

## Accounting for Wealth Inequality Dynamics: Methods, Estimates and Simulations for France (1800-2014)

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**Abstract.** This paper combines different sources and methods (income tax data, inheritance registers, national accounts, wealth surveys) in order to deliver consistent, unified wealth distribution series by percentiles for France over the 1800-2014 period, with detailed breakdowns by age, gender, income and assets over the 1970-2014 sub-period. We find a large decline of the top 10% wealth share from the 1910s to the 1980s (from 80-90% of total wealth during the 19<sup>th</sup> century up until World War 1, down to 50-60% in the 1980s), mostly to the benefit of the middle 40% of the distribution (the bottom 50% wealth share is always less than 10%). Since the 1980s-90s, we observe a moderate rise of wealth concentration, with large fluctuations due to asset price movements. In effect, rising inequality in saving rates and rates of return pushes toward rising wealth concentration, in spite of the contradictory effect of housing prices. We develop a simple simulation model highlighting how the combination of unequal saving rates, rates of return and labor earnings leads to large multiplicative effects and high steady-state wealth concentration. Small changes in the key parameters appear to matter a lot for long-run inequality. We discuss the conditions under which rising concentration is likely to continue in the coming decades.

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[Section 1. Introduction](#)

[Section 2. Relation to existing literature](#)

[Section 3. Concepts, data sources and methodology](#)

[Section 4. Long run wealth inequality series, 1800-2014](#)

[Section 5. Inequality breakdowns by age and assets, 1970-2014](#)

[Section 6. Accounting for wealth inequality: models and simulations](#)

[Section 7. International comparisons](#)

[Section 8. Concluding comments and research perspectives](#)

[References](#)

## **Section 1. Introduction**

Measuring the distribution of wealth involves a large number of imperfect and sometimes contradictory data sources and methodologies. In turn, the lack of reliable data series has made it very difficult for economists so far to test quantitative models of wealth accumulation and distribution. In this paper, we attempt to show that these measurement limitations can to some extent be overcome (using the case of France as an illustration), and that the new resulting series can be used to better understand the long-run determinants of wealth concentration.

This paper has two main objectives. Our first objective is related to the measurement of wealth inequality. We show that various sources of wealth data and methods can and should be reconciled and used together in order to obtain a consistent picture of wealth inequality trends. We illustrate this general point using detailed data for the case of France (a particularly interesting case, especially because of the early availability of homogenous inheritance registers from 1800 onwards). In effect, we combine different sources and methods (particularly income tax data, inheritance registers, national accounts, wealth surveys) in order to deliver consistent, unified wealth distribution series by percentiles for France over the 1800-2014 period.

Regarding the 1970-2014 period, we favor a mixed capitalization method based on income tax data and household surveys. The income capitalization method is in our view the most appropriate method for assets which generate taxable income flows and for certain parts of the distribution which are not well covered in surveys (particularly the top). However, it needs to be supplemented with additional

information coming from other data sources (particularly wealth surveys) regarding certain tax-exempt assets and certain parts of the distribution (particularly the bottom). Our mixed capitalization method allows us to highlight new dimensions of wealth inequality. First, it offers detailed wealth inequality series broken down by percentile, age, gender and asset categories for the 1970-2014 sub-period. Second, it allows to estimate the joint distribution of income and wealth as well as the determinants of wealth inequality dynamics such as rates of return, saving rates and rates of capital gains by wealth groups.

Over the longer run, we link up our 1970-2014 series together with historical 1800-1970 series that we construct using the estate multiplier method based on inheritance tax data (the only data source and method available over such a long period). We show that the two methods deliver consistent estimates over the 1970-2014 period, which is reassuring and gives us confidence in the fact that we can link up the two series. As a result, our unified series offer homogenous wealth inequality series broken down by percentile covering the entire 1800-2014 period. We also offer detailed comparisons and reconciliations with other data sources (wealth tax data and billionaire lists) for the recent period, although we do not formally use them for our benchmark series.

Our second objective is to use these new series in order to better understand the long-run determinants of wealth concentration. The two general facts that emerge from our series are, first, that wealth concentration is systematically much larger than income concentration, and next, that the exact level of wealth concentration displays strong variations over time. In particular, we confirm previous findings regarding a

significant decline in the top 10% wealth share between 1914 and 1984 (from 80-90% of total wealth during the 19<sup>th</sup> century up until World War 1, down to 50-60% in the early 1980s), mostly to the benefit of the middle 40% of the distribution (the bottom 50% wealth share is always less than 10%). Since the mid-1980s, we observe a moderate rise of wealth concentration, with large fluctuations due to asset price movements. We also find wealth inequality is almost as large within each age group as for the population taken as a whole.

