inheritance – France 1820-2050”, Working Paper, PSE, 2010, 126p.

J. Roine and D. Waldenstrom, “Wealth Concentration over the Path of Development: Sweden, 1873-2006”, *Scandinavian Journal of Economics*, 2009, n°111, pp.151-187

J. Séaillès, *La répartition des fortunes en France*, Editions Felix Alcan, 1910, 143p.

A.F. Shorrocks, « The Age-Wealth Relationship : A Cross-Sectional and Cohort Analysis », *Review of Economics and Statistics*, 1975, n°57(2), pp.155-163

S. Solomou & M. Weale, « Personal Sector Wealth in the United Kingdom, 1922-1956 », *Review of Income and Wealth*, 1997, n°43(3), pp.297-318

J.C. Stamp, “The Wealth and Income of the Chief Powers”, *Journal of the Royal Statistical Society*, 1919, n°82(4), pp.441-507

H.C. Strutt, “Notes on the Distribution of Estates in France and the United Kingdom”, *Journal of the Royal Statistical Society*, 1910, n°73(6), pp.634-644

J.C. Toutain, « Le produit intérieur brut de la France de 1789 à 1990 », *Economie et Sociétés* (Cahiers de l'ISMEA, série « Histoire économique quantitative »), 1997, n°1, pp.5-187

P. Villa, « Un siècle de données macroéconomiques », *INSEE-Résultats*, 1994, n°303-304 (série Economie générale n°86-87), 266p.

E. Wolff, « Trends in Aggregate Household Wealth in the U.S. 1900-1983 », *Review of Income and Wealth*, 1989, n°34(3), pp.1-29

E. Wolff & A. Zacharias, « Household Wealth and the Measurement of Economic Well-Being in the U.S. », *Journal of Economic Inequality*, 2009, n°7, pp.83-115

J. Zhu, “Wealth Distribution under Idiosyncratic Investment Risk”, mimeo, NYU, 2010

G. Zucman, « Les hauts patrimoines fuient-ils l'ISF ? Une estimation sur la période 1995-2006 », Master thesis, PSE, 2008

Figure 1: Annual inheritance flow as a fraction of national income, France 1820-2008

