Discussion on inheritance: France vs UK vs Sweden 1820-2010

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Computing inheritance flow

\[ \frac{B_t}{Y_t} = \mu^*_t \ m_t \ \frac{W_t}{Y_t} \]

- \( \frac{W_t}{Y_t} \) = aggregate wealth/income ratio
- \( m_t \) = aggregate mortality rate
- \( \mu_t \) = ratio between average wealth of decedents and average wealth of the living (= age-wealth profile)
- \( \mu^*_t = (1+v_t)\mu_t, \) with \( v_t \) = gifts-bequest ratio
Main Point

- Before computing $B_t/Y_t$, we need to compute $W_t/Y_t$

- $\beta_t = W_t/Y_t = \text{aggregate wealth/income ratio}$

- In steady-state, Harrod-Domar-Solow formula: $\beta^* = s/g$
  
  $(s = \text{saving rate}, g = \text{growth rate})$

  (i.e. $s=10\%, g=2\%$ implies $\beta^* = 500\%$)
Wealth-income ratio in France 1820-2010

Aggregate private wealth as a fraction of national income
Wealth-income ratio: France vs UK 1820-2010

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

- Economic flow (computed from national wealth estimates, mortality tables and observed age-wealth profiles)
- Fiscal flow (computed from observed bequest and gift tax data, inc. tax exempt assets)
• There are two ways to become rich: either through one’s own work, or through inheritance

• In the 19th century and early 20th, it was obvious to everybody that the 2nd channel was important: inheritance and successors are everywhere in the literature; huge inheritance flow in tax data
• **Q**: Does this belong to the past? Did modern growth kill the inheritance channel? E.g. rise of human capital and meritocracy?

• This paper answers « **NO** » to this question and attempts to explains why, taking France 1820-2050 as an illustration
Figure 1: Annual inheritance flow as a fraction of national income, France 1820-2008

- Economic flow (computed from national wealth estimates, mortality tables and observed age-wealth profiles)
- Fiscal flow (computed from observed bequest and gift tax data, inc. tax exempt assets)
Figure 2: Annual inheritance flow as a fraction of disposable income, France 1820-2008

- Economic flow (computed from national wealth estimates, mortality tables and observed age-wealth profiles)
- Fiscal flow (computed from observed bequest and gift tax data, incl. tax exempt assets)
What this paper does

• Documents & explains this fact; draws lessons for other countries

• Main lesson: with \( r > g \) (say, \( r = 4\%-5\% \) vs \( g = 1\%-2\% \)), then wealth coming from the past is being capitalized faster than growth, & inherited wealth dominates self-made wealth

• Dynastic model: heirs save a fraction \( g/r \) of the return to inherited wealth, so that wealth-income ratio \( \beta = W/Y \) is stationary. Then steady-state bequest flow \( b_y = B/Y = \beta/H \), with \( H \) = generation length. If \( \beta = 600\% , H = 30 \) \( \rightarrow b_y = 20\% \)

• This can be generalized to more general saving models: if \( g \) small & \( r > g \), then \( b_y \) close to \( \beta/H \)
Application to the structure of lifetime inequality

• Top incomes literature: Atkinson-Piketty OUP 2007 & 2010 → 23 countries.. but pb with capital side: we were not able to decompose labor-based vs inheritance-based inequality, i.e. meritocratic vs rentier societies

→ This paper = positive aggregate analysis; but building block for future work with heterogenity, inequality & optimal taxation
Data sources


• **National wealth and income accounts**: Insee official series 1949-2009; linked up with various series 1820-1949
• French estate tax data is exceptionally good: universal, fully integrated bequest and gift tax since 1791
• Key feature: everybody has to fill a return, even with very low estates
• 350,000 estate tax returns/year in 1900s and 2000s, i.e. 65% of the 500,000 decedents (US: < 2%)

(memo: bottom 50% wealth share < 10%)
Computing inheritance flow

\[ \frac{B_t}{Y_t} = \mu_t \ m_t \ \frac{W_t}{Y_t} \]

- \( \frac{W_t}{Y_t} \) = aggregate wealth/income ratio
- \( m_t \) = aggregate mortality rate
- \( \mu_t \) = ratio between average wealth of decedents and average wealth of the living (= age-wealth profile)