Regarding the long-run fall of wealth inequality between 1914 and 1984, the most natural interpretation is that top wealth groups were hit by a number of very large capital shocks that occurred during the 1914-1945 period (destruction, depression, inflation, nationalization, etc.). However, it is still a key challenge to understand how the structural policy changes that occurred after these shocks (e.g. rise of progressive taxation, social spending, financial regulation, rent control, etc.) have permanently reduced the steady-state level of wealth inequality. While we cannot evaluate the precise quantitative role played by each policy, we are able to better explore the reasons for wealth inequality dynamics.

We develop a simple steady-state formula to better understand the observed evolutions of wealth concentration. This formula highlights three key forces behind long term wealth inequality dynamics: unequal labor incomes, unequal rates of return and unequal saving rates. We show that the observed values of these parameters during the 1970-1984 period are consistent with the observed long-run reduction in wealth concentration over the 1914-1984 period. Regarding the post-1984 rise in wealth concentration, we find that this reversal of the trend can be accounted for by

rising inequality in saving rates and rates of return (which could itself be due to a mixture of factors, including growth slowdown, rising unemployment and labor earnings inequality, and financial deregulation). This effect tends to dominate the contradictory impact of rising housing prices (which in any case cannot continue in the very long run). We present various simulations for the coming decades and discuss the conditions under which rising wealth concentration is likely to continue, and whether this trend can go all the way toward pre-WW1 inequality levels.

Our general conclusion is not that we can make predictions about the future evolution of wealth concentration, but rather that relatively small changes in the key parameters appear to matter a lot for long-run steady-state inequality of wealth. We argue that in order to account for the high level of wealth concentration, one needs to use a class of models combining unequal saving rates, rates of return and labor earnings, as well as large dynamic multiplicative effects over long horizons.

We should also emphasize that the present paper is part of a broader multi-country project in which we attempt to construct “distributional national accounts” (DINA), i.e. detailed annual estimates of the distribution of income and wealth based on the reconciliation between different fiscal sources, household surveys and macroeconomic national accounts. The present paper focuses upon the wealth part of the DINA series for France. In our companion paper (Garbinti, Goupille-Lebret and Piketty, 2017), we combine tax, survey, and national accounts data in a comprehensive and consistent manner to build new series on the distribution of income in France over the 1900-2014 period.

In particular, the present work is closely related to recent work undertaken on the long-run evolution of wealth and income distribution in the United States (Saez and Zucman 2016; Piketty, Saez and Zucman 2016). More generally, the objective of the multi-country project is to release data series that can be used by future research to further investigate inequality dynamics and test formal models. All updated series will be made available on the “World Wealth and Income Database” (WID.world) website (<http://WID.world>). In our view, this provides an additional justification for the need to develop more transparency and better administrative data on wealth.

The paper is organized as follows. Section 2 relates our work to the existing literature. Section 3 presents our data sources and methodology. We then present our main results, starting in section 4 with the long-run picture (1800-2014), and then moving on in section 5 to the more detailed series available over the 1970-2014 period. In section 6 we discuss the possible interpretation behind our findings and present our simulation results. In section 7 we compare our findings with recent series constructed for other countries, and particularly with the U.S. series constructed by Saez and Zucman (2016). Finally, section 8 offers concluding comments. This paper is supplemented by an Online Data Appendix including complete series and additional information about data sources and methodology.

## **Section 2. Relation to existing literature**

### **Section 2.1. Literature on the historical evolution of wealth inequality**

Our work builds upon a long tradition of research on wealth inequality measurement dating back to the 19<sup>th</sup> century. It is also part of a recent project attempting to develop consistent estimates of the distribution of income and wealth at the global level: the “World Wealth and Income Database” (WID.world).

Economists and statisticians started using inheritance data in order to study the wealth of the living in a systematic manner in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. A large number of authors, often from the United Kingdom and France, independently developed the “estate multiplier” method, first to estimate aggregate wealth of the living from the aggregate inheritance flow, and subsequently in order to study wealth distribution among the living by reweighting individual inheritance data (using the inverse mortality rate of their age and gender group).<sup>1</sup>

It is only in recent decades, however, that these methods were used to construct homogenous historical series on top wealth shares. Even today, such series are available only for a handful of countries (in particular the U.S., the U.K., France, Sweden and Australia). The first attempt to construct long-run top wealth shares series using the estate multiplier approach was due to Lampman (1962), who exploited U.S. estate tabulations over the 1922-1956 period. Atkinson and Harrison (1978) then applied the estate multiplier method to British inheritance data over the

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<sup>1</sup> Some of the main references in this literature include Giffen (1878, 1889), Foville (1893), Colson (1903), Levasseur (1907), Mallet (1908), Séailles (1910), Strutt (1910), Mallet and Strutt (1915) and Stramp (1919). See Piketty (2011, p.1081-1083).



