The End of the Rentiers:
Paris 1842-1957

Thomas Piketty, Gilles Postel-Vinay, Jean-Laurent Rosenthal*

December 19, 2017

Abstract. This paper exploits a unique individual-level database that we collected from Paris inheritance archives from 1842 to 1957. We explore the interplay between aggregate macroeconomic shocks, the end of rentiers, and the long-run decline in wealth inequality. We quantify for the first time the role of the rise of progressive taxation of income and inheritance in these individual-level dynamics. We find that the real innovation of the twentieth century in reducing wealth inequality was the new fiscal regime that came in response to wars and other adverse shocks after 1914. Had it only been for the negative shocks themselves, the distribution of wealth in Paris and the consumption possibilities of the rich would have more easily returned to their pre-World War I level.

* Piketty: Paris School of Economics and EHESS; Postel-Vinay: Paris School of Economics; Rosenthal: Caltech. The research leading to these results has received funding from the European Research Council under the European Union's Seventh Framework Program, ERC Grant Agreement n. 340831.The authors would like to thank seminar participants at PSE, UC Irvine, Caltech for their comments.

Introduction

Over the century and a half from 1800 to 1945 French wealth inequality rose and then fell; this was followed by three decades of low inequality and rapid economic growth. In Paris, the wealth share of the top 1% rose from 50% in the first quarter of the nineteenth century to 65% in the decades before World War I before falling back to less than 50% in the aftermath of World War II and less than 30% three decades later (Piketty, Postel-Vinay and Rosenthal 2006).

What is not emphasized quite as often is that the rise and fall in inequality was associated with a massive rise and fall of aggregate private wealth (Piketty and Zucman, 2014). In fact, in Paris, wealth at death in 1947-1952 (right after World War II) deflated by the CPI was equivalent to wealth at death in 1817-22 (right after the end of the Napoleonic wars). In between, wealth at death had peaked at more than three times that level for the top decile, and five times for the super-rich (the top 0.1% see Figure 1). If we look not at wealth but the implied capital income and deflate that by adult labor income, throughout the second half of the nineteenth century the median member of the top 1% (henceforth P99.5) could afford to pay for about 35 years of adult labor income. By the 1870s that number had grown to about 40 years of labor income, only to collapse to less than two years after World War II *before* taxes.[1]

This paper seeks to understand this full revolution in wealth and inequality. Using a unique individual level database that we collected from the Parisian Estate tax archives over the

[1] The reader who is curious as to what such income might mean today should consider that the U.S. Social Security Administration reports average wage income in the US at $46,000 so the median 1% capital income of the 1840s corresponds to $1.2 million.

1842-1957 period, we explore the interplay between aggregate macroeconomic shocks, the end of rentiers, and the long-run decline in inequality.[2] We are also able to quantify for the first time the important role played by fiscal policy – in particular the rise of progressive taxation of income and inheritance – in these individual-level dynamics.

Changes in real wealth and capital incomes have profound effects on both the structure of production and on consumption. They can also have a profound impact on social mobility. In this paper, we consider a simple question that helps us understand one of the most dramatic social transformations of the first half of the twentieth century: why did rentiers disappear by 1945? Rentiers are usually defined as individuals whose wealth is such that their capital income dwarfs their labor income. We define them as individuals whose bequest is less than the capitalized value of the inheritance they received. In the data, as we shall see, individuals with very high capital incomes are also very likely to have inherited large estates. In the low tax, slow growth, environment of the nineteenth century, we show that a person who inherited wealth whose flow income was about 45 years of adult labor income could easily adopt a saving's program that would bequeath a level of wealth that would produce an equivalent income to his or her descendants. In other words, these rentiers could reproduce themselves indefinitely. A rentier could do so without engaging in any savings from labor income and, as we will show, at the same time consuming most of his or her capital income. The feasibility of such a program came to an abrupt end in World War I. There are three competing hypotheses to explain this decline. One focuses on the wealth destruction of the World War I, the Great Depression,

[2] The Estate tax archives are series DQ8 and DQ7 of the Paris Archives and are essentially complete from 1807-1960. Thereafter the collection has significant gaps. The last records end about 1977 for the arrondissements with the longest run of data.

and World War II. The second focuses on progressive taxation. The third invokes the far more rapid rise of wages relative to capital income.

To evaluate these hypotheses, we use the wealth at death data we have collected for Paris from 1842 onward and create an imaginary economy in order to perform simple counterfactual simulations. We assume that each estate was received by one person who lived for thirty more years after inheriting. The inheritor, who is the agent of interest, starts by paying the relevant inheritance taxes. Each year she earns the average rate of return on capital, receives average capital gains, and then pays the income taxes on capital income (allowing the unobserved labor income to pay taxes at the higher marginal rate). When she dies, she transmits her estate to a unique heir. We assume each inheritor is a dynast, in that her goal is either to leave her heir an estate that affords the same consumption possibilities or that is at the same rank in the wealth distribution as she enjoyed. In the first case, she is a perfect altruist with respect to her heir while in the second case she has a more socially-defined bequest motive. We demonstrate that simple strategies allowed high wealth holders with dynastic preferences to reproduce themselves indefinitely. Most importantly, we explore in detail how this self-perpetuating equilibrium broke down with the 1914-1945 macroeconomic and fiscal shocks. In particular, we find that the rise of progressive taxation (inheritance, but more so income) played a very significant role in explaining the long-run decline in wealth inequality.

The present paper reprises some of the questions laid out by Daumard (1970, 1973) on the connections between inequality and social classes. It is also directly related to our previous research based on Parisian estates (Piketty, Postel-Vinay and Rosenthal 2006, 2014). One crucial difference here is that we have now collected individual wealth

portfolios through 1957 (whereas our previous work stopped in the interwar period), so that we are now able to chart the “end of the rentiers” and to quantify the different processes at work. In addition, we have collected exhaustive information on tax legislation over this period (extending the work of Piketty 2001) and have computed, for the first time, a complete series of effective tax rates on income and inheritance.

Our work is also related to the larger international literature on the long-run evolution of wealth inequality (see e.g. Saez and Zucman (2016) on the U.S.; Garbinti, Goupille-Lebret and Piketty (2016) on France; Alvaredo, Atkinson and Morelli (2017) on the U.K.; see also Piketty (2014) and Piketty and Zucman (2015) for a survey). This literature documents large historical changes in wealth concentration at the country level. It stresses how differences in structural parameters such as the inequality of saving rates, and rates of return and the progressivity of the tax system can have large multiplicative long-run impact on steady-state wealth concentration.

In contrast to these country-level approaches, the Parisian data allow us to develop a more micro-level perspective on individual wealth dynamics. Indeed, the specific features of French inheritance taxes and the records they left behind provide us with much more detailed information on individual wealth portfolios and family trajectories than what is available for other countries over a century and a half.

The paper proceeds in four steps. In section 1, we present a simple model of dynastic accumulation, then detail the data we rely on to define wealth levels and returns. In section 2, we examine how consumption might have evolved in the absence of taxes and look at different ways of setting savings or consumption targets. In section 3, we add

estate taxes to the analysis and show that they have a moderate impact on wealth accumulation for several reasons. Such taxes only hit every thirty years and although marginal rate were high, they were capped by maximum average rates that were binding after moderate levels of wealth. Finally, estate taxes in direct line of descent were limited. In section 4, we add income taxes to the mix, which we find were far more important to reducing inherited wealth. A conclusion follows.

Section 1: Inheritors, Rentiers, and Dynasts

For those people who died married, French marriage and inheritance laws allow us to observe both their wealth at death and the wealth they had inherited. In an earlier paper (Piketty, Postel-Vinay and Rosenthal, 2014), we showed that the fraction of inheritors (individuals who received a bequest) increased with the fractile of wealth at death. This is hardly surprising since the more wealth an individual inherits, the easier it is for him or her to leave a bequest. We also defined rentiers as those inheritors whose wealth at death was smaller than the capitalized value of the wealth they inherited. This group would have been able to consume all of their labor income, and part of their capital income, and still leave behind substantial estates. We showed that the fraction of rentiers increased with the fractile of their wealth at death and was remarkably stable from 1872 to the Great Depression. We computed the inherited wealth share in estates as the sum of the wealth of the rentier and the value of capitalized inheritances for inheritors who were not rentiers. Inherited wealth was also very high for Paris until the Great Depression. We update these results using the six new cross sections from 1932 through 1957 (see

Figure 2). In doing so, another stark finding emerges: like inequality there was a substantial decline in the share of inherited wealth. By 1947, it had dropped to less than half of all bequeathed wealth from a high 70% before World War I. Remarkably, there is little movement in the fraction of rentiers. Rentiers did not disappear, they just became poor. Why and how this occurred is the focus of this paper.

Section 1.1 Savings and consumption

The stark changes in wealth levels leads us to consider the savings/consumption decisions of inheritors. A life-cycle savings approach that involves both accumulation through middle age and dis-accumulation in later years does not fit our data well, because Parisian age-wealth profiles are steep and have no internal maximum (for details see Appendix A1). Instead, we consider individuals who have strong bequest motives (after all, that is why there are estates and the estate tax is a political problem). Our data are low frequency (at most two observations per person) but run over long periods of time, so we focus on a simple problem. Each year our inheritor receives some nominal capital income; and she decides whether to save it or consume it; she does not consider capital gains in that decision—they mechanically feed into next year's wealth level.

When choosing a consumption level, our inheritor has only one goal: to bequeath an estate to her heir that affords either the same social standing (so the same fractile in the wealth distribution) or the same economic standing (consumption equal to the same number of years of adult labor income). Practically, she seeks either a constant savings' rate or a constant consumption rate over her lifetime that produces the desired outcome. Relative to models of wealth accumulation that consider the impact of taxation we shut

down two standard channels, tax avoidance and intertemporal arbitrage. The first channel does become important in the mid-1950s with the *Emprunt Pinay* (Tristram 2013). The Emprunt Pinay consolidated a large chunk of the national debt into low interest bonds, which were exempt from the estate tax. But at least through 1962 these bonds were reported in estate tax documents, so we do measure wealth correctly. Later other exemptions were added, including for newly built real estate. In any case, these exemptions essentially arose after the period of interest.[3] Preventing our dynasts from maximizing some discounted present value of consumption may seem contrary to economic doctrine. In this context, however, it actually helps them maintain their wealth longer. Indeed, because after 1915 the cost of future consumption gets ever larger (through estate taxes, and inflation) any intertemporal tax optimization would reduce savings. So in effect allowing dynasts and rentiers to be perfect altruists maximizes their survival chances. It is the right bias to impose when we are interested in their decline.

We now turn to the connection between capital returns and economic growth, summarized as the r>g equation (Piketty, 2014).Consider a simple world where the capital share in income is fixed (so wealth grows at the same rate as the economy). Our inheritor has wealth W_t. If the flow return to capital is r, then her capital income is rW_t. Define average adult labor income as Y_{Lt}. Then if the per capita growth rate of the economy is g, $Y_{Lt+1}= Y_{Lt}$ (1+g). If our inheritor saves a fraction g/r of her capital income rW_t, then W_{t+1} $=(1+g)W_t$. In this case her consumption is $(r-g)W_t/Y_{Lt}$ in period t and $(r-g)(1+g)W_t/(1+g)Y_{Lt}$

[3] Although these exemptions do not matter at all before 1957 and little in that year, our data have one additional advantage over published reports. We do observe assets that are exempt from tax. So we can measure both fiscal wealth (net of Pinay bonds and new real estate) and economic wealth (where these assets are counted).

in period t+1. Clearly, this inheritor's consumption is a constant multiple of average labor income. Consider now the same variable but reinterpret r as the rate of return over a generation and g as the rate of growth over a generation, one can use the same logic to find an appropriate savings rate. If growth is balanced, the dynast's problem has a simple solution: she allows her wealth to grow at the same rate as the economy (saves gW_t), and consumes the rest of her capital income $(r-g)W_t$.

The foregoing leaves out capital gains. One answer could be to roll them into an aggregate return to capital, but that would make the rate of return extraordinarily volatile. More importantly, it would be inconsistent with the way we think rentiers behaved, at least before World War I. It is better to decompose the aggregate return into three components: the flow return (rents, dividends, interest), nominal changes in asset value, and the aggregate price change. The sum of these three returns may be negative (as it was in the 1930s). If consumption is a fraction of the aggregate return it would also be negative which is clearly not credible. Instead, as noted above, we focus the consumption decision on the flow return, which is always positive (like the payments to capital in GDP). Second, for inheritors we observe the value of the wealth that they received in two buckets. The first is a detailed listing of assets that they inherited which still exist at the time of their death (e.g. the family house, or 100 shares of the Suez Canal). The other bucket is the sum of any cash received (dowries) and any inherited asset that was sold during the marriage. For most individuals, less than half of the assets they inherited were in cash at the time of their death, implying that less than half the capital gains/losses they experienced were realized before death. It seems appropriate to assume that capital gains were undistributed (otherwise all inherited wealth would be in cash). This implies

that wealth grew each year by a rate defined by the fraction of capital income that was saved plus capital gains γ:

$$W_{t+1} = (1+sr+\gamma)W_t$$

Again solving the problem for s such that the growth rate of wealth is equal to the growth rate of labor income is simple $sr+\gamma=g$; $s=(g-\gamma)/r$.

Finally, we must deal with aggregate price changes. Here it is important to recall that our rentier observes a capital income (rW) and adult labor income Y_L and makes a savings decision. Whether we make that decision real or nominal does not matter because we will divide both sides by the price index. What is more complicated is what to do about capital gains. As we shall show, differences between a nominal and a real approach are small when there are no taxes. So we will focus on the nominal approach which makes computing the income tax liabilities much easier (since the brackets are all nominal).

Of course fixing a target savings rate when returns are variable creates unwanted consumption volatility. So we solve for the constant consumption in number of years of labor income that allows wealth to grow at a rate that leads to the same terminal estate as we get from the constant savings rate.

In all the figures that follow we deflate capital incomes by a standardized annual average labor income. We focus on labor income for three reasons. First, this approach is the closest adaptation of the macro r>g equation to the micro environment we want to consider. Second, when discussing inequality, average labor income is a good yardstick. If we say that someone enjoys a capital income equal to 30 years of labor income it is

more meaningful than to say that he or she enjoys 38,250 1912 francs. Finally, we know that at least through the nineteenth century, rich individuals and households spent a lot on domestic staff (Hoffman et al, 2002). Thus, if we are concerned with the evolving consumption of the very rich we have to ask how they could afford the butler, the maid, the cook, and the footman.

Section 1.2. Rentiers forecasts

Solving the simple problem of a constant savings or consumption rate requires specifying what the rentier knows about returns and taxes. We specify four possible information regimes. First, perfect foresight: the rentier knows the future path of returns and acts accordingly. It is unrealistic but provides a good benchmark. Second, perfect hindsight: an equally extreme version where the rentier assumes that the world she will live in will looks exactly like the world her parents lived in. Therefore, she implements her parents' optimal savings rate. Third, adaptive expectations: each five years the rentier takes in the prior fifteen years of data to make her savings decision. This last regime proves a poor match to our data relative to the fourth possibility: a simple heuristic in which she saves 33.3% of capital income (the best ex-post average saving rates for the 19th century).

Section 1.3. Data sources

This paper rests on three sets of data. First, we extract the distribution of wealth for every five years from 1842 to 1957 (except 1917) from our database of Parisian estates (see Piketty, Postel-Vinay, Rosenthal 2006, 2014). The advantage of these data over alternative sources about individual wealth levels (in particular the published reports of the distribution of estate values) are twofold. First, we have data that reaches back a full

century before any regular publication of estate value distributions following the imposition of tax progressivity in 1901. This allows us to chain our counterfactual accumulation models, and ask whether the inheritors of 1842 bequeath something like the wealth of the 1872 cross-section or not. Second, our data are collected so that a year's wealth distribution is computed from the filings of individuals who died in that year rather than estates filed in that year. This may seem like a minor technical matter. However, in periods when inflation is 10% or more a year, and the rich systematically file later than the middle class, the published reports will produce lower levels of inequality than is actually the case.