→ The U-shaped pattern of inheritance is the product of three U-shaped effects
Figure 1: Annual inheritance flow as a fraction of national income, France 1820-2008

- Economic flow (computed from national wealth estimates, mortality tables and observed age-wealth profiles)
- Fiscal flow (computed from observed bequest and gift tax data, inc. tax exempt assets)
Figure 4: Wealth/income ratio in France 1820-2008

Private wealth as a fraction of national income
• 1900s: $Y = 35$ billions francs or, $W = 250$ billions, $B = 8.5$ billions
  $→ W/Y = 700\%, \ B/Y = 25\%$

• 2008: $Y = 1\,700$ billions € (i.e. $35\,000€$ per adult), $W = 9\,500$ billions € ($200\,000€$ per adult), $B = 240$ billions €
  $→ W/Y = 560\%, \ B/Y = 15\%$

• Between 1900s and 1950s, $W/Y$ divided by $3$, but $B/Y$ divided by $6$ → the fall in $W/Y$ explains about half of the fall in $B/Y$
Figure 8: The ratio between average wealth of decedents and average wealth of the living in France 1820-2008

- excluding inter-vivos gifts
- including inter-vivos gifts into decedents' wealth
<table>
<thead>
<tr>
<th>Year</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
<th>70-79</th>
<th>80+</th>
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<td>63%</td>
<td>73%</td>
<td>100%</td>
<td>113%</td>
<td>114%</td>
<td>122%</td>
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<tr>
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<td>1947</td>
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<td>76%</td>
<td>62%</td>
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<tr>
<td>1960</td>
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<td>52%</td>
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<td>2006</td>
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<td>111%</td>
<td>106%</td>
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How can we account for these facts?

• 1914-45 capital shocks played a big role, and it took a long time to recover

• Key question: why does the age-wealth profile become upward-sloping again?

→ the $r>g$ effect

• Where does the $B/Y=20\%-25\%$ magic number come from? Why $\mu_t \uparrow$ seem to compensate exactly $m_t \downarrow$?
Theory 1: Demography

- To simplify: deterministic, stationary demographic structure: everybody becomes adult at age $A$, has one kid at age $H$, inherits at age $I$, and dies at age $D$
- 1900: $A=20$, $H=30$, $D=60 \rightarrow I=D-H=30$
- 2050: $A=20$, $H=30$, $D=80 \rightarrow I=D-H=50$
- mortality rate among adults:
  \[ m_t = \frac{1}{(D-A)} \]
  (1900: about 2.5%; 2050: about 1.7%)
Theory 2: Production

- $Y_t = F(K_t, H_t) = F(K_t, e^{gt} L_t)$
- $g = \text{exogenous productivity growth rate}$
- E.g. Cobb-Douglas: $F(K,H) = K^\alpha H^{1-\alpha}$
- $Y_t = Y_{Kt} + Y_{Lt}$, with $Y_{Kt} = r_t K_t = \alpha_t Y_t$
- Define $\beta_t = K_t/Y_t = W_t/Y_t$ (closed economy)
  (open economy: $W_t = K_t + FW_t$) (+$D_t$)
- Then $\alpha_t = r_t \beta_t$, i.e. $r_t = \alpha_t/\beta_t$
- E.g. if $\beta_t = 600\%$, $\alpha_t =30\%$, then $r_t = 5\%$
Theory 3: Savings

- Aggregate savings rate = stable at about 10% of $Y_t$ since 1820
  \[ \beta^* = \frac{s}{g} \quad (g=1\% \land s=6\% \rightarrow \beta^* = 600\%) \]
- Exogenous saving: $S_t = sY_t = s_L Y_L + s_K rW_t$
- Is $s_K > s_L$?
- Dynastic utility function: $s_K = \frac{g}{r}$, $s_L = 0$
- Bequest in the utility function: $U(C,B)$
  \[ \rightarrow \text{easy to generate } s_K > s_L \text{ (or } s_K < s_L \ldots) \]
• **Dynastic model**: \( U = \int e^{-\theta t} C_t^{1-\sigma}/(1-\sigma) \)
  \( \rightarrow \) Ramsey steady-state:
  \[ r^* = \theta + \sigma g \ (> g) \]
• In effect: \( s_L^* = 0\% \), \( s_K = g/r^*\% \)
• Any wealth distribution s.t. \( f'(k^*) = r^* \) is a steady-state
• Intuition: \( Y_{Lt} \) grows at rate \( g \), workers don’t need to save; but capitalists need to save a fraction \( g/r \) of their capital income \( Y_{Kt} = r W_t \), so that \( W_t \) grows at rate \( g \)
Steady-state age-wealth profile