1923-1972 period. In addition, Atkinson and Harrison compared their estate-multiplier top wealth shares series with alternative series based upon the income-capitalization method (using income tax data) and showed that they are consistent.

In the case of France, top wealth shares covering the 1807-1994 period were first constructed by Piketty, Postel-Vinay and Rosenthal (2006, 2014), using national inheritance tabulations together with large micro-samples of inheritance declarations collected in the Paris archives and other local archives.<sup>2</sup> As compared to the U.S. and the U.K, where homogenous estate data is not available until the early 20<sup>th</sup> century, one key advantage of the French data is that it is available since 1800 (the modern inheritance tax system was put in place in 1791 during the French Revolution and hardly changed since then).

Long-run top wealth shares have also been constructed for Sweden by Roine and Waldenström (2009) using both inheritance registers since the early 19<sup>th</sup> century and annual wealth tax data since the early 20<sup>th</sup> century (when Sweden introduced an annual wealth tax).

The U.S. series first constructed by Lampman (1962) were subsequently extended until 2000 by Kopczuk and Saez (2004). More recently, Saez and Zucman (2016) have argued that estate-multiplier series underestimate rising wealth concentration for the latest decades, and that the rising inequality trend is better estimated by income-capitalization series.

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<sup>2</sup> See also Bourdieu, Postel-Vinay and Suwa-Eisenmann (2003) and Bourdieu, Kesztenbaum and Postel-Vinay (2013).

Our paper directly follows this literature. That is, we refine and update in various ways the wealth inequality series constructed by Piketty, Postel-Vinay and Rosenthal (2006, 2014). First, we estimate wealth series for all percentiles of the distribution, from the bottom to the top, and not only for top groups, by relying on the complete historical data from inheritance registers and inheritance tabulations and using generalized, non-parametric Pareto interpolation techniques recently developed by Blanchet, Fournier and Piketty (2017). Next, and most importantly, we link up our historical inheritance-based wealth inequality series (covering the 1800-1970 period) with new series that we construct for the 1970-2014 by using a mixture of income capitalization and survey-based method. These new series allow us to highlight the recent reversal of the decreasing trend that occurred since 1984. We also follow Saez and Zucman (2016) in computing synthetic saving rate series by wealth groups, which as we will show, offers a very powerful way to analyze the structural determinants of wealth inequality and constitutes a useful complementary approach to calibrated micro-founded theoretical models. Unlike Saez and Zucman (2016), we are able to reconcile estate-multiplier and income-capitalization method for the recent decades.

The reasons why we choose to favor the income-capitalization approach for our 1970-2014 series are twofold. First, this method offers joint annual information on both wealth and income, which inheritance-based approaches cannot offer. Next, we agree with Saez and Zucman (2016) that inheritance data and estate-multiplier methods raise more and more problems in recent decades, especially because of rising life expectancy (so that it is increasingly rare and abnormal to observe decedent wealth at earlier ages) and intensive terminal tax planning (with extensive

private information about terminal illness). In addition, access to inheritance data has deteriorated in a country like France (annual data is not available any longer, and available data comes from samples with limited size). In case inheritance data was annual and exhaustive, and income tax data was not, the situation would be different. But given present data availability in France (and also in the U.S.), the most sensible choice in our view is to use the income capitalization method. Of course the conclusion could be different in other countries (such as the U.K.; see the recent work by Alvaredo, Atkinson and Morelli, 2017).

## Section 2.2. Literature on wealth distribution using household surveys

This paper is also closely related to recent research on wealth distribution using household wealth surveys and Pareto adjustment for top wealth groups based upon billionaire rankings.

Generally speaking, household wealth surveys have become very widespread in recent decades.<sup>3</sup> The development of wealth surveys has led to a new wave of comparative wealth studies, with particular attention to the statistical modeling of the distribution, from the very bottom - including segments with negative net wealth - to the very top (see e.g. Cowell and Van Kerm (2015) for a survey article using HFCS data for 15 Eurozone countries; see also Cowell (2013) for a comparison of wealth distributions in the UK, Canada, Sweden and the U.S.).

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<sup>3</sup> One of the oldest and best established wealth surveys in the world is the SCF (Survey of Consumer Finances) run by the U.S. Federal Reserve. The SCF has been conducted every three years since 1983 (the last survey was conducted in 2013; a preliminary SCF survey was conducted in 1962, but there was no other survey until 1983. see SCF, 2015). A number of European countries also started to conduct household wealth surveys during the 1980s-1990s. It is only in recent years, however, that there has been some serious attempt to homogenize European wealth surveys. The first wave of the HFCS (Household Finance and Consumption Survey) was conducted in 2010-11 in 15 Eurozone countries (see HFCS, 2015).