Data for wealth at death is tautologically available for all individuals who die with a positive estate. Recall, however, that for the subset of those individuals who die married we also observe the value of the estates they inherited. These offer a second distribution of wealth and for those individuals we classify as rentier we can compute a savings rate out of capital income (t-th root of wealth bequeathed divided by wealth inherited minus one, where t is the generational interval).

The second set of data involves measures of flow income from capital and capital gains. Ideally, we would have liked to have individualized returns for each of the portfolios we recovered. Unfortunately, this is infeasible, because a very substantial share of individual portfolios was comprised of assets that were not listed on markets (real estate, privately held firms, and un-intermediated debts). Instead, we considered two sources of returns data, each with its advantages and problems. First, we could have relied on macroeconomic accounts (see Piketty and Zucman, 2014). In this case, the flow return to capital (r) is simply the capital share divided by the wealth to income ratio. To 'deflate'

these capital returns in terms of consumption we would want to track the most important component of consumption for the rich (servants and other labor inputs) that implies taking g to be the rate of change in payments to labor divided by the adult population. In the short run and using recent data this approach might be sensible for measuring returns because labor force participation is relatively stable, and the different components of the economy are relatively well measured. For our long time span, however, the macroeconomic approach has two problems. First, there have been massive changes in the paid labor force, in particular relating to the decline of family farms and the varying participation of women in the wage economy over time (Marchand and Thélot 1991). Second, the 19th century data for capital share seem, at the very least, suspect. They vary abruptly from decade to decade. Consequently there are decades with a high capital share where nominal returns are high and at the same time (because the labor share is low) the cost of servants is low, followed by decades where the reverse is true. These uncertainties made us prefer a more micro approach.

The alternative to macroeconomic returns is to rely on asset value from publically traded assets (e.g. bond yields and dividend yield for flows, and some qualitative sources for rents).Relative to macro returns, the returns we compute are typically lower because they are based on the most liquid and safest assets—with lowest illiquidity or risk premia. In particular we use the French government rente yield (Homer and Sylla 1991, then OECD) and the CAC40 dividend yield (Hautcoeur and Lebris 2010, Lebris 2011 p 69), as well as the tax officials' accepted yield on real estate net of fees as benchmarks for flow returns.[4]

[4] The law of 22 frimaire year 7 (12/12/1798) stated that the evaluation of real estate would be 20 times the return on the assets or the value of leases…for rented real estate the primary determination of revenue remained the leases in force at the time of death. (Dalloz 1913 p 550-1). The law of February 25, 1901

The advantage of using such returns is that they are correctly measured each year—and we can guess that the bias is generally towards lower returns. We then weight these returns by the average share of these assets in Estates (roughly 1/3 each) to produce a capital income. We deflate this capital income by the cost of hiring a worker for 2,750 hours a year, a figure that we take from Bayet (1997). 2,750 hours is the average number of hours worked per year over the full range of time (1840-1986) our study covers. It corresponds to less than a full-time worker at the beginning of our study when the workweek was 72 hours long and more than a full-time worker at the end when the workweek was 40 hours. Nevertheless, it does track the real cost of hiring servants for a determined number of hours. We also take the rate of capital gains (computed by Piketty and Zucman (2014)) which is actually an average index computed from a small range of assets. As we discuss below, these rates suppress an important source of variation, namely individual rates of return. Doing so, nonetheless provides a useful benchmark.

The key differences between the macroeconomic benchmarks and the micro series come before World War I when capital/labor shares seem to have been measured with a great deal of error. The key differences between using a constant set of hours to compute labor costs and using the income of a full-time employed person come after 1936 when labor hours fall and vacation weeks increase. Those differences would widen further if we added employers' payments to the state for health, retirement, and unemployment insurance. Still, our series show the same dramatic drop in the consumption possibilities

---

required that for real estate that was not rented one would use a fiscal value based on their value as declared by the heirs. Then the law of December 12 1908 required an evaluation based on the real estate taxes paid in the year of death. Fiscal estimates remained in place through the end of the 1940s (Abrégé d'Enregistrement 1947).

of the rich after World War I, whatever set of returns or labor incomes we use. We focus on the micro economic returns, because it was feasible for someone in the 1% to own a portfolio composed roughly 1/3 of real estate, 1/3 of government bonds and 1/3 of the leading equities, it was simply infeasible to find a stable portfolio that would track the macro-economic payment. Our representative agent is a possible agent.

The third set of data involves tax rates. We start with inheritance taxes.[5] In France, taxes levied on wealth at death were inheritance rather than estate taxes. Specifically, these taxes were paid by each heir at a rate that was defined by his or her relationship to the deceased. At all times, rates were relatively low for inheritors in direct line of descent and rose as the heir's relationship to the deceased grew more distant. Interestingly from 1926 to the 1950s, tax laws specified both a set of marginal rates and a maximum average tax burden. In almost all cases, the maximum average tax burden made the highest tax brackets irrelevant, even though there were estates large enough to be in these high brackets. For instance, children paid a flat 1.25% before 1873 and their rate rose to a maximum average rate of 25% after the 1930s (marginal rates were specified up to 60% but they were never binding). Taxes were far heavier for heirs with no family relationship to the deceased. They paid up to 9% before 1873 and their rates rose to a maximum average rate of 60% (again higher marginal rates were specified but they were not binding). It is important to note that a 25% tax once a generation is a large drain on inherited wealth flows, but it can be offset with an increased saving' rate of 1% of wealth

[5] A number of tax schedules were collected by Clément Dherbécourt (2013). We added to those by culling through the Journal Officiel using key word searches. In the end, we collected 16 different schedules, the first lasting from 1842 to 1873 and the last implemented in 1957.

annually, which would be a sizeable but feasible reduction in consumption if flow yields are 5%.

The French state also taxed capital income. First, in 1872, it implemented a tax on capital income (*Impôt sur le Revenu des Valeurs Mobilières, IRVM*). The IRVM was a tax on dividends and interest payments that ranged from 3% (1872 to 1915) to a maximum of 30% during World War II before it was folded into the general income tax in 1948. It was paid by the issuers of securities before income was released to the asset holders. Second, in 1915the French state began to collect a progressive income tax (*Impôt Général sur le Revenu, IGR)*. The income tax schedules are described in Piketty (2001). The IGR schedules reflected France's natalist policies in that there were substantial discount for households with children while single individuals paid the highest marginal rates. After 1912, schedules changed very frequently, not simply to deal with bracket creep but also to tinker with the extent of progressivity. Top marginal rates reached 20% by the end of World War I, and 70% at the end of World War II. As we shall, see for the wealthy the combined effect of the IRVM and high marginal rates on the IGR was actually far more onerous than the inheritance tax, in particular after the Great Depression hit when average tax rates were close to 50%.

Section 1.4. Things left unmodeled

The approach we follow leaves aside demographic change. In particular, Paris saw large increases in life expectancy from 1842 to 1957. In the first half of the period the average age at death for the top 5% of the wealth distribution rose much faster than for the rest of the population, but the 1890s ushered in a period of life expectancy convergence (see

Appendix Table A2). Because the process of life expectancy improvement was very slow however, it did not have much effect on the length of the intergenerational interval which is what matters for dynastic wealth planning. It is also worth noting that, Paris was a city of migrants (see Appendix Table A3) throughout our period with a large fraction of the population dying without direct heirs. One might worry that changes in the share of the population that had migrated to Paris or the share decedents with children might affect the level of wealth that was bequeathed. But in the aggregate at least, these rates are stable over time so it seems as a first pass best to leave these issues aside.

Section 2: A World without Taxes

The period between 1842 and 1957 saw wild fluctuations in the flow rate of return (the range runs from 2% to 9%), nominal capital gains (-8% to 50%), the nominal growth rate of labor income (-11%, 88%), and inflation rates (-13%, 58%). We can use these to evaluate how often the rate of return (r, as the sum the flow return and capital gains) exceeds the rate of growth of labor income ($g=\Delta Y_L$). In our data, r is greater than g for 99 years out of 145 from 1842 to 1986. Before 1913, the returns to capital exceed the growth of Y_L in 93% of the years. In contrast, from 1914 onwards, the return to capital exceeded the growth of Y_L only 43% of the years. Thus, it is an open question as to whether rentiers could actually maintain their wealth throughout this chaotic period.

To illustrate how we compute the different savings programs our rentiers could have implemented, consider a dynast who inherits in 1852 and is at the median of the top 1% (for more detail see Appendix B). We assume she will die in 1881. How do we find her

rank preserving or her consumption preserving program? Let's start with rank preservation. She inherited an estate of 530,000 francs and if her heir is to start at the same rank in the 1882 distribution, he will have to receive an estate of 959,000 francs in 1882.Increasing her wealth from 530,000 francs to 959,000 francs in 30 years requires an annual growth rate of 1.98%. Over this period the annualized rate of capital gains was about 0.9%. As a result, she must save about 1% out of capital income, which averages 4.5% from 1852 to 1881. That implies that her flow savings rate must be 22% of her flow income to maintain her wealth at rank. Such savings in turn lead her to consume, on average, 37.6 of Y_L each year.

Now consider the alternative goal where she wants to offer her heir an average consumption equal to her average life consumption, and assume she knows the paths of returns all the way to 1911 (when her heir will die). To preserve consumption she should choose the savings rate that equalizes consumption for both her and her heir over their lifetimes. Our 1852 inheritor chooses savings rate of 33.6%, an average of $34.6Y_L$ of consumption each year for herself from 1852 to 1881, and the same for her heir from 1882 to 1911. In this program her wealth would be 1.12 million francs when she dies in 1881. If she want to avoid any consumption volatility she can also decide to consume $33.4Y_L$ each year. That is less than the average from the constant savings rate because the inheritor consumes 'too' much when returns are low. The path of consumption is charted in Figure 3. The figure also displays our adaptive expectations benchmark, which sets the rate at the average optimal rate given the previous 15 years' experience.

There are two other ways that dynasts might manage their assets. The inheritor could use the best savings rate for her parents' generation. In this case the inheritor saves too

little, thus has high consumption early on and less so over time and leaves the smallest estate of all our computations. Finally, there is the heuristic approach. There, the inheritor uses a long-term savings rate which is the average of the perfect foresight rates for the cohorts who died before 1917 (33.3%). For our inheritor who died in 1852 the heuristic rate produces an average consumption of 38 years of labor income and a wealth at death of 1.05 million francs. The constant consumption equivalent here is 30.3 Y_L.

To understand how returns affected wealth and consumption, we repeat all the computations we did for the 1852 heir for all the individuals in our data set (see Table 1). We start with the simplest approach: rentiers use a rule of thumb, one that sets their savings' rate at a third of flow income (that rate, as we shall see when we consider the perfect foresight plans made sense for wealth preservation in the nineteenth century). Figure 4 shows the results for the P99.5 inheritor in every cohort from 1842 to 1957who saves all of her capital gains and 33.3% of her flow income. In the figure, each cohort gets its own line that lasts 30 years. Three important observations emerge. First, there is a massive difference between the consumption opportunities of the cohorts that inherited before World War I and those that inherited afterwards. Peak consumption for any cohort that inherited after World War I is less than 25 Y_L which is less than the minimum consumption of any cohort before 1914. World War I was a shock from which rich Parisians did not recover. Second World War II was, on a consumption basis, even worse, driving the consumption of our rentiers down to about 1 Y_L. Third, the recovery after World War II is long in coming, because as one can see, the inheritors of 1947 and 1952 have very low lifetime consumption and, although the 1957 cohort does a bit better, it remains very poor. The primary driver of these differences is the relatively much higher

cost of labor in the second half of the twentieth century (average nominal wealth at death in 1957 was 369 times what it was in 1842, but the 1957 nominal wage we estimated was 1,735 times what it had been in 1842). In real terms wealth was essentially the same in 1957 and 1842, while our measure of labor costs was almost seven times higher, it is no surprise that living standards of the very rich took a dive.[6]

The simple program with a constant saving's rate allows us to evaluate the importance of nominal vs real rates of return (recall that the flow rate of capital income is insensitive to these issues but capital gains are heavily influenced by inflation). Because Piketty Zucman (2014) report both a nominal and a real capital gains rate that are computed using different procedures, running both simulations affords a kind of robustness test. Figure 5 displays the results of this exercise and collapses the individual cohorts by averaging the five observations that are available each year. It shows these averages for both the nominal and real approaches. At times, the two series can be far apart, as in the 1880s when the nominal approach suggests a 15% higher level of consumption and after World War II when the real approach produces a reverse effect. Overall, however, the patterns are remarkably similar and the series cross 18 times over the 140 years. As a result, we continue the analysis focusing on the nominal approach which simplifies how we deal with tax brackets. The third line in the graph simply reports the value of consumption for the P99.5 in the year that we observe estates (1842, 1847…1957) with the intervening years interpolated. The series track very well overall.

[6] Average wealth in 1842 was 16,000 francs while it was 4.2 million in 1957. Average wage income was 449 francs in 1842 and 788,000 in 1857. Prices had multiplied by 258, so real average wealth at death was essentially the same in 1842 and 1857 while wages had risen by a factor of 6.7. See Table A1.

Figure 6 displays two alternative benchmarks against what we actually observe. The first involves adaptive expectations where the dynast computes stable consumption savings rate for a decade starting 20, 15, and 10 years before each quinquenium and then implements the average of those saving rates (for more detail see Appendix B). This retrospective approach introduces more volatility to the series and leads to excessive consumption before World War I and insufficient consumption after World War II. We will leave it aside.

The second alternative involves perfect foresight. The first possibility here is a goal of rank preservation. It leads to a flow savings rate of zero for a number of years because the nominal growth rate of wealth from one generation to the next is always less than the rate of capital gains (we do not display consumption under this solution). A second and more interesting program has the inheritor set a savings rate that equalizes the average consumption for herself and her heir. For each cohort that inherits before 1887 (and dies before 1917) this program has a unique solution, with an average savings rate of about 34%. These cohorts must save from flow income because labor costs are growing faster than wealth does just from capital gains. For cohorts who inherit after 1892 the frequency of years where $r<g$ implies that there is no solution to the problem as we defined it during the 19th century except to set savings rates to 1 and consumption to 0. Instead, we set the inheritor's savings rate to maximize the expected consumption of her heir assuming the heir will also implement that savings rate. Doing so produces savings rates between 25 and 30% from flow income for all cohorts that inherit from 1892 to 1947. Then after World War II, the perfect foresight program requires savings that are modest (less than

20%) because capital gains are substantial. This series, in any case, is quite close to the heuristic 33.3% savings rate until 1947.

The perfect foresight alternative is unrealistic because it presumes that individuals who inherited in 1877 would have set their savings rates anticipating both World War I and the Great Depression (their heirs die in 1936). Equivalently it assumes that those who inherited in 1912 would have foreseen the consequences of World War I, the Great Depression, and World War II, and the rapid rebirth of the French economy after 1950 since their heirs die in 1971. A crystal ball that sees forward for sixty years is unlikely, but these computations provide an important benchmark.

Finally, analyzing savings rates for agents who are averse to consumption volatility might well produce different results from setting consumption rates. Figure7shows both average consumption and the constant consumption equivalent for the P99.5 who either solve the perfect foresight constant savings rate problem or use the 33.3% heuristic for each cohort of decedents (1842, 1847….). Average and constant consumption are similar but constant consumption values almost always provides a lower average consumption because the rentiers consume “too much” in low return years.

The overall message, however, is clear. For rentiers, consumption opportunities were high before World War I (for the median of the 1%, steady state capital income provided at least 30 years of average labor income). For cohorts that inherited after World War I these opportunities declined very rapidly and stabilized in the post-World War II period at less than $5Y_L$.