- If \( s_L = 0\% \), then the cross-sectional age-wealth profile \( W_t(a) \) at time \( t \) is very simple:
  - If \( A < a < I \), then \( W_t(a) = 0 \) (zero wealth until age of inheritance)
  - If \( I < a < D \), then \( W_t(a) = W_t^{\text{old}} \) (growing at rate \( g \), but independent of age \( a \))

Intuition: young heirs receive larger estate (growing at rate \( g \)), but older heirs have capitalized their estate at rate \( s_K = g/r \), so that the cross-sectional profile is flat
Figure 9: Steady-state cross-sectional age-wealth profile in the dynastic model \( r = \theta + \sigma g, s_L = 0, s_K = g/r \)
Figure 10: Steady-state cross-sectional age-wealth profile in the dynastic model with demographic noise.

The graph shows the percentage of the average wealth of the age group divided by the average wealth of adults. The ages are marked from A=20 to D=70.

- A=20
- H=30
- I=40
- D=70

The values on the x-axis are represented by squares on the graph, indicating the age groups.
Proposition 1: Steady-state of dynastic model:

\[ r = \theta + \sigma g \ (> g), \; s_L = 0, \; s_K = g/r, \; \mu = (D-A)/H \ (> 1) \]

→ B/Y is independent of life expectancy:

\[ \mu = (D-A)/H, \; m = 1/(D-A), \; \text{so} \]

\[ B/Y = \mu \; m \; W/Y = \beta/H \]

E.g. if \( \beta = 600\% \), \( H = 30 \), then \( B/Y = 20\% \)

1900: \( D = 60, \; I = 30, \; m = 2.5\% \), but \( \mu = 133\% \)

2050: \( D = 80, \; I = 50, \; m = 1.6\% \), but \( \mu = 200\% \)

Proposition 2: More generally:

\[ \mu = \frac{[1-e^{-\,(g-s_K r)(D-A)}]}{[1-e^{-\,(g-s_K r)(D-I)}]} \]

→ \( \mu'(s_K) > 0, \; \mu'(r) > 0, \; \mu'(g) < 0 \)

(→ for \( g \) small, \( \mu \) close to \( (D-A)/H) \))
Simulations

- I start from the observed age-wealth profile $W_t(a)$ in 1820 or 1900
- I take $s_t$ and $r_t$ from national accounts
- I take observed age-labor income (+transfer income) profiles
- I apply observed mortality rates by age group, and observed age structure of heirs, donors and donees
- I try different savings behavior to replicate observed dynamics of $\mu_t \& B_t/Y_t$
Figure 9: Observed vs simulated inheritance flow B/Y, France 1820-2100

- Observed series
- Simulated series (2010-2100: g=1.7%, (1-t)r=3.0%)
- Simulated series (2010-2100: g=1.0%, (1-t)r=5.0%)
Simulations 1: 19th century

- France 1820-1910 = quasi-steady-state
- $\beta = W/Y = 629\%, \ g=1.0\%, \ s=10.1\%, \ \alpha=38\% \rightarrow r = 6.0\% >> g=1.0\%$
- Key fact about 19th century growth = rate of return $r$ much bigger than $g$
  $\rightarrow$ wealth holders only need to save a small fraction of their capital income to maintain a constant or rising $W/Y$
  ($g_w=s/\beta=1.3\% \rightarrow W/Y$ was slightly rising)
→ in order to reproduce both the 1820-1910 pattern of B/Y and the observed age-wealth profile (rising at high ages), one needs to assume that most of the savings came from capital income (i.e. $s_L$ close to 0 and $s_K$ close to $g/r$) (consistent with high wealth concentration of the time)
Figure 11: Private savings rate in France 1820-2008

- Private savings (personal savings + net corporate retained earnings) as a fraction of national income
Figure 13: Labor & capital shares in (factor-price) national income, France 1820-2008
Figure 14: Rate of return vs growth rate France 1820-1913