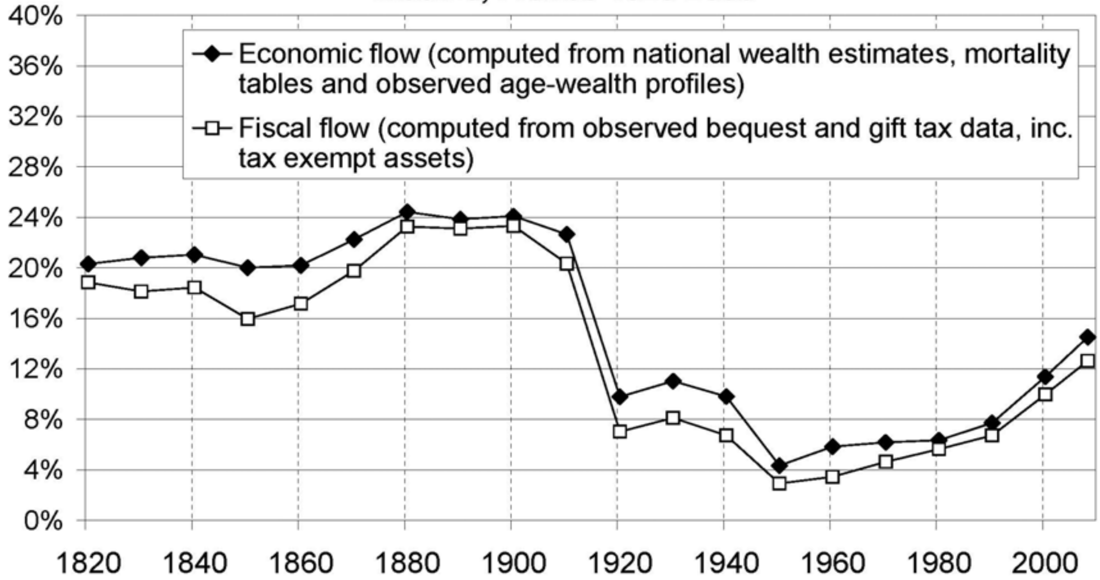

Table 1: Accumulation of private wealth in France, 1820-2009

	Real growth rate of national income	Real growth rate of private wealth	Savings-induced wealth growth rate	Capital-gains-induced wealth growth rate	*Memo: Consumer price inflation*
	g	g_w	$g_{ws} = s/\beta$	q	*p*
1820-2009	1.8%	1.8%	2.1%	-0.3%	*4.4%*
1820-1913	1.0%	1.3%	1.4%	-0.1%	*0.5%*
1913-2009	2.6%	2.4%	2.9%	-0.4%	*8.3%*
1913-1949	1.3%	-1.7%	0.9%	-2.6%	*13.9%*
1949-1979	5.2%	6.2%	5.4%	0.8%	*6.4%*
1979-2009	1.7%	3.8%	2.8%	1.0%	*3.6%*