To close this section without taxes, consider an extreme version of a perfect altruist with perfect foresight who wants to equalize consumption over a very long period of time. Let us start first with the period 1842-1913. The 442,000 francs of initial wealth allowed the dynasty to enjoy $34Y_L$ each year (equivalent to the 1/3 savings program). Had the nineteenth century capital returns and growth rate of labor costs continued into the future, the dynasty could have maintained that consumption indefinitely. The shocks that started in 1914 changed everything. Given wealth in 1912, the best a dynasty could achieve from 1912 to 1986 and avoid going bankrupt was to consume only about $14Y_L$ (the dynasty that maintains consumption at $34Y_L$ goes bankrupt in the early 1950s). Interestingly, in the absence of adjustment the steady 1/3 savings program would have led the dynasty's consumption to start at about $30Y_L$ in the 1840s, then run up to a high of about $42Y_L$ on the eve of World War I. The dynasty's wealth then plummets to a low of $2.5Y_L$ in 1951 and it would have grown slowly at the end of our period when it reached $6Y_L$ in 1986. The shocks were indeed severe, but the returns history of France does not, per se, rule out the survival of the rentier. To understand the end of the rentiers we have to bring in taxes.

Section 3: The impact of Estate Taxes

The previous section has focused on the bad news from the point of view of returns. Yet 1914-1945 was also a period of significant fiscal innovation and we start with estate taxes. As noted in the introduction, estate taxes were tiny prior to 1873 and remained very modest until 1910 when real progressivity began. To evaluate how much tax was paid, we return to our data from estates and use the information on heirs, and apply the tax

rules in force in the year when each individual died.[7] As noted earlier, French estate tax is in fact an inheritance tax with each heir's payment based on what he or she inherits and on the schedule that is relevant to his or her relationship to the deceased. This was true when taxes were proportional and the introduction of progressivity in 1902 did not change that. Thus, an estate of 100,000 francs may face a very different tax bill if it is inherited by one or more children or by cousins. We proceed in a simple way: we use all the information we have to assess the tax burden of the estate. For example, if it is to be divided among three children we divide it in three and apply the relevant rate. We then compute the tax rate faced by the estate as the total of inheritance taxes divided by the value of the estate. To examine the impact of estate taxes, we evaluate the consumption opportunities it would have afforded a dynast who had inherited the estate net of the taxes estimate it has paid. Clearly these inherited estates are artificial constructs. In general, each individual inherits from at least his or her parents, and possibly from other individuals (e.g. childless relatives). We simply do not have the data to reassemble an individual's diverse inheritances. On the other hand, we can compute the tax burden faced by different fractiles precisely because we have good detail on who inherits each estate.

As Figure 8 shows, the inheritance tax burden was negligible until World War I: even the richest Parisians paid less than 10% on the estates they inherited. However, change came abruptly: in twenty years the average burden passed 15% and for the top estate it was never less than 20% after 1932. Even small estates faced an average tax rate of 10% or more. The consequences for consumption, however, are limited. Figure 9 shows

[7] The actual estate tax paid by the estate is reported in the archival documents but in a spirit of economy we did not collect it. When we checked our computations against a sample of estates, we were very near the mark.

average consumption by cohort for the base line (33.3%) savings rate. After the introduction of the progressive inheritance tax, consumption parallels what we estimate it would have been in the absence of taxes and is only slightly lower. The limited impact of estate taxes is clarified when we consider two alternative scenarios. In the first, we make the nineteenth century cohorts pay the average tax rate of 1952 (30.7%), then these P99.5 inheritor would have had a consumption of 28 Y_L rather than 35 or more. Taxing the nineteenth century at the 1952 rates produces an important downward adjustment but insufficient to remove capital income's dominance in consumption. In the second scenario, we apply the pre-1873 rate of 1.25% estate tax to estates from the post 1932 cohorts, and find that their consumption averages 1.91 Y_L. This is better than the 1.5 they actually experienced but not by much relative to the 34 Y_L their forebears enjoyed around 1860. In short, estate taxes do not seem to matter so much. One reason is that even after high rates were put in place in the last 1920s, it took a full three decades before they applied to everyone, and by then wealth had fallen massively. The shock to wealth at death seems to occur whether or not estate taxes were in place.

Section 4: The Impact of Income Taxes

Estate taxes hit only once a generation and, as we noted above, they were kept in check for individuals with children. Because the rich had a relatively high likelihood of having children, estate taxes adversely affected rentiers' ability to consume but they did not threaten their existence. The other fiscal innovation of the twentieth century involves income taxation at rates that matter (the 19th century did have a form of income tax, the

"*taxe personelle et mobilière*" but rates were both low and strictly proportional so we leave it aside). There was one fiscal innovation prior to 1915, the IRVM but it too was small. The IRVM was a proportional tax assessed on interest payments and dividends. We apply the IRVM to 40% of the capital income of our individuals to reflect the fact that large portions of their portfolios were not subject to the tax (these included at various times government bonds, peer to peer debts, real estate, pensions, and cash equivalent assets). We also apply the rate that applies to French assets rather than the differential rates to French and foreign assets that came into force in the interwar period. Doing so probably downward biases the impact of the IRVM but, given that we want to demonstrate the importance of the income taxation, a downward bias is the right way to proceed. Again World War I ushered in rapid change and by the 1930s, the rate was about 20% and with a basis of 40% of income our procedure produces an IRVM that amounts to an 8% income tax or more.

To pay for the war effort, an aggregate income tax (IGR) was introduced in 1915 and in 1948 it absorbed the IRVM. From the outset it was a progressive tax on all income. As with modern income taxes, there were deductions depending on household size. We do not observe household composition so we fix the household of every rentier at two; we also assume that individuals inherited at about age 40 with their children on the way out of the house. At the same time, we assume that the inheritors were all married to someone with equal capital income. These assumption are certainly wrong for many households (some households were larger than two, some were single, and individual household size surely varied over time). Here again we choose to leave out variation to improve the

readability of our findings. Finally, because we do not observe labor income, we assume that its contribution is paid at the margin.

Figure 10 reports average lifetime income tax rates by income wealth fractile. This makes for an easier comparison with estate tax rates that are paid once a generation. It is important to note that these rates are composite rates from the schedules in force during the 30 years of each inheritor's life. Computing average lifetime tax rates is easy because savings, returns, and household structure do not vary across individuals. Thus, an individual's place in the wealth distribution within his or her cohort is constant over his or her lifetime. As the figure shows, tax rates are trivial for all cohorts through 1887 because their members die before the imposition of the IGR tax in 1915. After 1915 tax rates start to rise and a decline in consumption is already notable for the cohorts who inherit in 1907 (10% decline) and 1912 (13% decline) because they lived through the war. The total tax burden tops 30% for all the cohorts who inherit after 1922. The move from an effective tax rate less of than 2% to more than 30% occurs across five cohorts but most of it is accomplished in the decade and a half that follows 1915.

To understand the impact of these tax rates, we allow our inheritors to receive capital income, then pay their income tax and make a consumption versus savings decision. For simplicity, we examine what happens when they save 33.3% of after-tax income (so savings and consumption share the tax burden proportionally). Figure 11shows P99.5 consumption for each year averaged over the representative of the five cohorts present. Prior to 1912, all series look identical, consumption grows from about $27Y_L$in 1842 to $40Y_L$ in 1874.Then, after a sharp decline, it stabilizes around 33 Y_L until 1914. From 1914 to 1919 the collapse in consumption is evident. Then a gap opens between the series that

take income taxes into account and those that take estate taxes into account. Consumption without taxes is about one third higher than with taxes until the beginning of World War II. The reason is that income taxes bind identically and immediately on all cohorts but the estate tax does not. Consider 1928: the data include all the cohorts that died between 1902 and 1927, and in particular the 1902 cohort that paid an estate tax average of 5% and the 1927 cohort that paid an average of 16%.For the median of the 1% the jump is somewhat higher (from 3.3% to 17.9%). On average, the individuals who make up the observation for 1928 had thus paid about 8% in inheritance taxes. In the same year, however they all paid about 27.7% in income taxes combining the IGR and IRVM. Even after 1937, when all the cohorts have paid a substantial estate tax, the impact of income taxes is twice that of the estate tax, in part because the combination of the IGR and IRVM produced a higher rate of taxation than the 25% maximum rate allowed by the inheritance tax for children.

If we combine both sets of taxes (the All Taxes line in Figure 11) then the impact of fiscal innovation becomes stark. Prior to World War I taxes are irrelevant, consumption after tax is 95% of what it would have been in their absence. Then during the interwar period, the state takes almost 40% of all capital income. After World War II the take is closer to 60% and consumption falls dramatically.

Figure 12 shows the impact of taxes on cohort level consumption. Although, taxes reduced consumption, it is also obvious shocks had a broad impact. The cohorts that inherit after 1912 are simply poorer than the ones that came before and the decline is monotonic from 1912 to 1942. What is striking is that it seems there is very little post World War II recovery. The answer to why recovery was so limited seems to lie in the

behavior of labor income relative to wealth. Nominal wealth per positive estate grew by a factor of 6.5 from 1912 to 1947 but our different labor income measures grew by a factor of at least 90. So, at the end of World War II, given a constant average rate of return to capital, labor had become massively more expensive than it was in 1912. From 1947 to 1957, nominal wealth grew by a factor of almost 5, but labor costs grew by a bit more than 5. In the absence of a large jump in capital returns, labor remained very expensive in 1957 because of the changes that happened from 1912 to 1947.

The foregoing results depend on inheritors following the one-third savings rule of thumb, but it seems likely that they would have revised their heuristic after World War I. Just how much of change in savings rates might have occurred can be derived by examining optimal savings rates in two ways. First, we start by examining cohort level perfect foresight wealth after taxes. We plot the hypothetical wealth levels averaged over the cohorts present and compare those to the actual wealth levels that Parisian inherited linearly interpolated and what they would have had if they had followed a perfect foresight program without taxes. Figure 13 reports these two curves with the data deflated to 1912 by the Consumer price index. The perfect foresight curves and observed wealth are close until 1900 or so. Afterwards, the perfect foresight no tax curve is substantially higher than either the perfect foresight after tax curve or actual observed wealth at death. Moreover the perfect foresight curves remains persistently above actual wealth levels through the beginning of World War II. This is consistent with the notion that individuals did not adjust their savings behavior as much as they might have if they had wanted to stabilize consumption. The actual and after tax perfect foresight curves then converge in the late 1940s.

Our second approach considers the optimal saving rate for the dynasty given taxes. We consider a dynasty that makes a savings plan following the death of the founder in 1842. The dynasty seeks to equalize average consumption between 1842-1913and 1913-1986 (when the inheritors of 1957 die). In the absence of taxes, the dynast will set a savings rate of 84% and average consumption is about 21.1Y_L both before and after World War I. As Figure 14 shows, this saving program leads to consumption that grows from 6 to 40 Y_L from 1842 to 1913, then a fall to 4.8Y_L in 1951, followed by a recovery to 24Y_L in 1986. If we add estate taxes and income taxes, the constant consumption program returns has no solution (the only way to set consumption equal for both period is to set the savings rate at 100%, but that produces no consumption at all). Instead, the dynasty is best off with a savings rate of 71% that produces an average consumption of 29Y_L before World War I and 17Y_L afterwards. As when there are no taxes, consumption first rises before falling. It starts at 12Y_L in 1842, and then runs up to 50Y_L in 1913.From there consumption plummets to 3.5 Y_L in 1950. The dynasty's financial recovery after World War II is much smaller since in 1986 consumption is still below 7Y_L and wealth is only 15% of what it would have been in the absence of taxes. The 71% savings rate of the after-tax program produces very high levels of wealth on the eve of World War I—close to 8 million francs. This means the dynasty's wealth would have been be four times larger than was observed for the P99.5 in 1912. In fact, the wealth accumulated by this dynasty, which started as the median of the 1% (P99.5) in 1842, would put it at the median of the 0.1% (P99.95) in terms of actual inherited wealth on the eve of World War I (See Figure 1). If we leave out taxes, the accumulation effort of the dynasty is ever more extreme: its wealth peaks at 15

million francs in 1935 before plummeting by 75% in a decade. Clearly then, taxes made large scale accumulation much more difficult.

Finally, let us return to the issue of the disappearance of rentiers. Recall the contrasted evolution of wealth shares, consumption possibilities, and share of the population that are rentiers that we started with in the introduction. Table 2 identifies three populations: the wealthy, the inheritors (those whose wealth was at least in part inherited), and the rentier population (those whose bequests could have been produced from capitalized inherited wealth) computed with market rates of return. Since to be a rentier one has to be both an inheritor and die wealthy, the maximum possible fraction of rentiers is the share of wealthy times the share of inheritors. If inheritors save a lot, many will die wealthy and relatively few will die as rentiers. Conversely, if they consume a lot, many may still die wealthy but most will leave smaller bequest and thus be termed rentier. We evaluate the size of these groups for three periods: before World War I, the Interwar period (1922-1937) and World War II and afterwards (1942-57). Two contrasts are apparent: first, the fraction of the population that is wealthy is increasing (from 28 to 38%). This is largely the consequence of forced savings retirement programs that started in the last third of the nineteenth century. The fraction of inheritors also increases (from 38 to 47%) and that is likely a direct consequence of the secular increase in the share of the population leaving an estate to their children. As a result, the share of potential rentiers jumps from 11% to 18%. Our computations actually suggest that the fraction of rentiers changes very little (never more than 11% or less than 9%). However, before World War II the fraction of rentiers among inheritors was 85% while it was barely above half from 1942 onwards. In

the aggregate population, the proportion of inheritors was increasing just as the share of rentiers within that group was falling.

The top 1% and the top 0.1% have a different pattern. At the top of the wealth distribution, during those three periods, almost every one (at least 92%) is an inheritor—the pure self-made person is always very rare. The computed fraction of rentiers is very high before World War I but then plummets in the Interwar period and falls further to less than half of all inheritors from 1942 on, a trend that is more dramatic than for the whole of the Parisian population. After 1922, many inheritors had to save out of labor income to accumulate the bequest they left behind, in particular if they wanted to leave large bequests. Surprisingly, the wealth share of the top 0.1% remains essentially constant (it bounces around 23%) suggesting that the disasters of 1914 to 1945 did create new room at the top. That room was taken up by inheritors whose wealth grew more rapidly than the simple cumulation of capital returns would have allowed.

Conclusion

When we consider life-cycle savings, the past is self-erasing: cohorts contribute to wealth for a while and then dis-save and bequests are small. By definition, the bequest decisions of life-cycle savers do not impact the long-term distribution of wealth. Wealth at any point in time only concerns the saving and dis-saving behavior of the living. To the contrary, when we consider the many Parisian individuals with bequest motives, the past can be very persistent. This will be particularly true when there are dynastic families where accumulation decisions are driven both by inherited wealth and the desire to transmit that

wealth into the future. The history of wealth and its structure in Paris from 1842 to 1957 powerfully reflects the importance of dynastic wealth.

This paper describes two economic regimes where inherited wealth is important. In the first regime, which ended about 1914, wealth grew rapidly, taxes were low and returns were sufficiently high that modest savings programs (33.3%) of capital income allowed rich dynasts to maintain their consumption possibilities forever. In this regime, the wealth of the top 1% was high and the consumption derived from it was high as well: some 34 years of annual labor income for the median of the top 1%. There is good evidence the number of domestic servants in Paris that we obtain from French censuses that the collapse in capital incomes following World War I mattered to the consumption of the very rich. Prior to World War I servants accounted for nearly 10% of the adult population, after World War II it was less than 7% and by 1962 3.5% (see Table 3). It does seem that the rise in average labor income, which is also an indicator of average labor costs, led rich Parisians to forego servants.

In the second regime that begins with World War I, returns were low relative to the growth of labor income and taxes were high. Taken together these changes dramatically reduced consumption possibilities. The difference between total nominal returns (flow returns and capital gains) and the nominal growth rate of labor income was about 3.6% before World War I, it then fell to 2.8% before taxes and to only about 1.1% after all taxes are taken in after World War II. As a result, by the 1950s rich rentiers earned about one tenth of their income of the nineteenth century forebears. In our simulations, this decline was driven by three forces: negative shocks to wealth, high rates of taxation, and a rapid rise in labor costs. It is important to note that we chose a labor series that produces high rates of labor

income gains and thus reduces the impact of taxes and other shocks. Nonetheless, it is clear that taxes account for about half the decline in capital incomes, because the combined effects of estate and income taxes imply that about half of capital income accrued to the state.