There has also been growing recognition in recent years that despite the best efforts of the organizing institutions these wealth surveys suffer from major biases, particularly regarding top wealth groups, and that new methods need to be developed in order to correct for these biases in a systematic manner.<sup>4</sup> The fact that both the Federal Reserve and the ECB have limited ability to measure and monitor the evolution of the distribution of wealth is increasingly regarded as highly problematic, especially in light of the fact that quantitative-easing policies conducted in recent years are likely to have major distributional consequences. In light of this, several recent studies have attempted to reconcile administrative and wealth survey data (Bricker et al. (2016)) or to use billionaire rankings and Pareto interpolation techniques in order to correct upwards the top wealth levels reported in household wealth surveys (see in particular Vermeulen (2016) and other references provided in Blanchet, 2016).

Our contribution to this literature is twofold. First, we argue that wealth surveys and Pareto adjustments using billionaire rankings can be useful, but that whenever possible these sources and methods need to be used together with fiscal data (via income capitalization, estate multiplier, and/or annual wealth tax methods). The central advantages of fiscal sources are that - in addition to being available over much longer time periods than wealth surveys and billionaire rankings – they are annual (as opposed to wealth surveys, which are typically conducted every 3 to 5 years), they are exhaustive (i.e. they do not suffer from sampling problems: the entire

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<sup>4</sup> Although the SCF is usually regarded as the best existing wealth survey, recent research by Saez and Zucman (2016) using fiscal data and the income capitalization method has shown that the SCF significantly underestimates rising wealth concentration in recent decades. The European HFCS is likely to suffer from even bigger biases, with potentially large variations between countries (since the methodologies used in each country are still far from being fully homogenous).

population is covered, rather than a small subsample), and they rely extensively on third-party reporting and auditing (rather than self-reporting). These are key strengths that cannot be neglected, especially given the many uncertainties surrounding self-reporting biases in surveys, and the methodology used in billionaire rankings.

Next, in countries where fiscal sources do not exist and/or are not accessible, it is critical to develop flexible, non-parametric generalized Pareto interpolation methods (such as those developed by Blanchet, Fournier and Piketty, 2017) and to systematically compare the patterns of Pareto coefficients with those obtained in countries where fiscal data are available. There is still a long way to go before we can use these methods in a reliable way.

### Section 2.3. Literature on Calibrated Models of Wealth Distributions

Our work is also related to the large literature attempting to use dynamic quantitative models of wealth inequality to replicate observed wealth inequality. As recently surveyed by Piketty and Zucman (2015), Benhabib and Bisin (2016), De Nardi and Fella (2017), several authors have recently introduced new ingredients into calibrated micro-founded dynamics models, such as uninsured idiosyncratic shocks to labor earnings and/or asset returns, tastes for savings and bequests, entrepreneurship, preference heterogeneity.<sup>5</sup> Typically, these models can generate substantial wealth concentration at the top. For a given structure of individual-level shocks (unequal labor incomes, saving rates, and rates of return), they also predict that the long-run steady-state level of wealth inequality tends to be magnified if the gap  $r - g$  between

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<sup>5</sup> See among others Castaneda, Diaz-Gimenez and Rios-Rull (2003), De Nardi (2004), Cagetti and De Nardi (2006), Aoki and Nirei (2016), Benhabib, Bisin, and Zhu (2015).

the net-of-tax rate of return  $r$  and the economy's growth rate is larger (Piketty 2014, chap.10; Piketty and Zucman 2015; Piketty 2015). However, while some ingredients of these models taken separately or a combination of them help to reproduce the level of wealth inequality at a point in time, more work is still needed to evaluate and quantify rigorously the relative importance of each of these elements. Moreover, these studies mostly abstract from the historical evolution of inequality and do not explicitly simulate transitional dynamics.

Recently, three papers have investigated the ability of dynamic models to reproduce and explain transition dynamics, from one stationary wealth distribution to another, after a change in the economic environment. Gabaix, Lasry, Lions, and Moll (2016) show that the baseline random growth model is not able to reproduce the observed rise in the U.S top wealth shares since the early 1980s. To account for that fact, they conjecture that one need to introduce either heterogeneity (type dependence) or wealth-dependence (scale dependence) on both rates of returns and saving rates.<sup>6</sup> Kaymak and Poschke (2015) show that the increase in U.S wealth inequality can be explained by the historical changes in the tax and transfer system and by the increase of wage inequality, which have affected differently the saving behaviors of the bottom and middle income groups as compared to that of the top income group. The crucial role of taxation in explaining the rise in U.S wealth inequality is also emphasized by Hubmer, Krusell and Smith (2016). They find that the most important driver is the significant drop in tax progressivity that started in the late 1970s.