Figure 2: Wealth-income ratio in France 1820-2008

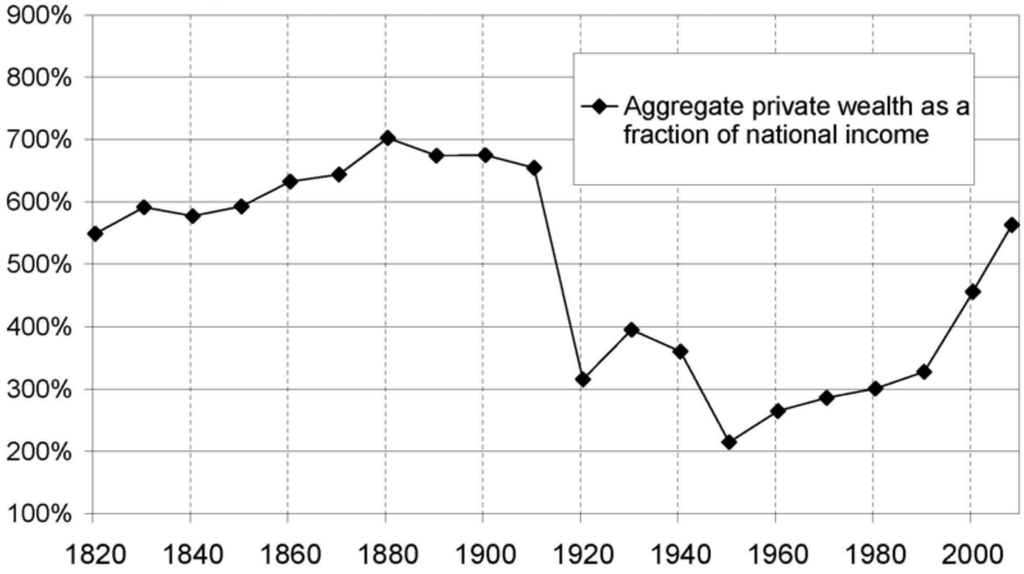

Figure 3: Mortality rate in France, 1820-2100

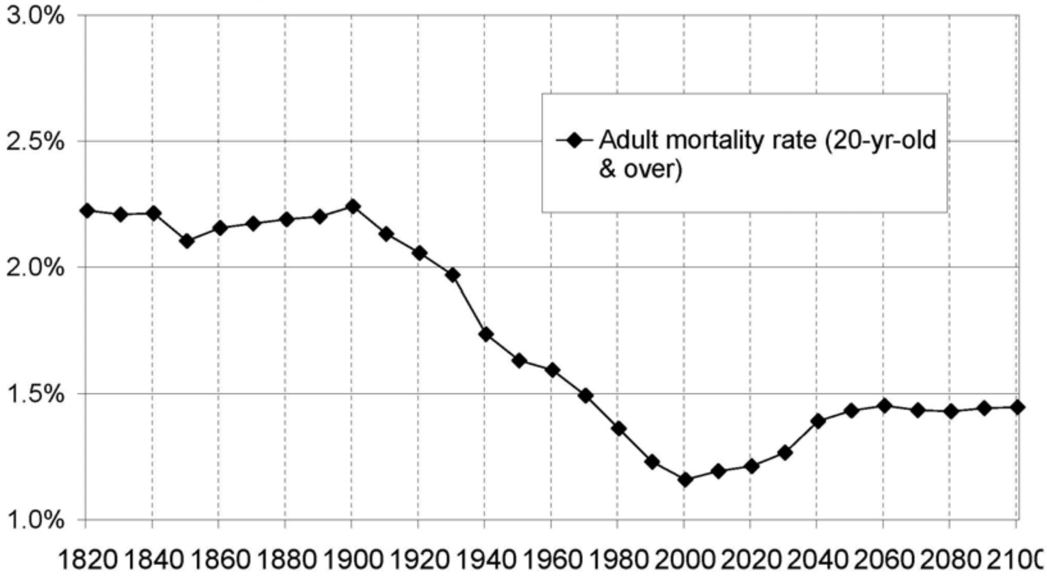

Figure 4: The ratio between average wealth of decedents and average wealth of the living France 1820-2008

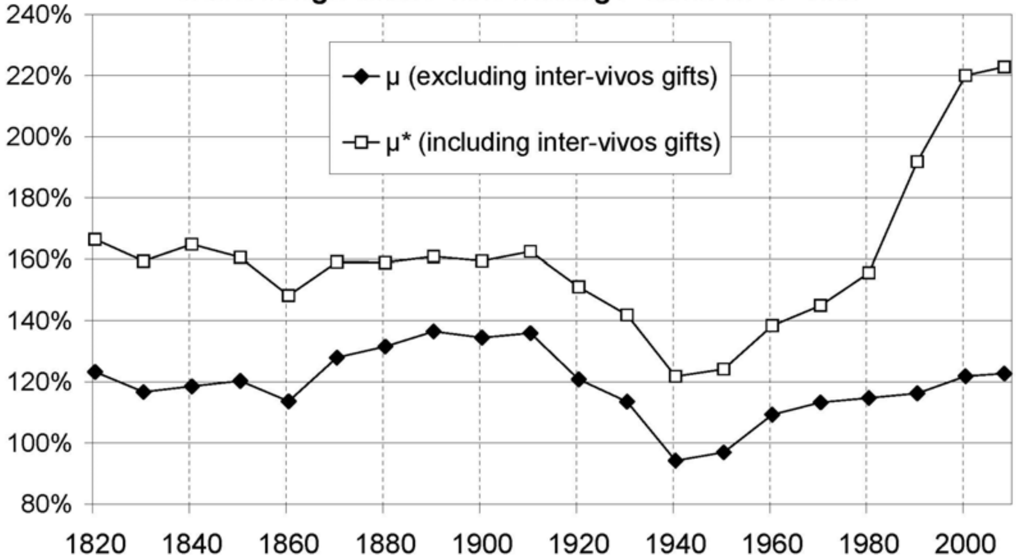

Figure 5: Inheritance flow vs mortality rate in France, 1820-2008

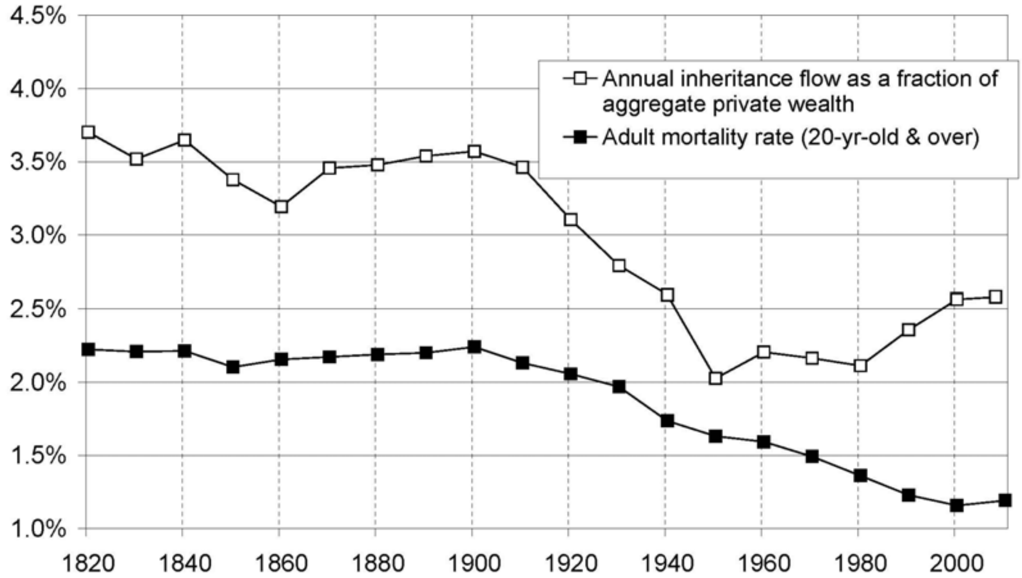

Figure 6: Steady-state cross-sectional age-wealth profile in the class saving/dynastic model (s_L=0, s_K>0)