In this context, one might also have expected inherited wealth to decline. And it did, from 75% or so before World War I to 45% in 1947. But even 45% is not trivial given the magnitude of the shocks from 1914 to 1945 (moreover by 1957 inherited wealth had returned to about 60% making up more than half the decline from the nineteenth century highs. In particular, because bequests had fallen so steeply in value in the intervening years, one might have thought that new wealth would be much more important. Instead, it seems all Parisians became poorer. It seems likely that private savings rates fell dramatically after 1915 both for rentiers and for individuals who saved out of labor income. It is also the case that for the top 1% the first half the twentieth century was a catastrophe: around 1900 the state's share of their capital income was less than 5%, in the 1940s and 1950s it was close to half.

In future work we will return to these questions because our data allow us to measure the rate of growth of wealth for each individual who inherited some wealth, providing an additional path of analysis. Yet even without such detail, it is clear that the real innovation of the twentieth century in reducing wealth inequality was the taxation that followed wars and other adverse events. Had it only been for the negative shocks themselves, the distribution of wealth in Paris and the consumption possibilities of the rich would have returned to their pre-World War I level *before* the Great Depression. Following World War II, other policy innovations contributed to a structural reduction of the consumption

possibilities of top wealth holders, including nationalization and rent control. But even then progressive tax appears to play a central role in the end of rentiers.

References

Abrégé d'Enregistrement. Paris: Préparation Francis Lefebvre 1947.

Alvaredo, F., A.B. Atkinson, S. Morrelli, "Top wealth shares in the UK over more than a century", WID Working Paper 2017.

Bayet, A., "Deux siècles d'évolution des salaires en France," Document de travail F9702 *INSEE, Direction des Statistiques Démographiques et Sociales.* 1997.

Daumard, A. *Les bourgeois de Paris au XIXe siècle*. Paris, Flammarion, 1970.

Daumard, A. *Les fortunes françaises au 19e siècle*. Paris, Mouton, 1973.

Dherbécourt, C., La fortune des héritiers. Essais sur la transmission du capital en France du Second Empire à la Seconde Guerre Mondiale, These EHESS Paris 2013.

Dalloz. Griolet, G. Et Ch. Vergé ed. *Répertoire pratique de législation, de doctrine et de jurisprudence, t. 5,* Paris, Librairie Dalloz, 1913..

Garbinti, B., J. Goupille-Lebret, T. Piketty, "Accounting for wealth inequality dynamics: data and simulations for France (1800-2010)," WID. Working Paper, 2016.

Hoffman, P. T., Jacks, D. S., Levin, P. A., & Lindert, P. H. (2002). Real inequality in Europe since 1500. *The Journal of Economic History*, *62*(2), 322-355.

Homer, S., and R. Sylla, *A History of Interest Rates.* Rutgers UP 1991

Le Bris, D., and P.-C. Hautcoeur, "A challenge to the Triumphant Optimists, A Blue Chips Index for the Paris Stock Exchange (1854-2007),"*Financial History Review*, Vol. 27, No. 2, 141-18(2010)

Lebris, D. Les actions françaises depuis 1854 : analyses et découvertes :Thèse de doctorat Université d'Orléans 2011.

Louat, T. Atlas Statistique de la Population de Paris. Paris : J. Degey et cie. 1873

Marchand, O., and C., Thélot, *Deux siècles de travail en France*. INSEE: 1991

Piketty, T., *Les Hauts revenus en France au 20e siècle: inégalités et redistribution, 1901-1998*, Ed. Grasset, 2001.

Piketty, T., "On the long-run evolution of inheritance: France 1820-2050,"*Quarterly Journal of Economics*, vol. 126, no.3, 2011, p. 1071-1131.

Piketty, T., *Capital in the 21st century*, Harvard University Press, 2014

Piketty, T., Postel-Vinay G., Rosenthal J.-L.: "Wealth concentration in a developing economy: Paris and France, 1807-1994", *American Economic Review*, vol.96, no 1, 2006, p. 236-256.

Piketty, T., Postel-Vinay G., Rosenthal J.-L.,"Inherited vs self-made wealth: theory and evidence from a rentier society (Paris 1872-1927)." *Explorations in economic history*, vol.51, n.1, 2014, p.21-40.

Piketty T., Zucman, G.: "Capital is back: wealth-income ratios in rich countries 1700-2010," Quarterly Journal of Economics, vol.129, no.3, 2014, p.1155-1210.

Piketty T., Zucman, G., « Wealth and inheritance in the long run », *Handbook of Income Distribution*, vol.2B, chapter 15, p.1303-1368, North-Holland, 2015

Tristram, F., *Une fiscalité pour la croissance: La direction générale des impôts et la politique fiscale en France de 1948 à la fin des années 1960.* Institut de la gestion publique et du développement économique. 2013.

Saez, E., G. Zucman, “Wealth Concentration in the United States since 1913”, *Quarterly Journal of Economics* 2016

Table 1:Savings and consumption levels for the top 1%

Year bequest received	Bequest received	Estate left (30yr later)	Growth Rate	Capital gains	Flow rate of capital income	Savings rate from Capital Income	Average annual labor income Y_L	Consumption expressed in Y_L
1842	262,690	536,032	2.4%	0.9%	4.7%	32.3%	308	27.3
1847	290,000	573,142	2.3%	0.9%	4.8%	29.6%	398	24.5
1852	309,944	586,988	2.2%	0.9%	4.8%	26.5%	361	30.4
1857	378,000	721,922	2.2%	0.9%	4.8%	27.3%	480	27.3
1862	378,231	730,585	2.2%	0.9%	4.7%	28.7%	514	24.5
1867	425,888	800,472	2.1%	0.9%	4.5%	27.6%	566	24.5
1872	536,032	735,203	1.1%	0.9%	4.4%	3.5%	611	37.0
1877	573,142	783,125	1.0%	0.9%	4.1%	4.4%	619	36.4
1882	586,988	798,525	1.0%	1.1%	4.0%	0.0%	688	34.5
1887	721,922	1,037,936	1.2%	1.4%	4.1%	0.0%	624	47.5
1892	730,585	1,737,176	2.9%	2.2%	4.5%	0.0%	788	42.1
1897	800,472	1,860,019	2.9%	3.9%	5.9%	0.0%	874	54.4
1902	735,203	1,755,834	2.9%	4.5%	7.0%	0.0%	886	58.0
1907	783,125	2,587,000	4.1%	3.7%	7.6%	4.3%	929	61.4
1912	798,525	6,737,031	7.4%	6.1%	8.0%	15.6%	1005	53.6
1922	1,037,936	16,700,000	9.7%	9.3%	8.3%	4.7%	3774	21.9
1927	1,737,176	43,565,217	11.3%	10.3%	8.3%	12.1%	6366	20.0

The table reports the P99wealth level for each cohort and the P99 wealth level for the cohort that dies 30 years later (e. g. 1842 and 1872) and then estimates the savings rate from capital income required so that the bequest grows to the level of the P99 estate 30 years later and the attendant consumption in years of adult labor income. E.g. an inheritor receiving P99 bequest equal to 262,690 francs in 1842 needs to save 32.3% of his or her capital income in order to leave a P99 estate equal to 536,032 francs in 1872.

Table 2: The Evolution of the Estates, Inheritors and Rentiers by Period

	Fraction with positive estate (A)	Inheritors (with separate assets) (B)	Potential Rentiers in Population (A*B)	Computed fraction Rentiers	Rentiers in Inheritors	Wealth Share	N
			All Parisians				
Pre-World War I	28%	38%	11%	9%	85%	100%	188,000
Interwar	37%	41%	15%	11%	70%	100%	107,000
World War II-after	38%	47%	18%	10%	54%	100%	91,000
			Estates P99-99.9				
Pre-World War I	100%	92%	92%	64%	70%	36%	1,692
Interwar	100%	94%	94%	57%	60%	33%	963
World War II-after	100%	94%	94%	45%	48%	31%	819
			Estates P99.9-100				
Pre-World War I	100%	95%	95%	70%	74%	23%	188
Interwar	100%	95%	95%	43%	45%	24%	107
World War II-after	100%	94%	94%	42%	44%	23%	91

Table 3: the Domestics and the adult population in Paris 1846-1962

	Adult population	Number of Servants	Number of male Servants	Number of female servants	Number of servants/Parisian adult population	Female among servants %
1846	721,956	67,554	19,720	47,834	9.4%	71%
1856	873,766	83,826	19,070	64,756	9.6	77
1866	1,313,990	113,337	29,993	83,344	8.6	74
1872	1,348,946	112,031	30,248	81,783	8.3	73
1881	1,603,770	178,832	49,510	129,322	11.2	72
1886	1,650,338	132,416	30,658	101,758	8.0	77
1891	1,771,033	133,541	29,208	104,333	7.5	78
1896	1,837,244	200,418	36,907	163,511	10.9	82
1926	2,225,961	193,645	22,053	171,592	8.7	89
1931	2,206,659	191,819	21,506	170,313	8.7	89
1946	2,067,855	134,838	11,269	123,569	6.5	92
1954	2,203,097	87,975	3,012	84,963	4.0	97
1962	2,197,527	77,704	3,215	74,489	3.5	96

Sources: French censuses

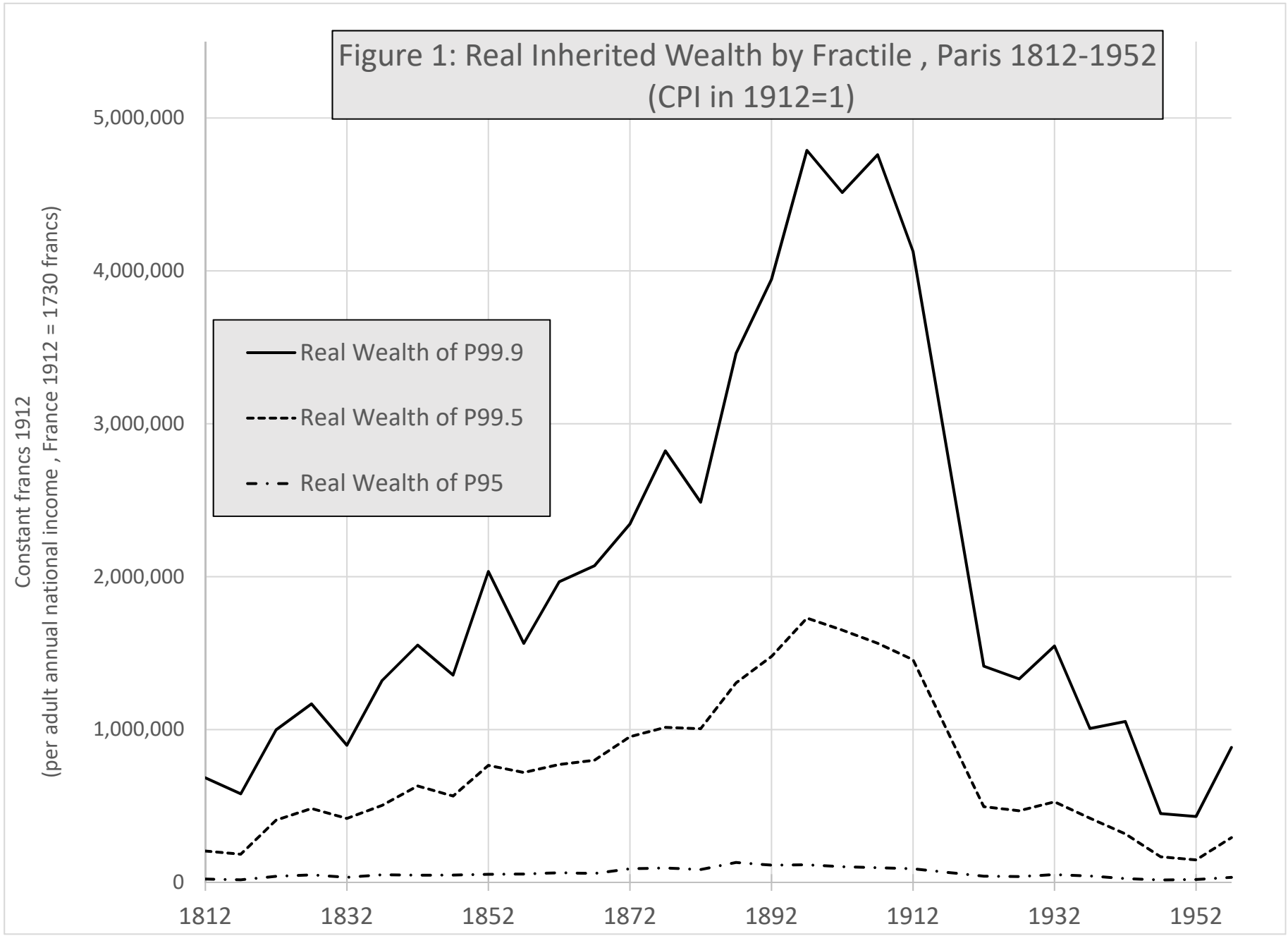
Figure 1: Real Inherited Wealth by Fractile , Paris 1812-1952
(CPI in 1912=1)
Constant francs 1912
(per adult annual national income , France 1912 = 1730 francs)
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
1812
1832
1852
1872
1892
1912
1932
1952
Real Wealth of P99.9
Real Wealth of P99.5
Real Wealth of P95

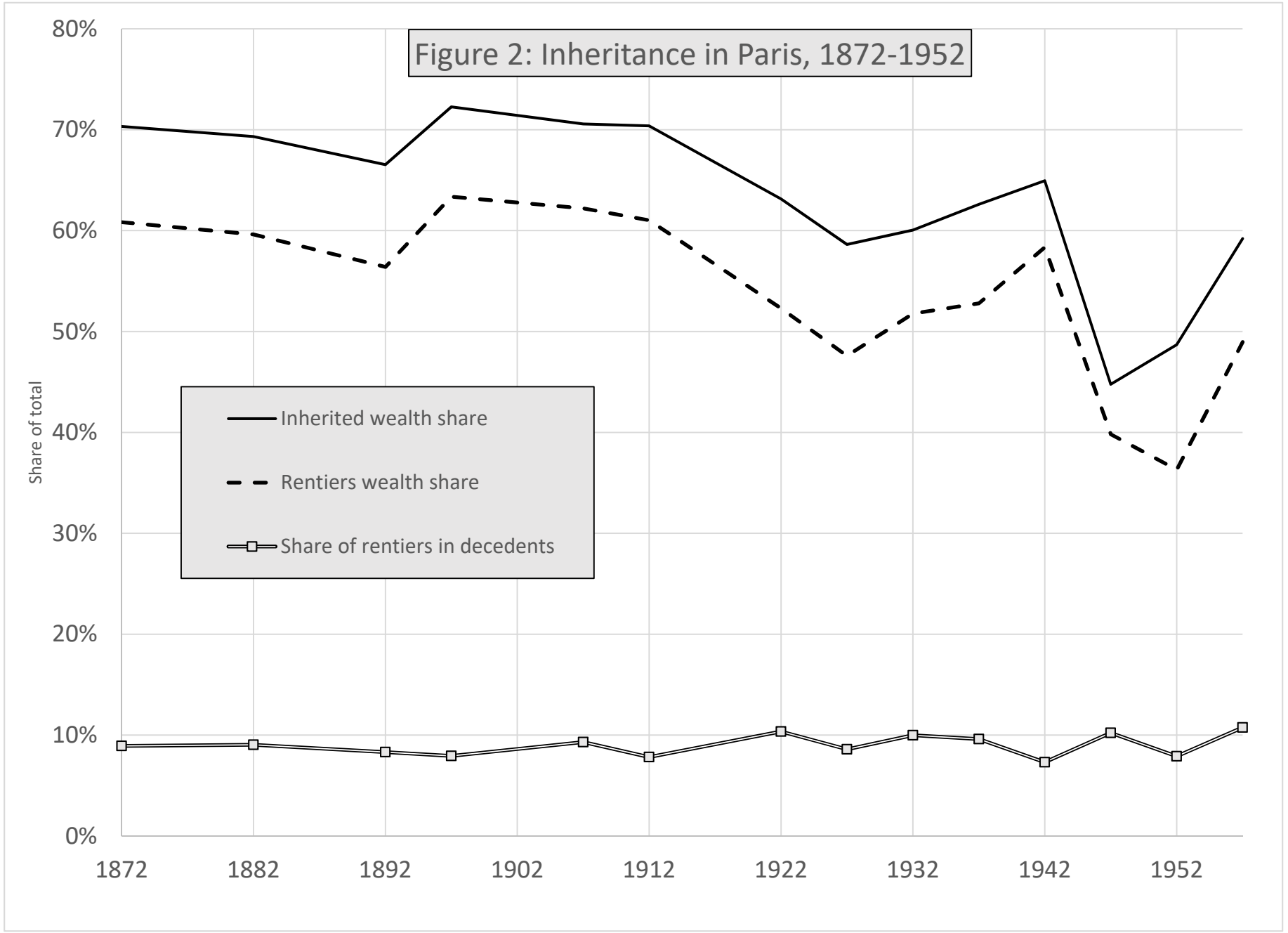
Figure 2: Inheritance in Paris, 1872-1952
80%
70%
60%
50%
40%
30%
20%
10%
0%
Share of total
1872
1882
1892
1902
1912
1922
1932
1942
1952
Inherited wealth share
Rentiers wealth share
Share of rentiers in decedents