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<sup>6</sup> The main purpose of Gabaix, Lasry, Lions, and Moll (2016) is to reproduce and explain the fast rise in U.S top income inequality since the early 1980s. However, the online Appendix E of the paper is dedicated to the dynamics of wealth inequality.

These approaches using micro-founded calibrated models are of great interest, and we see our work as complementary to these approaches.<sup>7</sup> In particular, we provide original series on the joint distribution of income and wealth along with labor income share, rates of returns and synthetic saving rates by wealth groups that could be useful to calibrate such models and to test their predictions. For instance, we show that the rates of return and the saving rates are strongly positively correlated with wealth. This evidence supports the claim of Gabaix, Lasry, Lions, and Moll (2016) to introduce wealth-dependence (scale dependence) on both rates of returns and saving rates in order to reproduce the rapid rise in wealth concentration observed during the recent period. It would also be interesting to compare the saving rates predicted by theoretical models (such as that of Hubmer, Krussel and Smith, 2016) with observed synthetic saving rates. One of the limitations of the existing literature on micro-founded dynamic wealth models is that they mostly attempt to reproduce a given level – or change in levels – of wealth concentration, without testing explicitly for the economic parameters and mechanisms – e.g. unequal saving rates, labor incomes and rates of returns – generating such a pattern.

In the context of this particular paper, we do not go all the way toward a reconciliation of the different approaches, in the sense that we calibrate a reduced-form dynamic model using synthetic saving rates and rates of return per wealth fractiles, rather than a full-fledged micro-founded model. In effect, we do not model explicitly individual-level shocks and mobility between wealth fractiles. The advantage is that we obtain very simple and easy-to-calibrate steady-state formulas and simulations. But it is clear that

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<sup>7</sup> See also Fagereng, Guiso, Malacrino and Pistaferri (2016) and Bach, Calvet and Sodini (2016).

the next step is to embed these structural parameters into a micro model with individual-level shocks.

We should also stress that France offers an interesting case to understand the determinants of wealth inequality dynamics. Indeed, France has followed the same pattern of wealth inequality as the U.S with decreasing inequality until early 1980s and a reversal of this trend since then. But contrary to the U.S, there was no increase in labor income inequality. To understand this pattern, we develop a very simple steady-state formula that allows to study the impact of a change in key economic parameters – growth rate, inequality in rates of returns, saving rates and labor income – on both the stationary wealth distribution and the transition dynamics. While our formula is much less sophisticated than the dynamic models, it relies on stronger empirical basis. We show that the reversal of the trend in wealth inequality since the early 1980s can be accounted for by rising inequality in saving rates in a context of persistently high but stable inequality in rates of return. As a result, we argue that in order to account for dramatic changes in wealth inequality dynamics, one needs to use a class of models combining unequal saving rates, rates of return and labor earnings, as well as large dynamic multiplicative effects over long horizons.



### **Section 3. Concepts, data sources and methodology**

In this section we describe the concepts, data sources and main steps of the methodology that we use in order to construct our wealth distribution series. Broadly speaking, we combine three main types of data: national income and wealth accounts; fiscal data (income tax returns and inheritance tax returns); and wealth surveys. A longer and more complete discussion of the general methodological issues involved in creating DINA estimates (not specific to France) is presented in Alvaredo et al. (2016). Complete methodological details of our French specific data sources and computations are presented in the Online Data Appendix along with a wide set of tabulated series, data files and computer codes.

#### **Section 3.1. Wealth and income concepts**

Our wealth distribution series are constructed using a concept of "net personal wealth" based upon national accounts categories.<sup>8</sup> That is, net personal wealth is defined as the sum of non-financial assets and financial assets, net of financial liabilities (debt), held by the household sector. All these concepts are defined using the latest international guidelines for national accounts (namely *SNA 2008*; for additional details, see Alvaredo et al, 2016, and the Appendix). We break down non-financial assets into housing assets and business assets. We include in housing assets the value of the building and the value of the land underlying the building. We include in business assets all non-financial assets held by households other than housing assets. In practice, these are mostly the business assets held by self-

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<sup>8</sup> The reason for using national accounts concepts is not that we believe they are perfectly satisfactory. Our rationale is simply that national accounts are the only existing attempt to define income and wealth in a consistent manner on an international basis.

employed individuals (but this also includes other small residual assets). We break down financial assets into four categories: deposits (including currency and saving accounts); bonds (including loans); equities (including investment funds shares); life insurance (including pension funds). We therefore have seven asset categories (housing assets, business assets, four financial asset categories, and debt), or actually eight categories when we break down housing into owner-occupied and tenant-occupied housing.