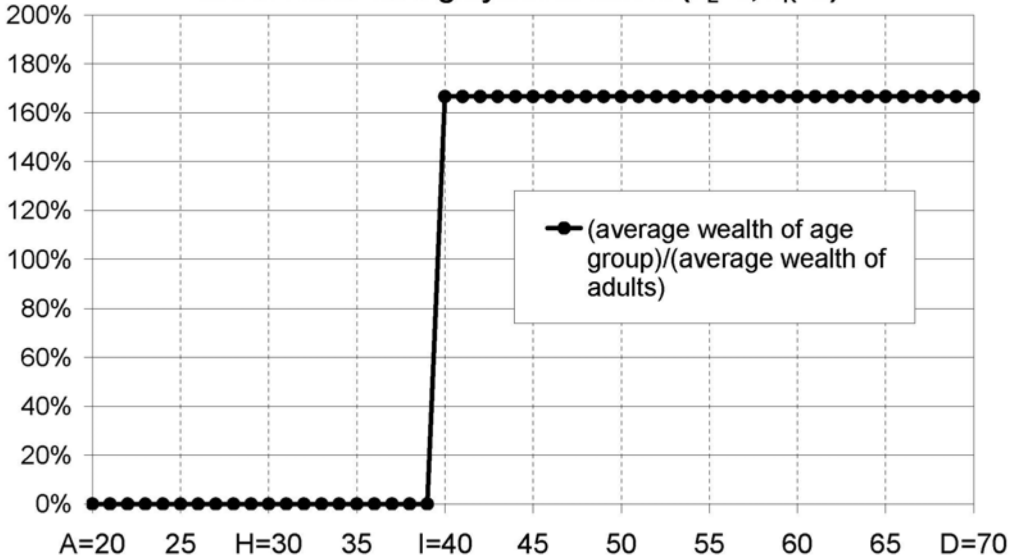

Figure 7: Steady-state cross-sectional age-wealth profile in the class saving model with demographic noise