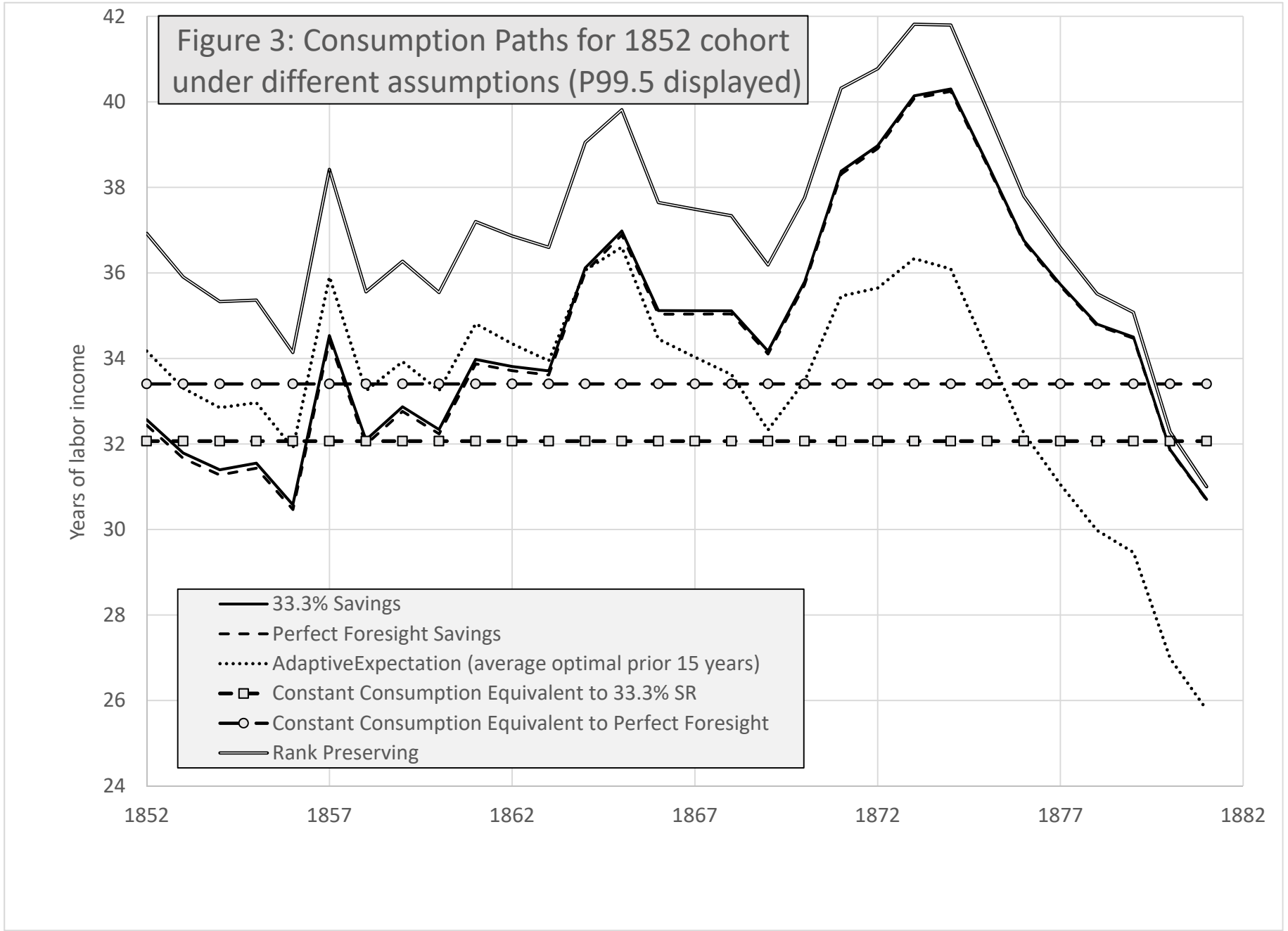
Figure 3: Consumption Paths for 1852 cohort under different assumptions (P99.5 displayed)
Years of labor income
42
40
38
36
34
32
30
28
26
24
1852
1857
1862
1867
1872
1877
1882
33.3% Savings
Perfect Foresight Savings
AdaptiveExpectation (average optimal prior 15 years)
Constant Consumption Equivalent to 33.3% SR
Constant Consumption Equivalent to Perfect Foresight
Rank Preserving

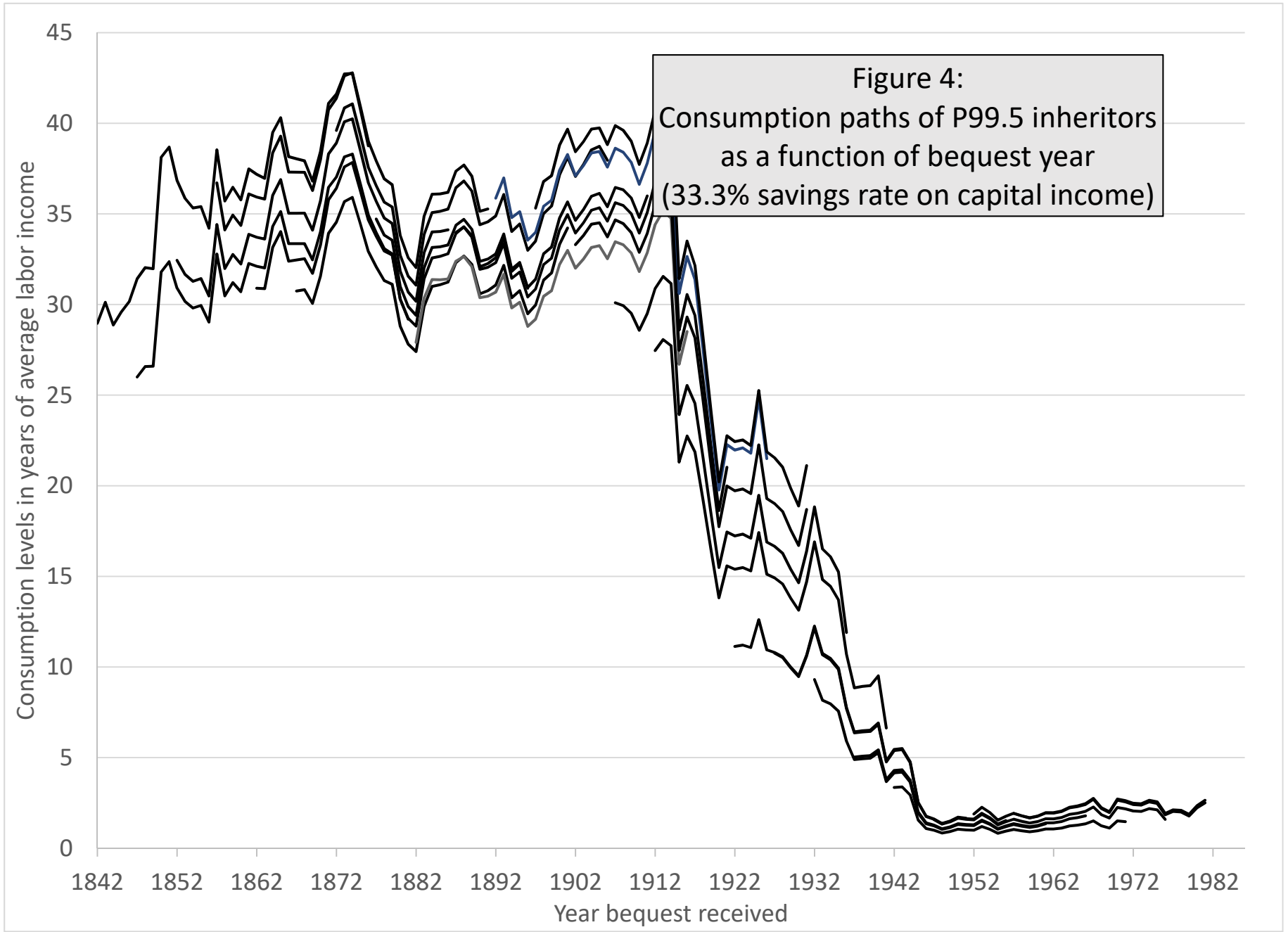
Figure 4:
Consumption paths of P99.5 inheritors
as a function of bequest year
(33.3% savings rate on capital income)
Consumption levels in years of average labor income
45
40
35
30
25
20
15
10
5
0
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952
1962
1972
1982
Year bequest received

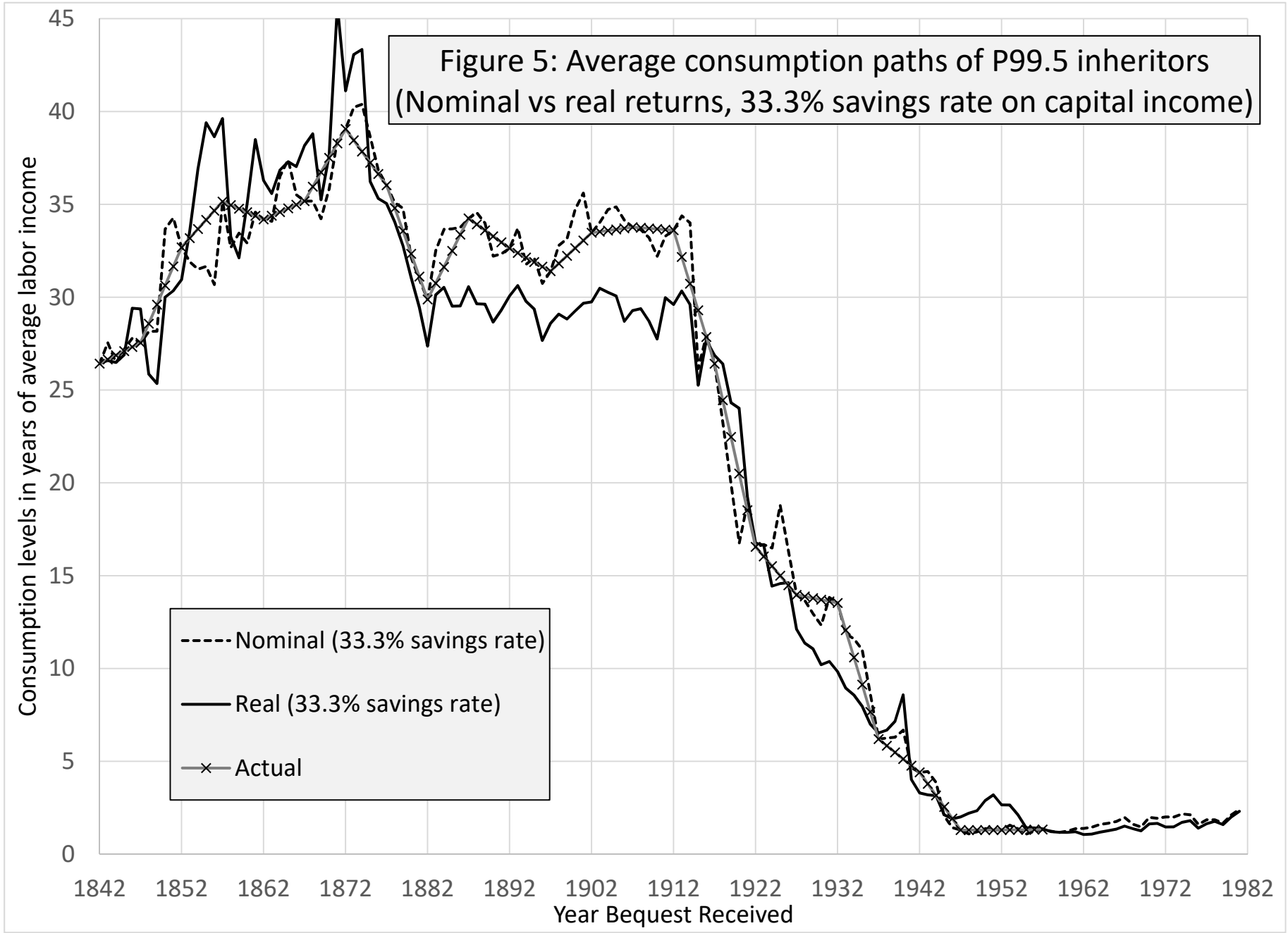
Figure 5: Average consumption paths of P99.5 inheritors
(Nominal vs real returns, 33.3% savings rate on capital income)
Consumption levels in years of average labor income
Year Bequest Received
Nominal (33.3% savings rate)
Real (33.3% savings rate)
Actual
0
5
10
15
20
25
30
35
40
45
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952
1962
1972
1982