Also, our wealth distribution series always refer to the distribution of personal wealth among individual adults (i.e. the net wealth of married couples is divided by two, unless available information suggests to do differently).<sup>9</sup>

We use official national accounts established by INSEE for the recent decades (post-1969 for national wealth accounts, and post-1949 for national income accounts). For the earlier periods, we use the historical series provided by Piketty and Zucman (2014). National income series for housing rental income (owner-occupied and tenant-occupied), self-employment income, and interest and dividend income (which are available separately for the four financial asset categories described above, at least for the recent decades), allow us to compute average rates of return for housing, business and financial assets, which we then use when we apply the income capitalization method (see below).

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<sup>9</sup> With most methods, we do not observe adequate information that would allow us to split the wealth of married couples on the basis of unequal individual property rights, so we revert to the equal-split method. With the estate multiplier method, however, we are sometimes able to directly observe own assets and community assets, so that we can compare equal-split wealth inequality estimates with unequal-split estimates.

### Section 3.2. Mixed income capitalization-survey method (1970-2014)

We now describe the data sources and methodology used to estimate the distribution of wealth for the 1970-2014 period. This is a mixed method, in the sense that it is based both on the income capitalization method and on the survey-based method.

In order to apply the income capitalization method, we use the micro-files of income tax returns that have been produced by the French Finance Ministry since 1970. We have access to large annual micro-files since 1988. These files include about 400,000 tax units per year, with large oversampling at the top (they are exhaustive at the very top; since 2010 we also have access to exhaustive micro-files, including about the universe of all tax units, i.e. about 37 million tax units in 2010-2012).<sup>10</sup> Before 1988, micro-files are available for a limited number of years (1970, 1975, 1979 and 1984) and are of smaller size (about 40,000 tax units per year).

We also have access to income tax tabulations, which have been produced by the French Finance Ministry since the creation of income tax in France in 1914 (first applied in 1915). These tabulations are available on an annual basis throughout the 1915-2014 period (with no exception) and are based upon the universe of all tax units.<sup>11</sup> They report the number of taxpayers and total income for a large number of income brackets. By applying the generalized, non-parametric Pareto interpolation techniques developed by Blanchet, Fournier and Piketty, (2017), they can be used to estimate annual series on income percentiles (for all percentiles, from the bottom to the top of the distribution of total income; see Garbinti, Goupille-Lebret and Piketty,

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<sup>10</sup> As of July 2016, the latest micro-file available is the 2012 micro-file. For years 2013-2014 we apply the same method as that described below for 1971-1974, 1976-1978, 1980-1983 and 1985-1987.

<sup>11</sup> As of July 2016, the last tabulation available is the 2014 tabulation.

2017). These tabulations also include detailed breakdowns by income categories (wages, self-employment income, dividend, interest, etc.), which we use to estimate separately the distribution of labor income and capital income (see Garbinti, Goupille-Lebret and Piketty (2017, Appendix D)). In principle, one could also use these historical tabulations and the income capitalization method in order to estimate the distribution of wealth prior to 1970. However these tabulations by income categories suffer from a number of limitations, so that we prefer to use the income capitalization method as our benchmark method solely for the 1970-2014 period (when we have access to micro-files of income tax returns), and to adopt the estate multiplier method (based upon inheritance tax returns) as our benchmark method prior to 1970.<sup>12</sup>

Thanks to the 1970-2014 income tax micro-files, we have access to detailed, individual-level information on taxable asset income flows, including tenant-occupied rental income, self-employment income, interest income, and dividend income.<sup>13</sup> We divide these flows by the relevant asset-specific average rates of return (as described above) in order to compute the stock of tenant-occupied housing assets, business assets, bonds, and equities.<sup>14</sup>

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<sup>12</sup> Generally speaking, the main limitation of income tax tabulations is that prior to 1985 they only cover tax units that are subject to positive income tax. Another specific limitation of tabulations by income categories is that prior to 1945 they only cover a limited number of years (namely, 1917, 1920, 1932, 1934, 1936 and 1937; they then become annual in 1945). In contrast, inheritance tax tabulations cover the entire distribution of wealth (whether the resulting asset income is subject to income tax), and they cover many more years prior to 1945. Full details on income tax tabulations and the way we exploit them are given in Garbinti, Goupille-Lebret and Piketty (2017, Appendix D).