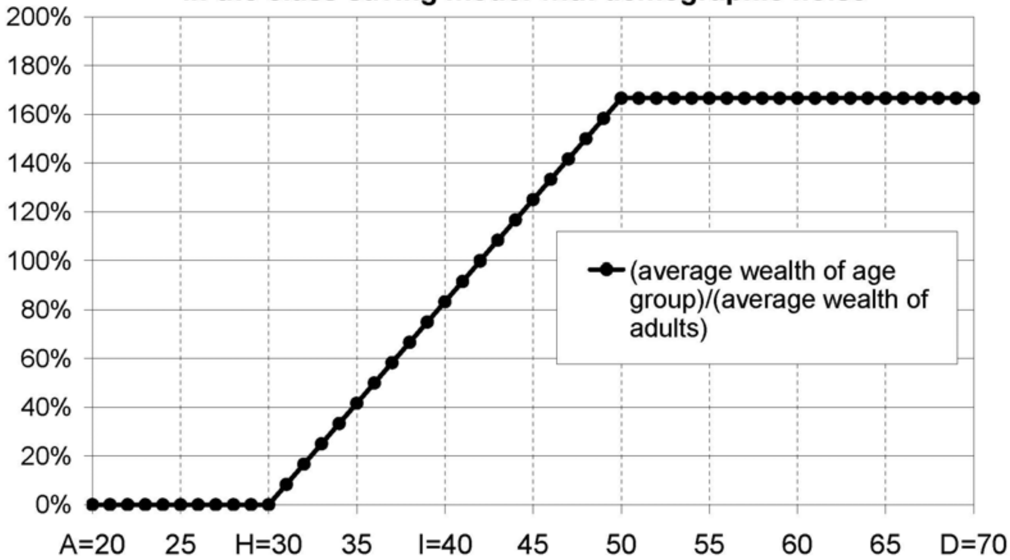

Figure 8: Private savings rate in France 1820-2008

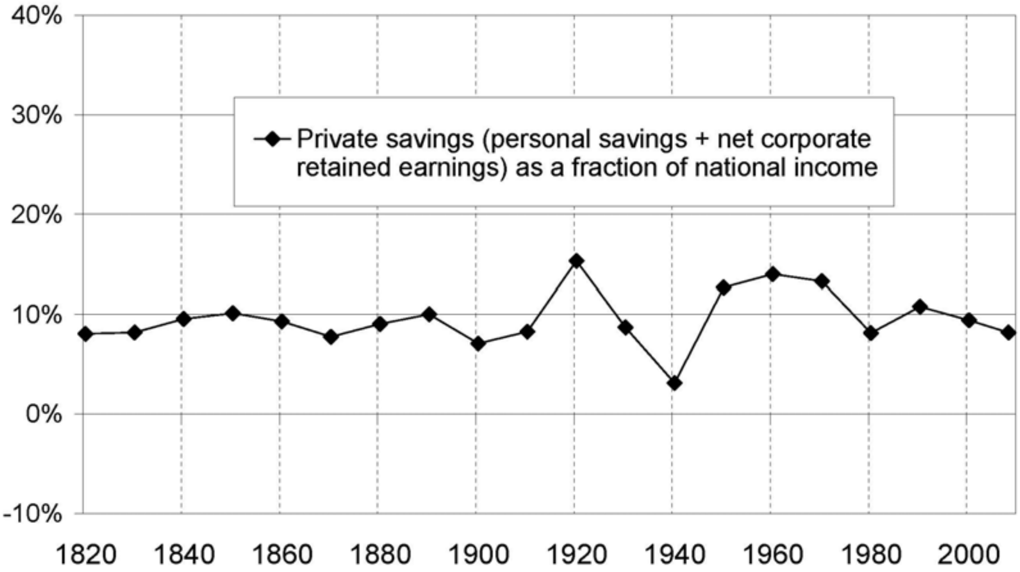

Figure 9: Observed vs simulated inheritance flow B/Y, France 1820-2100

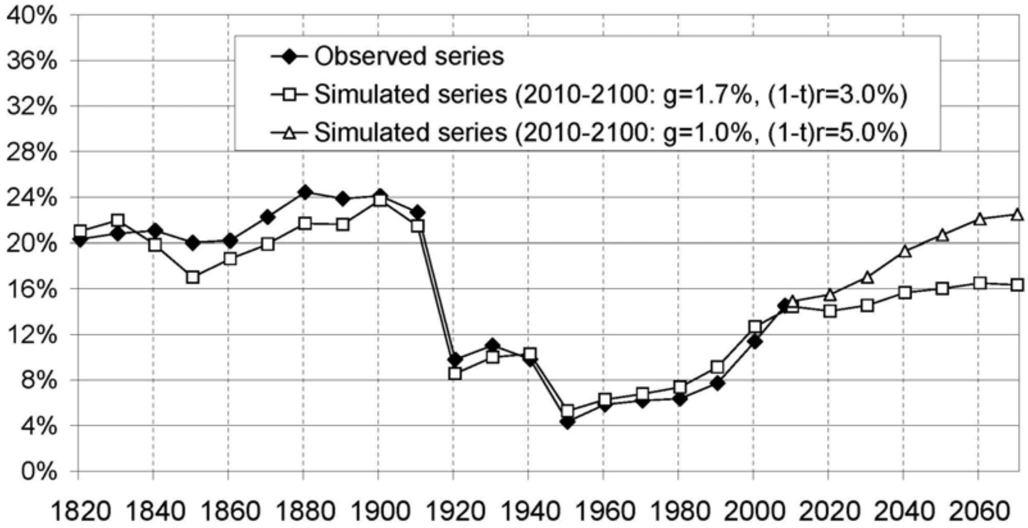

Figure 10: Labor & capital shares in national income, France 1820-2008

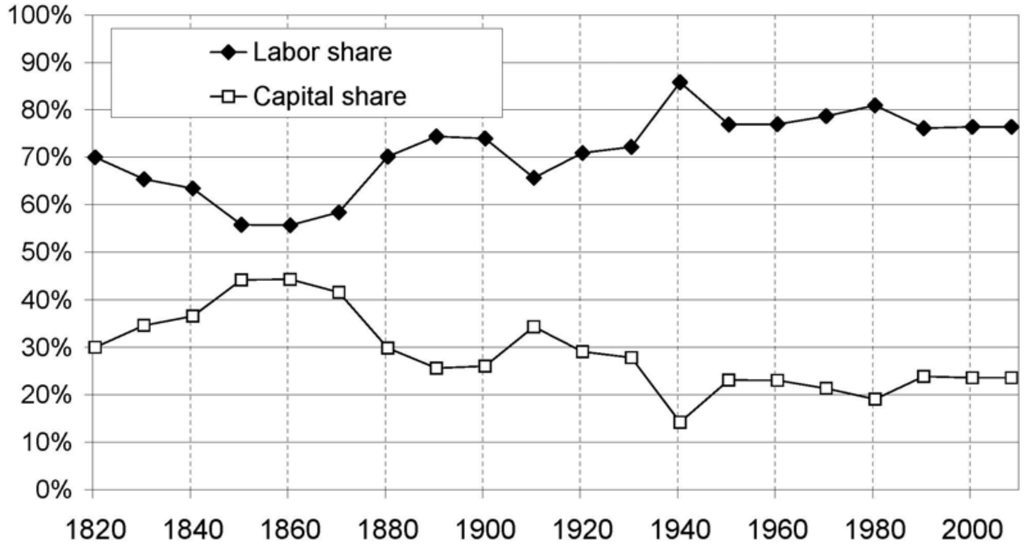

Table 2: Rates of return vs growth rates in France, 1820-2009

	Growth rate of national income g	Rate of return on private wealth $r = \alpha/\beta$	Capital tax rate τ_K	After-tax rate of return $r_d = (1-\tau_K)\alpha/\beta$	Real rate of capital gains q	Rate of capital destruct. (wars) d	After-tax real rate of return (incl. k gains & losses) $r_d = (1-\tau_K)\alpha/\beta + q + d$
1820-2009	**1.8%**	**6.8%**	19%	**5.4%**	-0.1%	-0.3%	**5.0%**
1820-1913	**1.0%**	**5.9%**	8%	**5.4%**	-0.1%	0.0%	**5.3%**
1913-2009	**2.6%**	**7.8%**	31%	**5.4%**	-0.1%	-0.7%	**4.6%**
1913-1949	**1.3%**	**7.9%**	21%	**6.4%**	-2.6%	-2.0%	**1.8%**
1949-1979	**5.2%**	**9.0%**	34%	**6.0%**	0.8%	0.0%	**6.8%**
1979-2009	**1.7%**	**6.9%**	39%	**4.3%**	1.0%	0.0%	**5.3%**

Figure 11: The share of inheritance in lifetime ressources received by cohorts born in 1820-2020