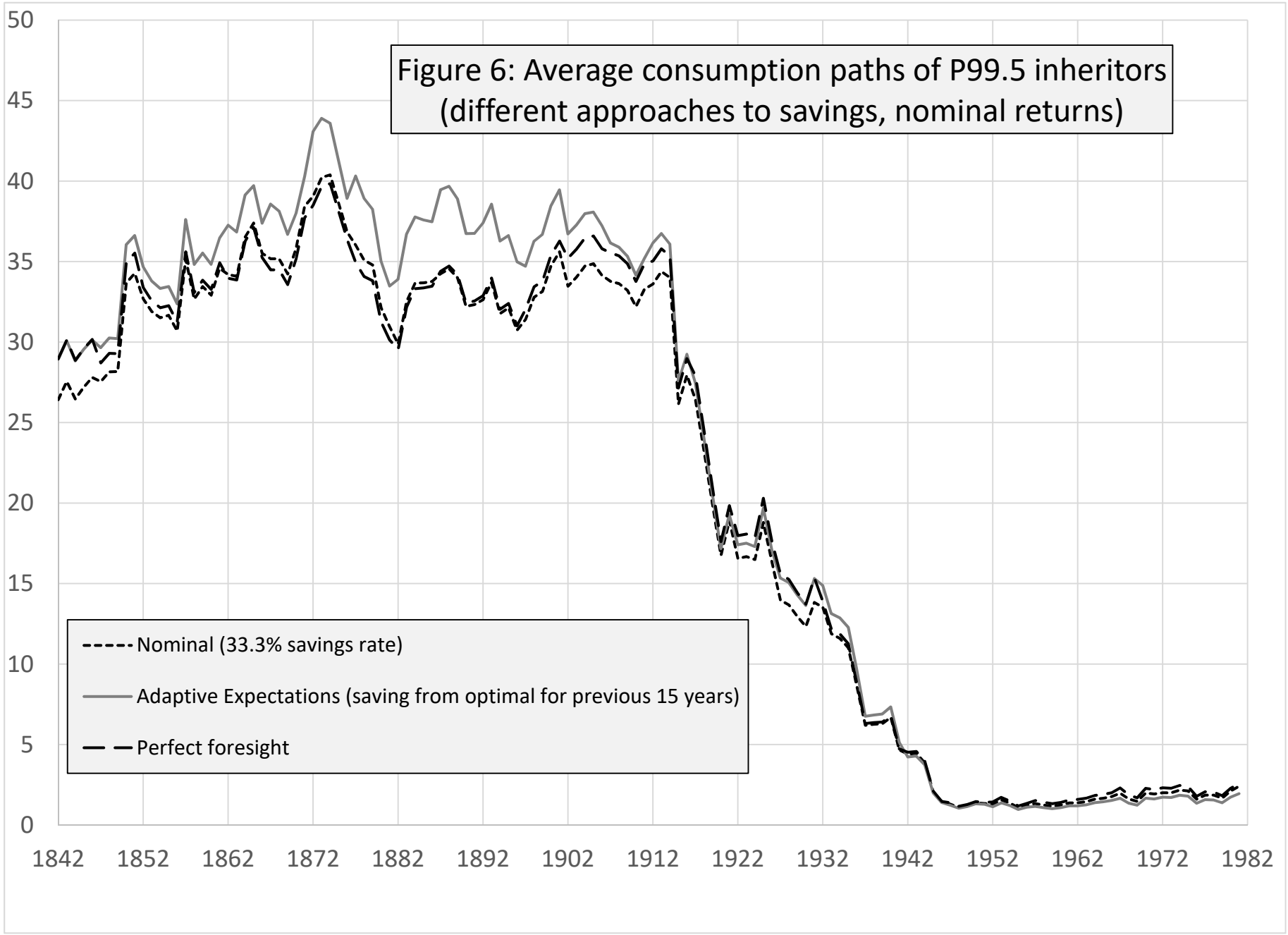
Figure 6: Average consumption paths of P99.5 inheritors (different approaches to savings, nominal returns)
50
45
40
35
30
25
20
15
10
5
0
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952
1962
1972
1982
Nominal (33.3% savings rate)
Adaptive Expectations (saving from optimal for previous 15 years)
Perfect foresight

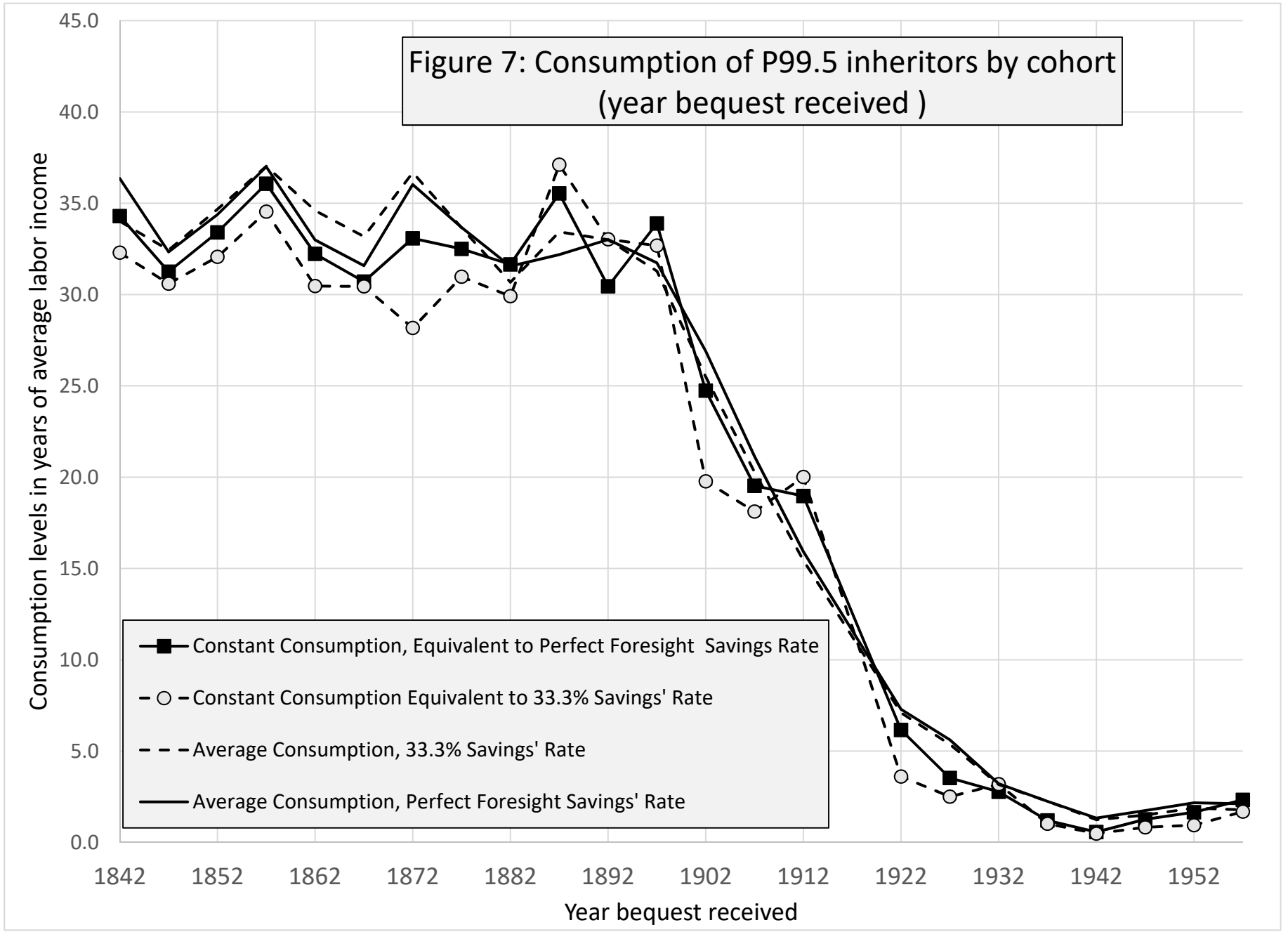
Figure 7: Consumption of P99.5 inheritors by cohort (year bequest received)
Consumption levels in years of average labor income
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952
Year bequest received
Constant Consumption, Equivalent to Perfect Foresight Savings Rate
Constant Consumption Equivalent to 33.3% Savings' Rate
Average Consumption, 33.3% Savings' Rate
Average Consumption, Perfect Foresight Savings' Rate

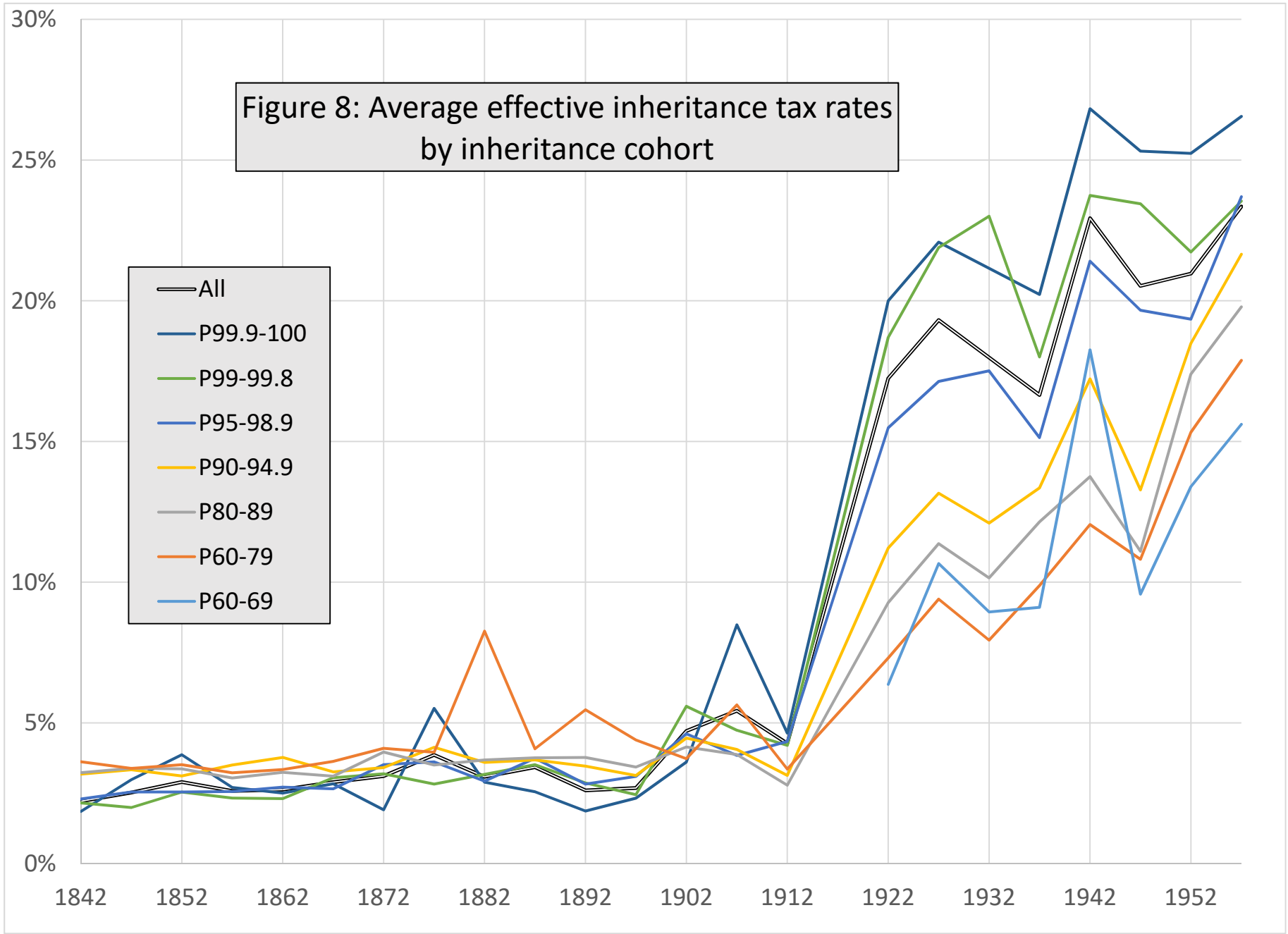
Figure 8: Average effective inheritance tax rates by inheritance cohort
All
P99.9-100
P99-99.8
P95-98.9
P90-94.9
P80-89
P60-79
P60-69
30%
25%
20%
15%
10%
5%
0%
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952

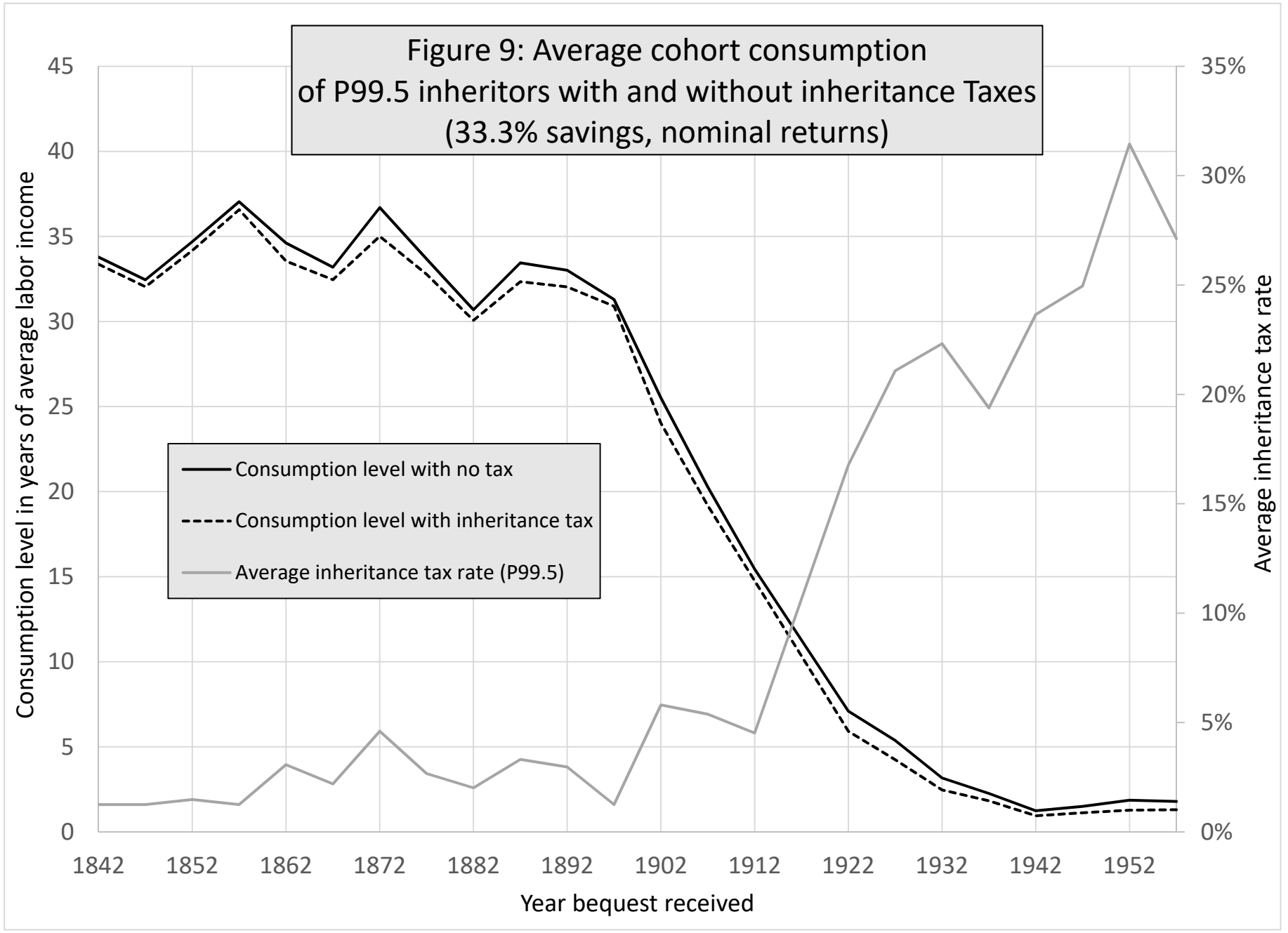
Figure 9: Average cohort consumption
of P99.5 inheritors with and without inheritance Taxes
(33.3% savings, nominal returns)
Consumption level in years of average labor income
Average inheritance tax rate
Year bequest received
Consumption level with no tax
Consumption level with inheritance tax
Average inheritance tax rate (P99.5)
0
5
10
15
20
25
30
35
40
45
0%
5%
10%
15%
20%
25%
30%
35%
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952