<sup>13</sup> Realized capital gains are reported in the tax returns. We exclude them from our analysis for two reasons. First, only realized capital gains, i.e. capital gains resulting from the sale of an asset, have to be reported in the income tax returns. Second, the capital gains reported correspond to the cumulative of all past capital gains (since the purchase of the asset) rather than those of the current period.

<sup>14</sup> We interpolate the missing years 1971-1974, 1976-1978, 1980-1983 and 1985-1987 by using annual aggregate series by asset categories and by assuming linear trends in within-asset-class distribution. As an alternative strategy, we also used annual income tax tabulations (broken down by income categories) and found that this makes very little difference.

The next step is to deal with assets that do not generate taxable income flows, namely owner-occupied housing, life insurance, and deposits (including currency and saving accounts).<sup>15</sup> We use available wealth surveys in order to impute these assets on the basis of labor income, financial income and age. Housing surveys (including information on housing assets and debt) were conducted by INSEE in 1970, 1973, 1978, 1984, 1988, 1992, 1996, 2002, 2006, 2010 and 2013. Household wealth surveys (including housing, business and financial assets and debt) were conducted by INSEE in 1986, 1992, 1998, 2004, 2010 and 2014.<sup>16</sup> The 2010 and 2014 wealth surveys are the French component of the Eurosystem HFCS survey and are more sophisticated than previous surveys.<sup>17</sup> We conducted sensitivity tests and applied several alternative imputation methods for tax-exempt assets using housing and wealth surveys over the 1970-2014 period, and the general conclusion is that the overall impact on wealth distribution series is extremely small (Figures B7 to B12, Appendix B).

By construction, our methodology delivers individual-level information on both wealth and income over the 1970-2014 period (which we will later use to compute synthetic saving rates and to perform simulations), together with detailed breakdowns by age, gender, and asset categories.

All data files, computer codes and robustness checks regarding our mixed income capitalization-wealth survey method are given in the Data Appendix (Appendix B).

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<sup>15</sup> Note that owner-occupied rental income (i.e. imputed rent) was included in taxable income in France from the creation of the income tax until 1963.

<sup>16</sup> These wealth surveys were called « enquête actifs financiers » in 1986 and 1992, and « enquête patrimoine » since 1998. Housing surveys were always called « enquête logement ».

<sup>17</sup> The 2010 and 2014 surveys include answers with exact amounts (rather than answers by wealth brackets, which were used in previous surveys) and large oversampling at the top (although the sample size of the survey is still insufficient to go beyond the 99<sup>th</sup> percentile).

### Section 3.3. Estate multiplier method (W2) (1800-1970)

We now describe the data sources and the estate multiplier methodology that we use in order to estimate the distribution of wealth over the 1800-1970 period.

The main reason for using the estate multiplier technique over the 1800-1970 period is simply that this is the only data source and method available over such a long time period. The income tax was created in France in 1914, so there is no data on capital income flows prior to this date. In contrast, the modern inheritance tax was set up in 1791, and individual-level inheritance registers have been well preserved and are accessible to researchers since 1800. These registers include detailed information about assets, age, and gender, in principle for all decedents (irrespective of the level of their wealth), so they constitute the ideal source to apply estate multiplier techniques. That is, we reweight the distribution of wealth at death by using the mortality rate of the relevant age-gender cell (with standard corrections for differential mortality), so as to recover the distribution of wealth among the living. Regarding the 1800-1902 period, we refine the estate-multiplier estimates already computed by Piketty, Postel-Vinay and Rosenthal (2006, 2014) on the basis of the large individual-level micro-samples of estates which they collected in Paris inheritance registers and of the provincial samples collected by Bourdieu et al (2003, 2013) in the context of the TRA survey.

In 1902 the French inheritance tax was made progressive, and the tax administration started to compile detailed tabulations reporting the number of decedents and

amount of their wealth for a large number of inheritance brackets. These tabulations are consistent with the data collected in inheritance registers, and they are available on a quasi-annual, exhaustive national basis between 1902 and 1964 (except for the 1914-1924 sub-period). They occasionally include supplementary breakdowns by age brackets and asset categories. We use these national tabulations (together with the estate multiplier method and the Pareto interpolation techniques developed by Blanchet, Fournier and Piketty, 2017) in order to compute our wealth distribution series for the 1902-1970 period.<sup>18</sup>

Unfortunately, annual inheritance tabulations were interrupted by the French Finance Ministry in 1964. Instead, for the recent decades, the tax administration compiled national micro-samples of inheritance tax returns in 1977, 1984, 1987, 1994, 2000, 2006 and 2010 (with limited sample size). We applied the estate multiplier method to the 1984-2010 samples (the 1977 file is not usable), together with correction for tax-exempt assets (particularly life insurance), and we refine previous estimates using differential mortality rates.<sup>19</sup> We found that the resulting estate multiplier method estimates for the wealth distribution are extremely close to the estimates coming from our mixed income capitalization-survey method. This is reassuring and gives us confidence that we can link up our 1800-1970 estate-multiplier series with our 1970-2014 income-capitalization-survey series (Figures D1 to D4, Appendix D).<sup>20</sup>

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<sup>18</sup> We complete the missing years 1914-1924 and 1965-1969 by using data on top capital incomes from income tax tabulations.