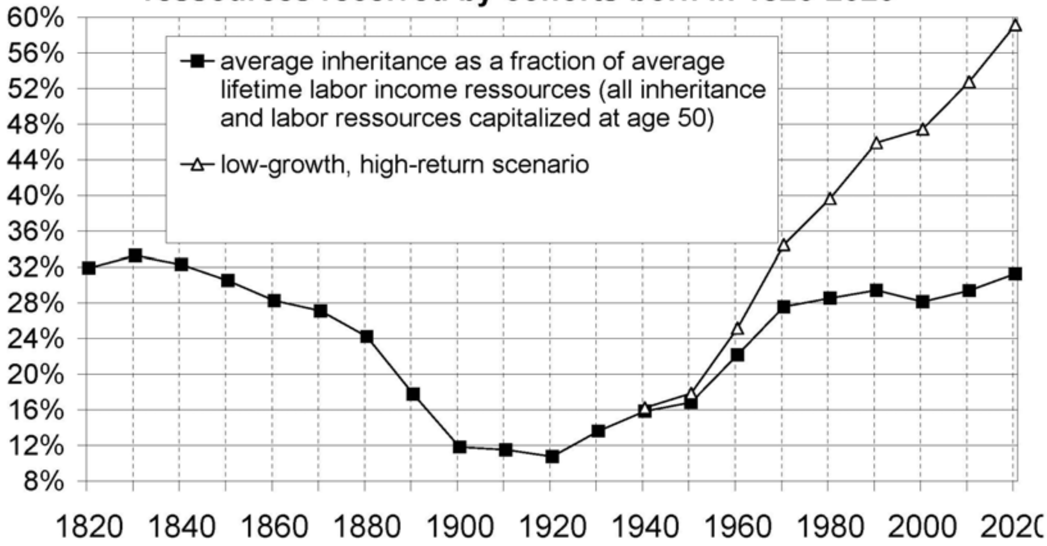

Table 3: Intra-cohort distributions of labor income and inheritance, France, 1910 vs 2010

Shares in aggregate labor income or inherited wealth	**Labor income 1910-2010**	**Inherited wealth 1910**	**Inherited wealth 2010**
Top 10% "Upper Class"	**30%**	**90%**	**60%**
incl. Top 1% "Very Rich"	*6%*	*50%*	*25%*
incl. Other 9% "Rich"	*24%*	*40%*	*35%*
Middle 40% "Middle Class"	**40%**	**5%**	**35%**
Bottom 50% "Poor"	**30%**	**5%**	**5%**

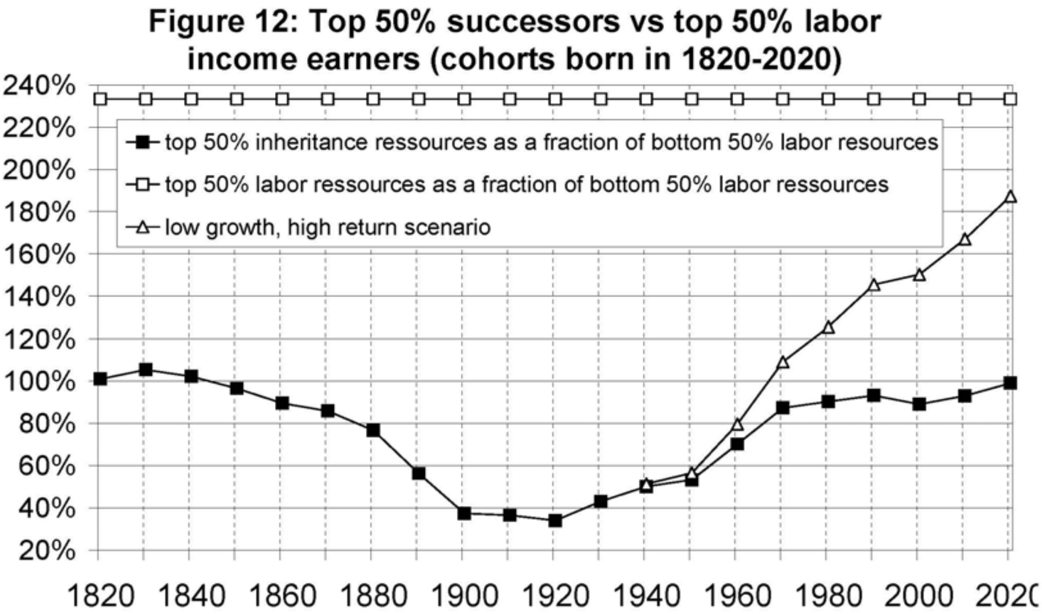
Figure 12: Top 50% successors vs top 50% labor income earners (cohorts born in 1820-2020)
top 50% inheritance ressources as a fraction of bottom 50% labor resources
top 50% labor ressources as a fraction of bottom 50% labor ressources
low growth, high return scenario
240%
220%
200%
180%
160%
140%
120%
100%
80%
60%
40%
20%
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
2020