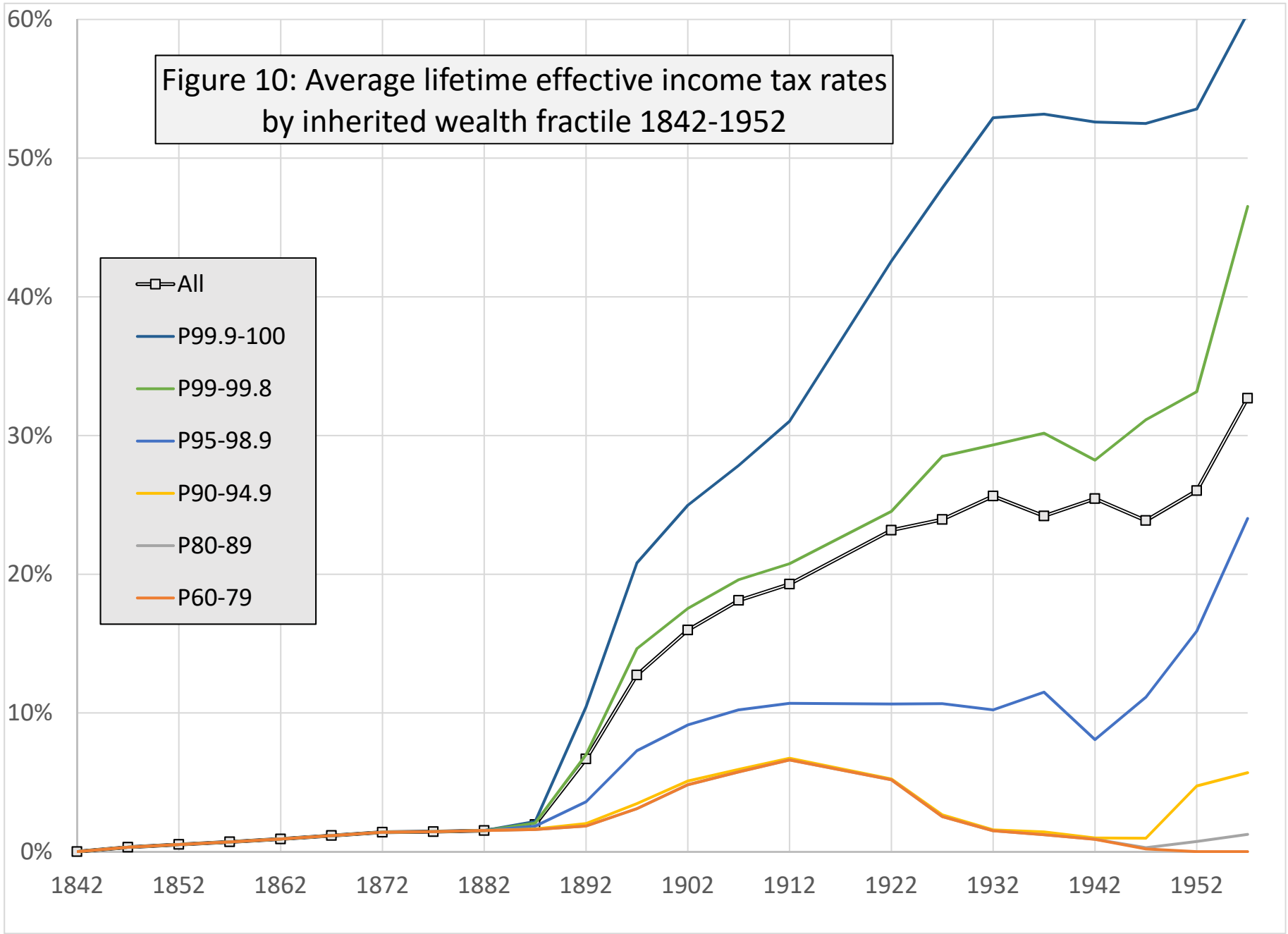
Figure 10: Average lifetime effective income tax rates by inherited wealth fractile 1842-1952
60%
50%
40%
30%
20%
10%
0%
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952
All
P99.9-100
P99-99.8
P95-98.9
P90-94.9
P80-89
P60-79

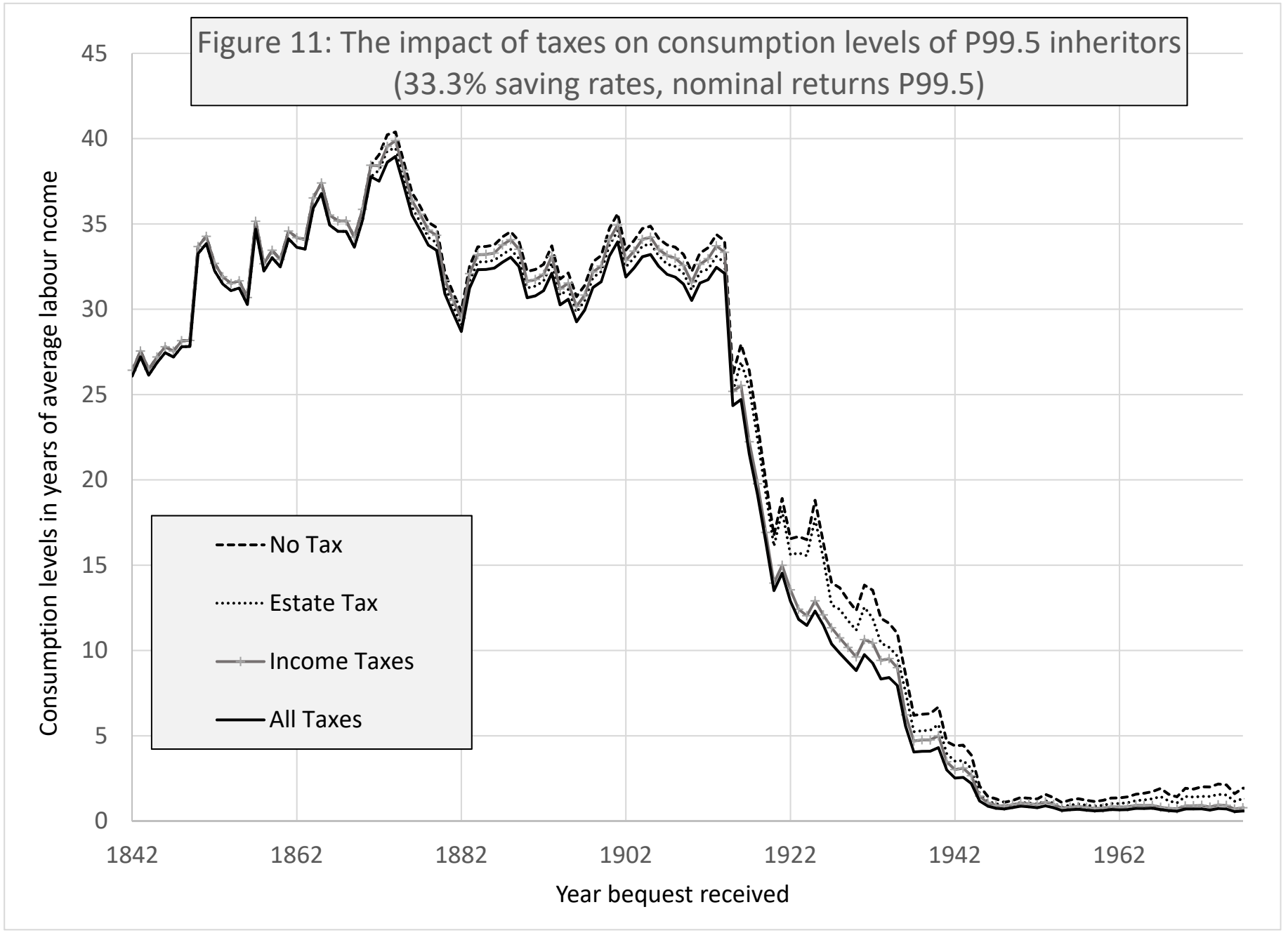
Figure 11: The impact of taxes on consumption levels of P99.5 inheritors
(33.3% saving rates, nominal returns P99.5)
Consumption levels in years of average labour ncome
45
40
35
30
25
20
15
10
5
0
1842
1862
1882
1902
1922
1942
1962
Year bequest received
No Tax
Estate Tax
Income Taxes
All Taxes

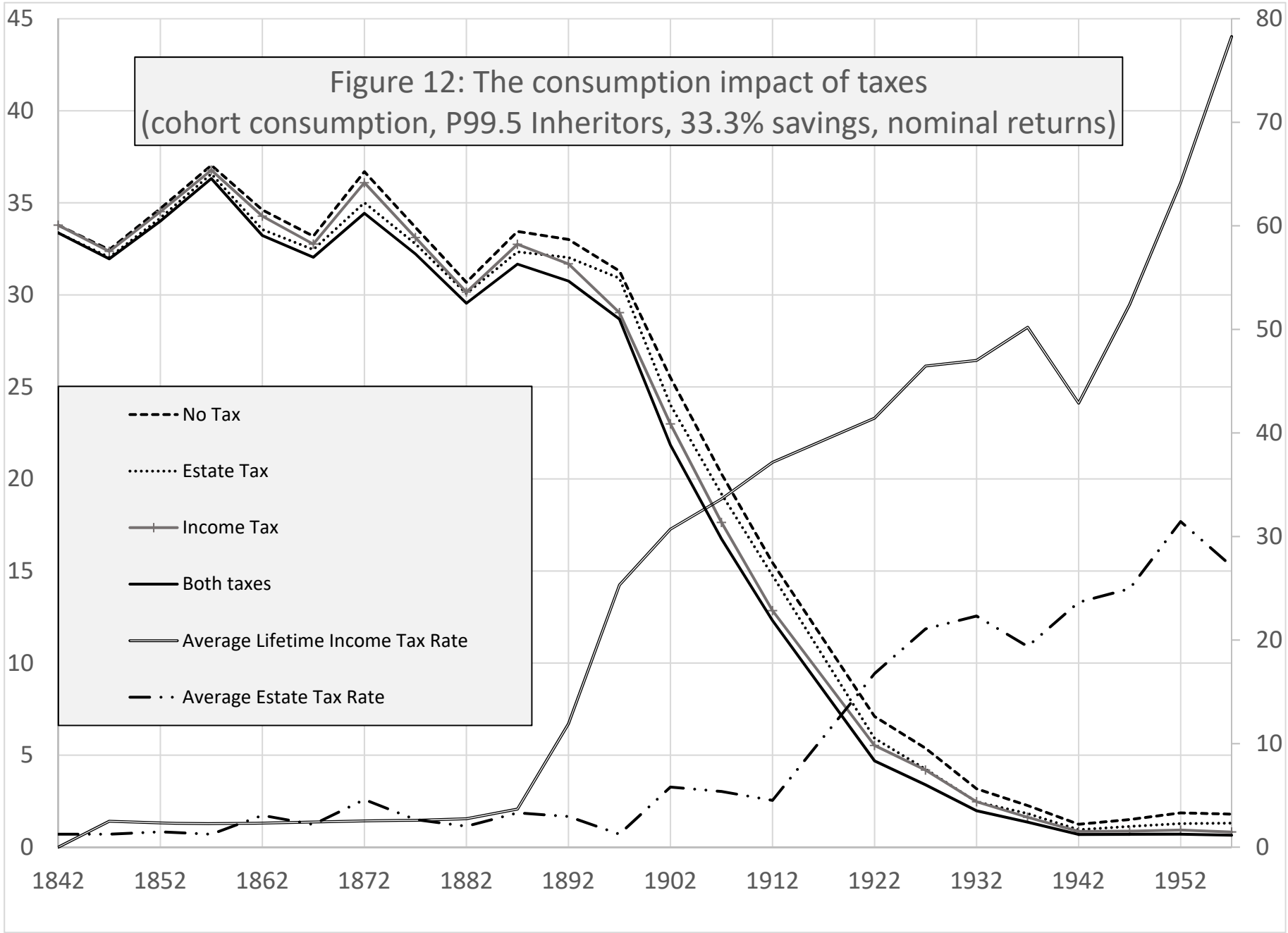
Figure 12: The consumption impact of taxes
(cohort consumption, P99.5 Inheritors, 33.3% savings, nominal returns)
No Tax
Estate Tax
Income Tax
Both taxes
Average Lifetime Income Tax Rate
Average Estate Tax Rate
45
40
35
30
25
20
15
10
5
0
80
70
60
50
40
30
20
10
0
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952

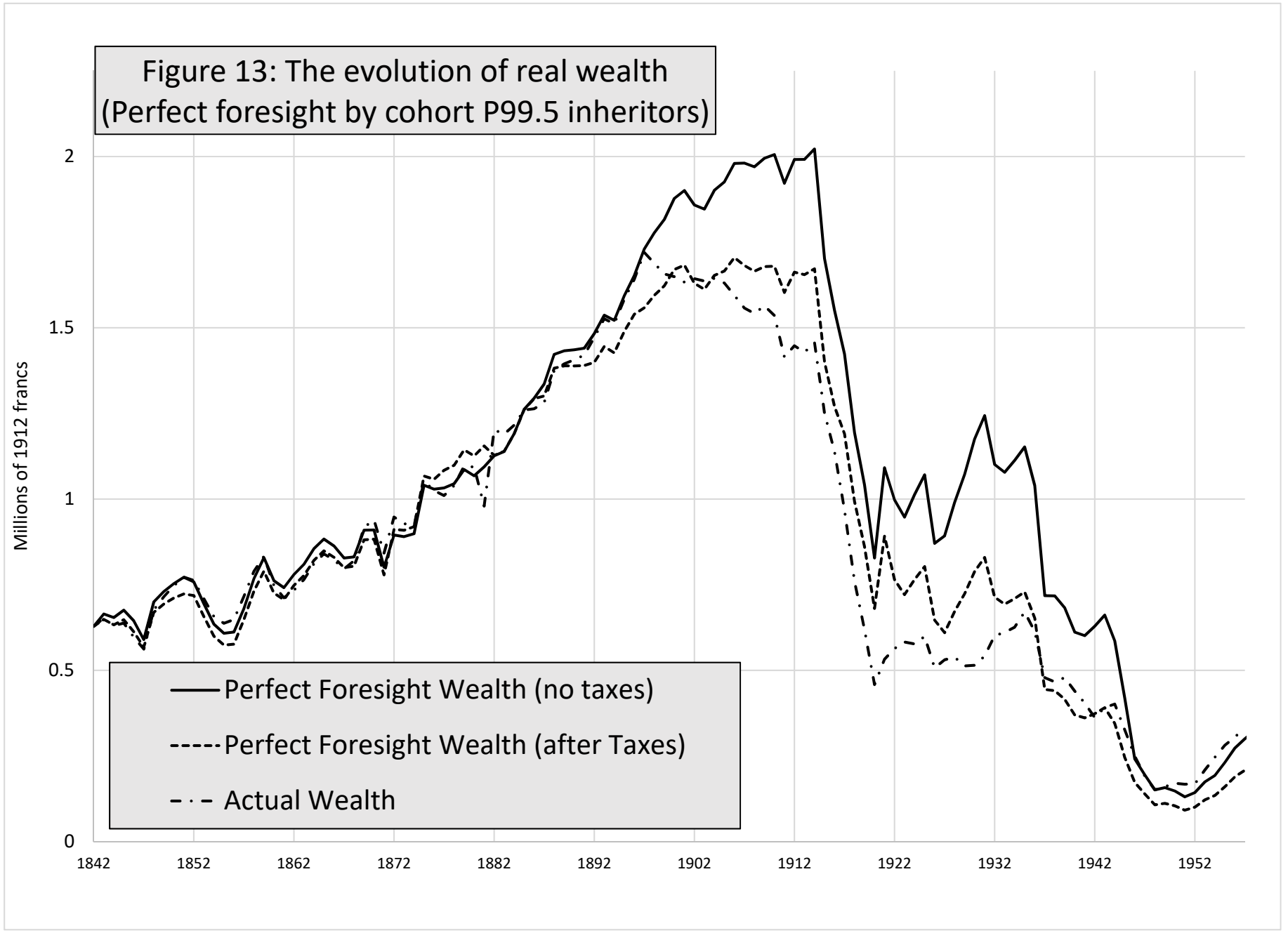
Figure 13: The evolution of real wealth
(Perfect foresight by cohort P99.5 inheritors)
Millions of 1912 francs
2
1.5
1
0.5
0
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952
Perfect Foresight Wealth (no taxes)
Perfect Foresight Wealth (after Taxes)
Actual Wealth