Real rate of return on private wealth $r = \alpha / \beta$

Real growth rate of national income $g$
Figure 15: Capital share vs savings rate France 1820-1913
Simulations 2: 20th & 21st centuries

- Uniform savings $s=s_K=s_L$ can reproduce both B/Y & observed age-wealth profiles over 1900-2008

- **2010-2050 simulations**: $g=1.7\%, \ s=9.4\%, \ \alpha=26\%, \ \text{after-tax } r=3.0\%$
  \[ \rightarrow \ \text{B/Y stabilizes at 16\%} \]

- But if $g=1.0\%$ & after-tax $r=4.5\%$ (rising global $k$ share and/or $k$ tax cuts), then B/Y converges towards 22%-23\%
Applications to distributional analysis

• 19\textsuperscript{c}: top successors dominate top labor earners; top 1\% spouse > top 1\% job
• Cohorts born in 1900s-1950s: for the first time maybe in history, top labor incomes dominate top successors
• Cohorts born in 1970s-1980s & after: closer to 19\textsuperscript{c} rentier society than to 20\textsuperscript{c} meritocratic society. E.g. with labor income alone, hard to buy an appartment in Paris..
Figure 11: The share of inheritance in lifetime resources received by cohorts born in 1820-2020

- □ average inheritance as a fraction of average lifetime labor income resources (all inheritance and labor resources capitalized at age 50)
- ▲ low-growth, high-return scenario
Table 3: Intra-cohort distributions of labor income and inheritance, France, 1910 vs 2010

<table>
<thead>
<tr>
<th>Shares in aggregate labor income or inherited wealth</th>
<th>Labor income 1910-2010</th>
<th>Inherited wealth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Top 10% &quot;Upper Class&quot;</strong></td>
<td>30%</td>
<td>90%</td>
</tr>
<tr>
<td>incl. Top 1% &quot;Very Rich&quot;</td>
<td>6%</td>
<td>50%</td>
</tr>
<tr>
<td>incl. Other 9% &quot;Rich&quot;</td>
<td>24%</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Middle 40% &quot;Middle Class&quot;</strong></td>
<td>40%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Bottom 50% &quot;Poor&quot;</strong></td>
<td>30%</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5%</td>
</tr>
</tbody>
</table>
Figure 12: Top 50% successors vs top 50% labor income earners (cohorts born in 1820-2020)

- ■ top 50% inheritance resources as a fraction of bottom 50% labor resources
- ○ top 50% labor resources as a fraction of bottom 50% labor resources
- ▲ low growth, high return scenario
Figure 13: Top 10% successors vs top 10% labor income earners (cohorts born in 1820-2020)

- □ top 10% inheritance resources as a fraction of bottom 50% labor resources
- ■ top 10% labor resources as a fraction of bottom 50% labor resources
- ▲ low growth, high return scenario
Figure 14: Top 1% successors vs top 1% labor income earners (cohorts born in 1820-2020)

- ■ top 1% inheritance resources as a fraction of bottom 50% labor resources
- □ top 1% labor resources as a fraction of bottom 50% labor resources
- Δ low-growth, high-return scenario

1820 1840 1860 1880 1900 1920 1940 1960 1980 2000 2020
Figure 15: Cohort fraction inheriting more than bottom 50% lifetime labor resources (cohorts born in 1820-2020)

- Benchmark scenario
- Low-growth, high-return scenario
Application to the share of inheritance in total wealth

- Modigliani AER 1986, JEP 1988: inheritance = 20% of total U.S. wealth
- Kotlikoff-Summers JPE 1981, JEP 1988: inheritance = 80% of total U.S. wealth
- Three problems:  
  - Bad data
  - We do not live in a stationary world: life-cycle wealth was much more important in the 1950s-1970s than it is today
  - We do not live in a representative-agent world → new definition of inheritance share
Figure 18: The share of non-capitalized inheritance in aggregate wealth accumulation, France 1850-2100

- non-capitalized inherited wealth as a fraction of aggregate private wealth
- low-growth, high-return scenario
Figure 19: The share of capitalized inheritance in aggregate wealth accumulation, France 1900-2100

- Capitalized inherited wealth as a fraction of aggregate private wealth
- Low-growth, high-return scenario
What have we learned?