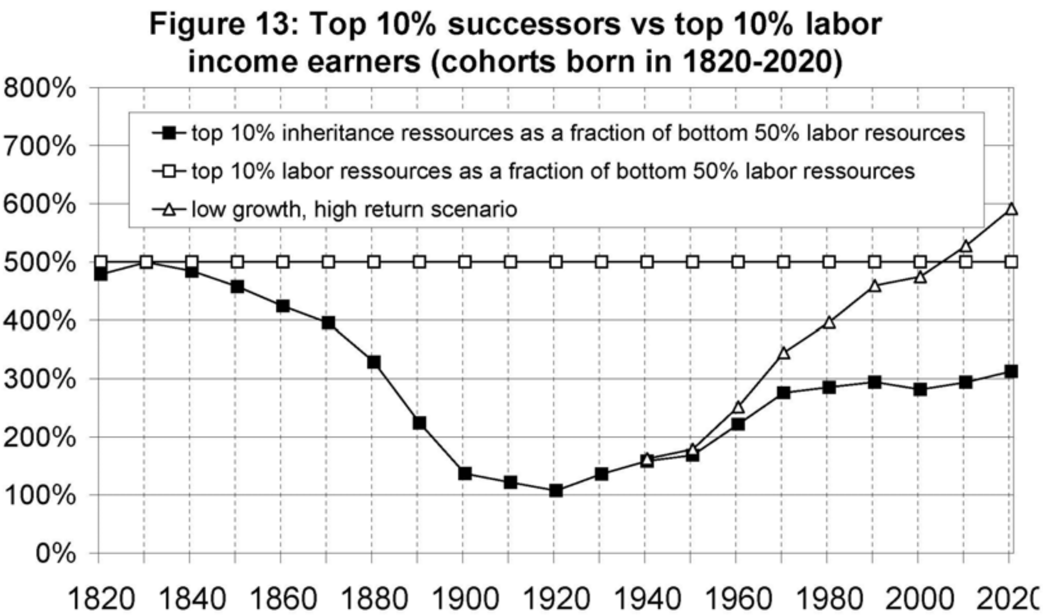
Figure 13: Top 10% successors vs top 10% labor income earners (cohorts born in 1820-2020)
top 10% inheritance ressources as a fraction of bottom 50% labor resources
top 10% labor ressources as a fraction of bottom 50% labor ressources
low growth, high return scenario
800%
700%
600%
500%
400%
300%
200%
100%
0%
1820
1840
1860
1880
1900
1920
1940
1960
1980
2000
2020

Figure 14: Top 1% successors vs top 1% labor income earners (cohorts born in 1820-2020)

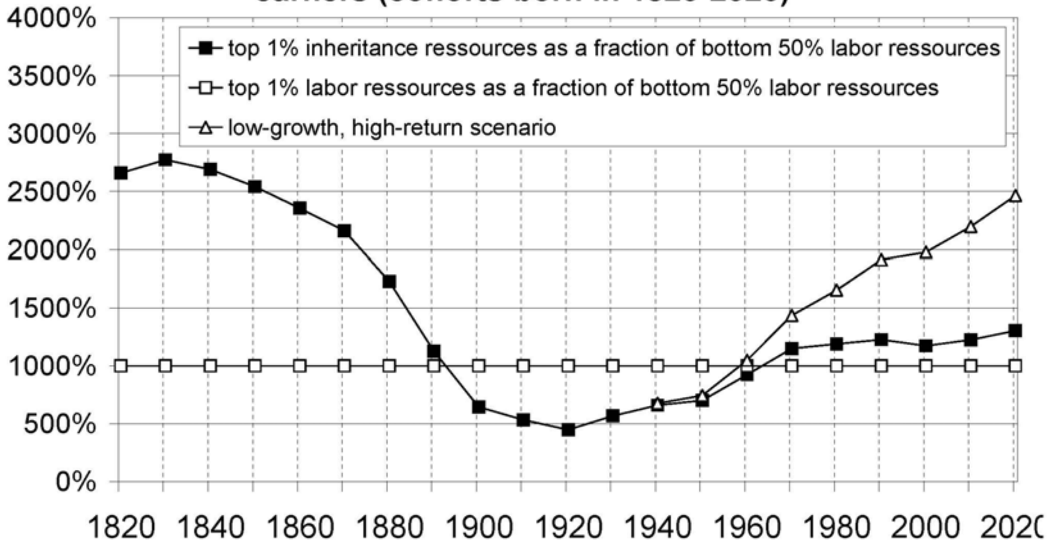

Figure 15: Cohort fraction inheriting more than bottom 50% lifetime labor resources (cohorts born in 1820-2020)