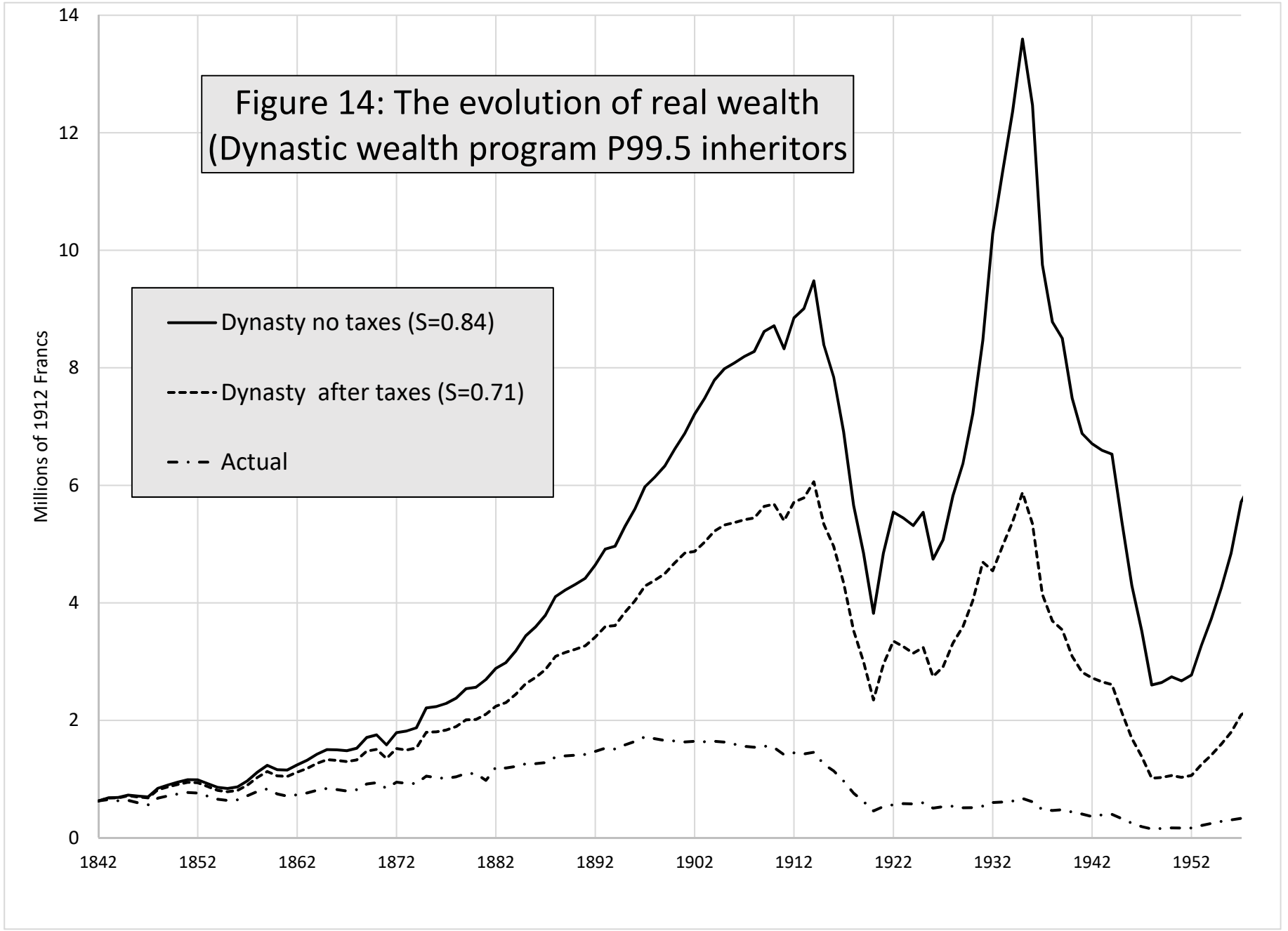
Figure 14: The evolution of real wealth
(Dynastic wealth program P99.5 inheritors
Dynasty no taxes (S=0.84)
Dynasty after taxes (S=0.71)
Actual
Millions of 1912 Francs
0
2
4
6
8
10
12
14
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1942
1952

Appendices for

The End of the Rentiers: Paris 1842-1957

Thomas Piketty, Gilles Postel-Vinay, Jean-Laurent Rosenthal *

Appendix A: Additional Evidence

A1: The sample

Table A1 Sample Values

	Full sample response rate	Number of decedents	N. with net estate>0	% with net estate >0	Consumer price index (1912=100)	Average estate (net estate>0)	Average estate (all deced.)	Aggregate inheritance flow (millions)
						1912 francs)		
1807	100%	11,617	3,560	31%	68	24,489	7,504	87
1812	100%	11,266	3,811	34%	98	18,000	6,089	69
1817	100%	11,654	3,147	27%	107	19,947	5,386	63
1822	100%	13,057	3,809	29%	61	46,205	13,479	176
1827	100%	13,834	3,762	27%	66	48,626	13,223	183
1832	100%	31,380	6,890	22%	72	46,095	10,121	318
1837	100%	16,603	4,864	29%	69	48,966	14,345	238
1842	100%	16,936	4,419	26%	72	64,645	16,867	286
1847	100%	17,831	4,742	27%	80	59,713	15,880	283
1852	100%	16,577	4,495	27%	69	75,916	20,585	341
1857	100%	18,906	5,779	31%	89	57,594	17,605	333
1862	100%	24,428	6,907	28%	83	76,424	21,609	530
1867	100%	27,989	7,248	26%	91	79,346	20,547	575
1872	87%	21,287	6,064	28%	96	92,110	26,239	639

Table A1 Sample Values								
	Full sample response rate	Number of decedents	N. with net estate>0	% with net estate >0	Consumer price index (1912=100)	Average estate (net estate>0)	Average estate (all deced.)	Aggregate inheritance flow (millions)
						1912 francs)		
1877	98%	28,161	8,144	29%	95	106,267	30,732	884
1882	86%	31,720	8,120	26%	96	103,079	26,387	971
1887	92%	31,399	9,680	31%	89	124,522	38,389	1,314
1892	88%	32,695	8,535	26%	90	169,013	44,121	1,634
1897	91%	31,197	8,232	26%	85	160,722	42,410	1,446
1902	92%	33,424	9,210	28%	87	154,528	42,580	1,544
1907	90%	35,755	9,456	26%	88	152,982	40,459	1,599
1912	94%	34,840	9,747	28%	100	133,547	37,362	1,378
1917					166			
1922	85%	28,278	9,163	32%	311	53,553	17,353	578
1927	90%	28,258	9,656	34%	571	45,151	15,428	485
1932	84%	26,533	10,120	38%	534	51,141	19,506	619
1937	81%	24,546	10,370	42%	613	35,883	15,159	459
1942	97%	47,206	14,460	31%	1,241	36,037	11,039	540
1947	88%	22,059	9,900	45%	6,370	13,685	6,142	153
1952	89%	23,305	8,845	38%	16,362	16,139	6,125	160
1957	92%	26,783	11,723	44%	17,488	24,461	10,707	312
Total	89%	*727,907*	*221,298*	*30%*				

Table A2: Average Age at Death

	men		women		Men and Women		(France)	
	(all)	(net estate>0)	(all decedents)	(net estate>0)	(all decedents)	(net estate>0)	(men)	(women)
1807	49.6	58.7	56.0	56.2	52.6	57.5		
1812	49.6	59.9	56.1	56.7	52.6	58.3		
1817	49.7	56.7	55.8	54.0	52.5	55.3		
1822	47.4	56.7	54.1	53.1	50.4	54.9	56.9	56.6
1827	50.3	58.9	53.8	55.1	52.1	57.0	56.6	56.8
1832	50.2	55.2	50.9	53.0	50.6	54.0	56.4	57.1
1837	51.1	56.8	51.0	54.8	51.0	55.8	56.3	57.3
1842	47.4	54.9	49.7	54.0	48.5	54.5	56.2	57.5
1847	48.6	56.0	50.9	54.9	49.8	55.4	56.1	57.6
1852	48.8	55.8	51.2	53.9	50.1	54.9	56.7	58.5
1857	47.1	54.2	49.4	53.1	48.3	53.6	57.1	59.0
1862	49.9	55.1	50.4	53.7	50.1	54.5	57.5	59.6
1867	50.4	55.4	51.6	55.0	51.0	55.2	57.9	60.1
1872	49.1	55.9	49.7	54.5	49.4	55.3	58.2	60.5
1877	50.1	55.6	51.9	55.6	51.0	55.6	58.5	61.0
1882	48.0	55.4	50.7	55.8	49.2	55.6	58.8	61.3
1887	49.4	55.4	52.8	57.1	51.0	56.1	58.9	61.5
1892	53.3	56.4	50.6	58.5	51.8	57.3	59.2	61.8
1897	51.0	55.9	54.5	57.2	52.7	56.5	59.4	62.0
1902	51.6	55.2	54.3	56.4	52.9	55.7	59.6	61.5
1907	52.0	55.6	55.5	58.1	53.7	56.8	59.7	62.2
1912	52.0	54.9	56.0	58.3	54.0	56.4	59.5	62.3
1917							50.9	63.7
1922	54.8	58.1	57.5	60.4	56.2	59.1	61.4	63.6
1927	54.6	58.1	57.4	60.0	56.1	59.0	61.4	64.1
1932	55.0	59.2	60.1	61.3	57.5	60.2	61.4	64.7
1937	56.6	60.1	62.1	62.9	59.3	61.4	61.9	65.8
1942	55.8	65.1	55.2	62.2	55.4	63.8	62.0	67.0
1947	60.0	62.0	65.1	65.5	62.7	63.7	64.7	68.6
1952	63.1	64.4	68.0	67.6	65.6	65.9	66.1	70.5
1957	63.9	64.9	69.7	69.3	66.8	66.8	66.4	71.9
1962								

Table A3: Place of Birth and Marriage		
	Share Parisian	
	At Birth	At Marriage
1872		62.3%
1882		61.1%
1892	17.3%	60.9%
1897	24.8%	58.0%
1907	25.4%	64.8%
1912	25.6%	67.8%
1922	29.5%	65.0%
1927	27.8%	63.7%
1932	27.8%	65.2%
1937	28.2%	63.3%
1942	28.8%	64.7%
1947	28.3%	63.1%
1952	28.5%	62.0%
1957	32.6%	64.8%

Table A4: average estate (all decedents) by age group (50-59=100)							
	20-29	30-39	40-49	50-59	60-69	70-79	80+
1807	11%	48%	90%	100%	70%	98%	138%
1812	10%	76%	107%	100%	101%	119%	273%
1817	10%	17%	25%	100%	54%	58%	65%
1822	17%	30%	52%	100%	100%	60%	87%
1827	13%	41%	47%	100%	83%	94%	84%
1832	28%	62%	75%	100%	111%	106%	162%
1837	21%	50%	88%	100%	132%	145%	188%
1842	14%	33%	52%	100%	107%	239%	216%
1847	17%	42%	60%	100%	165%	209%	237%
1852	21%	25%	63%	100%	179%	211%	437%
1857	10%	23%	45%	100%	129%	133%	271%
1862	13%	23%	49%	100%	133%	187%	182%
1867	22%	27%	64%	100%	200%	259%	370%
1872	19%	29%	108%	100%	212%	250%	301%
1877	21%	50%	56%	100%	203%	308%	548%
1882	12%	21%	50%	100%	157%	241%	385%
1887	16%	21%	52%	100%	158%	282%	459%
1892	17%	26%	36%	100%	220%	185%	787%
1897	8%	18%	45%	100%	161%	217%	288%
1902	28%	23%	50%	100%	201%	270%	414%
1907	27%	20%	46%	100%	196%	322%	488%
1912	13%	23%	48%	100%	215%	263%	376%
1922	26%	37%	75%	100%	174%	328%	368%
1927	12%	24%	49%	100%	131%	143%	206%
1932	24%	36%	53%	100%	269%	270%	291%
1937	25%	40%	106%	100%	167%	240%	297%
1942	7%	15%	30%	100%	193%	228%	388%
1947	32%	37%	69%	100%	122%	169%	233%
1952	27%	37%	70%	100%	141%	167%	240%
1957	17%	49%	48%	100%	126%	138%	162%

Appendix B: Saving and consumption rates

B1: Computing savings rates for the perfect foresight program.

Our perfect altruist wants to find a savings rate ŝ such that his undiscounted consumption is equal to her heir if he uses the same savings program.

Notation: the altruist is denoted by the subscript A and the heir by the subscript H

Wealth is W_{it} it evolves at the rate $W_{it+1} = W_{it}(1+\hat{s}r_{ft} + r_{gt})$

Where ŝ is the savings rate from flow income to capital, r_{ft} is the flow rate of return, r_{gt} is the rate of capital gains.

Consumption by individual i in year t is $C_{it} = W_{it}(1-s)(r_{ft})$.

Life time undiscounted consumption for the altruist who inherits W_{At} at date T is

$$C_{AT} = \sum_{d=T}^{d=T+29} W_{At}(1-\hat{s})r_{fT}/l_t \text{ ; or}$$

$$C_{AT} = W_{AT}\left(\sum_{d=T}^{d=T+29}\prod_{t=T}^{t=d}\left(1+\hat{s}r_{ft}+r_{gt}\right)(1-\hat{s})r_{ft})/l_t\right)$$

Life time undiscounted consumption for the heir is

$$C_{HT} = W_{HT}\left(\sum_{d=T+30}^{d=T+59}\prod_{t=T}^{t=d}\left(1+\hat{s}r_{ft}+r_{gt}\right)(1-\hat{s})r_{ft})/l_t\right)$$

Finding ŝ such that $C_{AT} = C_{HT}$ is relatively simple in many years (1842-1887 and 1932-1957) the difference function has a unique interior 0. In the intervening years. In the intervening years, the returns to wealth are so poor relative to the change in labor costs that the only solution is to set the savings rate to 1 and consume nothing at all. In any other rate, the altruist consumes more than the heir. This is clearly not the savings rate we want. The problem actually begins with 1867, there setting $C_{AT} - C_{HT}$ to zero inplies ŝ=42.8% and altruist and her heir both consume 30.16 years of labor. It turns out this is not renegotiation proof. Indeed, there exists an alternative savings rate ŝ' that maximizes the heir's consumption and it is also acceptable to the altruist because it is the best she can do for her heir and her consumption is higher than when we set $C_{AT} - C_{HT}$ to zero. In 1867 that rate is 39% and it provides a consumption of 31.5 to the altruist and 30.2 to the heir. The problem essentially boils down to whether C_{AT} is decreasing in s and C_{HT} is increasing in s around ŝ. In this case ŝ=ŝ'.

B2. Computing savings rates for the Adaptive Expectation program

In this case we post a simpler problem. The altruist computes the optimal savings rate for past periods and then averages the three most recent observation to set her savings rate for the next five years. When the altruist inherits in 1867 she compute the optimal

savings rate for 1852, 1857, and 1862. For 1852 $\hat{s}_a$ must set consumption equal for the periods 1852-56 and 1857-61 or

$$D_T = \left(\sum_{d=T}^{d=T+4} \prod_{t=T}^{t=d} \left(1 + \hat{s}_a r_{ft} + r_{gt}\right)(1 - \hat{s}_a) r_{ft}/l_t \; - \sum_{d=T+5}^{d=T+9} \prod_{t=T}^{t=d} \left(1 + \hat{s}_a r_{ft} + r_{gt}\right)(1 - \hat{s}_a) r_{ft}/l_t \right)$$

There are two key differences with the perfect foresight program. First these shorter intervals can lead to consumption of the heir being higher than consumption of the altruist under any savings rate program leading to a corner solution $\hat{s}_a = 0$. Second, these rates are retrospective so the altruist could actually compute this program and execute it.

B3. Computing savings rates for the Rank Preserving program

From 1842 to 1927 can link a fractile's wealth W_{AI} to its corresponding value 30 years later (the intergenerational interval) W_{AD} this allows us to compute the savings rate $\hat{s}_r$ such that the altruist produces an estate at the same rank

$$W_{AD} = W_{AI} \prod_{t=T}^{t=T+29} \left(1 + \hat{s}_r r_{ft} + r_{gt}\right)$$

B4 Computing savings rates for other programs

The 1842-1986 perfect foresight savings rate 34% so we set the heuristic 1/3 a simple number. Similarly we also compute the consequence of a savings' program do as your parents should have done. In 1867 the altruist implements the 1837 perfect foresight equilibrium.

B5: Computing constant consumption rates.

To find the constant consumption equivalent we look for the constant consumption that replicates the wealth at death of any of the constant savings programs above. Because wealth at death is strictly decreasing in consumption over the altruist's lifetime this problem is easy to solve.