• Capital accumulation takes time; one should not look at past 10 or 20 yrs and believe this is steady-state; life cycle theorists were too much influenced by what they saw in the 1950s-1970s…

• Inheritance is likely to be a big issue in the 21st century

• Modern economic growth did not kill inheritance; the rise of human capital simply did not happen; g>0 but small not very different from g=0
• A lot depends on r vs g+n:
  → China/India: inheritance doesn’t matter
  → US: inheritance smaller than in Europe
  → Italy, Spain, Germany (n<0): U-shaped pattern probably even bigger than France
  → world, very long run: g+n=0%: inheritance and past wealth will play a dominant role; back to 19th century intuitions
• But no normative model… difficult conceptual issues before we have good optimal k tax theory (endogenous r)
  → see Piketty-Saez, in progress…
<table>
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<tr>
<th></th>
<th>g</th>
<th>$g_w$</th>
<th>$g_{ws} = s/\beta$</th>
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<td>1820-2009</td>
<td>1.8%</td>
<td>1.8%</td>
<td>2.1%</td>
<td>-0.3%</td>
<td>4.4%</td>
</tr>
<tr>
<td>1820-1913</td>
<td>1.0%</td>
<td>1.3%</td>
<td>1.4%</td>
<td>-0.1%</td>
<td>0.5%</td>
</tr>
<tr>
<td>1913-2009</td>
<td>2.6%</td>
<td>2.4%</td>
<td>2.9%</td>
<td>-0.4%</td>
<td>8.3%</td>
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<td>1913-1949</td>
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<td>-1.7%</td>
<td>0.9%</td>
<td>-2.6%</td>
<td>13.9%</td>
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<tr>
<td>1949-1979</td>
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<td>6.2%</td>
<td>5.4%</td>
<td>0.8%</td>
<td>6.4%</td>
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<td>1979-2009</td>
<td>1.7%</td>
<td>3.8%</td>
<td>2.8%</td>
<td>1.0%</td>
<td>3.6%</td>
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Table 1: Accumulation of private wealth in France, 1820-2009

Memo: Consumer price inflation
<table>
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<tr>
<th>Period</th>
<th>Growth rate of national income</th>
<th>Rate of return on private wealth</th>
<th>Capital tax rate</th>
<th>After-tax rate of return</th>
<th>Real rate of capital gains</th>
<th>Rate of capital destruct. (wars)</th>
<th>After-tax real rate of return (incl. k gains &amp; losses)</th>
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<td>1.8%</td>
<td>6.8%</td>
<td>19%</td>
<td>5.4%</td>
<td>-0.1%</td>
<td>-0.3%</td>
<td>5.0%</td>
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<td>1820-1913</td>
<td>1.0%</td>
<td>5.9%</td>
<td>8%</td>
<td>5.4%</td>
<td>-0.1%</td>
<td>0.0%</td>
<td>5.3%</td>
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<td>1913-2009</td>
<td>2.6%</td>
<td>7.8%</td>
<td>31%</td>
<td>5.4%</td>
<td>-0.1%</td>
<td>-0.7%</td>
<td>4.6%</td>
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<td>1913-1949</td>
<td>1.3%</td>
<td>7.9%</td>
<td>21%</td>
<td>6.4%</td>
<td>-2.6%</td>
<td>-2.0%</td>
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<td>1949-1979</td>
<td>5.2%</td>
<td>9.0%</td>
<td>34%</td>
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<td>1979-2009</td>
<td>1.7%</td>
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<td>5.3%</td>
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Figure 5: Wealth/disposable income ratio France 1820-2008

Private wealth as a fraction of disposable income
Figure 6: Mortality rate in France, 1820-2100

Adult mortality rate (20-yr-old & over)
Figure A1: Annual inheritance flow as a fraction of national income, France 1900-2008 (annual series)

- Economic flow (computed from national wealth estimates, mortality tables and observed age-wealth profiles)
- Fiscal flow (computed from observed bequest and gift tax data, inc. tax exempt assets)
Figure A2: Wealth-income ratio in France 1896-2009
(annual series)

- Private wealth as a fraction of national income
Figure A3: Wealth-disposable income ratio in France 1896-2009 (annual series)

- Private wealth as a fraction of personal disposable income