<sup>19</sup> We detail how to take into account differential mortality rates for different wealth groups and present a general formula in Appendix D.

<sup>20</sup> In principle, one could return to individual-level inheritance registers to collect annual samples for the recent decades; unfortunately it is very difficult to access these registers for the recent period.

All data files, computer codes and robustness checks regarding the estate multiplier method are given in the Data Appendix (see Appendix C for estate-multiplier estimates over the 1800-1970 period, and Appendix D for reconciliation between estate-multiplier and income-capitalization estimates for the 1984-2010 period).

### Section 3.4. Reconciliation with other methods

We also provide in the Data Appendix detailed computations in order to reconcile our benchmark series with other available methods for the recent period (see Appendix F for reconciliation with wealth surveys, Appendix G for reconciliation with wealth tax data, and Appendix H for reconciliation with billionaire lists).

As we mentioned above, the latest wealth surveys (2010 and 2014) are of relatively high quality and are matched with income tax declarations. The main limitation is their sample size, which is too small to go beyond the 99<sup>th</sup> percentile. In effect, very top capital income and wealth levels are under-estimated in wealth surveys. To take into account misreporting and non-response at the top, we assume differential reporting rates (estimated thanks to comparison with National Accounts).<sup>21</sup> We show that using differential reporting rates just for equities and bonds allows to obtain top wealth shares series that are consistent both in trend and level with those from our benchmark method (Figures F1 and F2, Appendix F).

We also compare the top wealth levels estimated in our benchmark series with the top wealth levels that can be estimated using wealth tax tabulations that are available

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<sup>21</sup> The different steps of our estimation are fully described in our Appendix, section F.2.



over the 1982-2013 period (with a number of missing years). A progressive annual tax on top wealth holders (approximately the top 1%) was instituted in France in 1982 (IGF), abolished in 1986, re-instituted in 1989 (ISF), and still in place in 2016. There has been very limited access to micro-files so far, but tabulations by wealth brackets have been published on an irregular basis since 1982. The main difficulty with this data is that there are many tax-exempt assets, in particular regarding equity participations in family firms and in companies where asset holders play an active management role (the exemption for so-called “professional assets”). By making plausible assumptions on the fraction of tax-exempt wealth by asset categories and levels, we are able to reconcile this data with our benchmark estimates. Figures G2 to G5 (Appendix G) show consistent patterns and levels between our adjusted wealth tax series and our benchmark wealth inequality series. But there is significant uncertainty about the exact level and evolution of tax exemptions, so it is difficult to use this source on its own.

Finally, we also compare our benchmark estimates with the top wealth levels that can be estimated using the billionaire list published by magazines (Challenges at the French level and Forbes at the global level). The main difficulty here is that very little is known about how these lists are established, and also about the size of the family unit. By making plausible assumptions on the distribution of family unit size, we are able to reconcile this data with our benchmark estimates (Figure H2, Appendix H). However we conclude that there is so much uncertainty about billionaire lists that they should be used with a lot of caution (in addition to other sources rather than on their own).

#### **Section 4. Long-run wealth inequality series (1800-2014)**

We now present our benchmark unified series for wealth distribution in France over the 1800-2014 period.

The wealth levels, thresholds and shares for 2014 are reported on Table 1. In 2014, average net wealth per adult in France was about 200,000 €. Average wealth within the bottom 50% of the distribution was slightly more than 20,000 €, i.e. about 10% of the overall average, so that their wealth share was close to 5%. Average wealth within the next 40% of the distribution was slightly less than 200,000 €, so that their wealth share was close to 40%. Finally, average wealth within the top 10% was about 1.1 million € (i.e. about 5.5 times average wealth), so that their wealth share was about 55%.

We report in Figure 1 the evolution of the wealth shares going to these three groups over the 1800-2014 period. The wealth share going to the bottom 50% (the “lower class”) has always been very small (less than 10%). The major long-run transformation is the rise of the share going to the middle 40% (the “middle class”) and the decline of the share going to the top 10% (the “upper class”). This major change entirely took place between 1914 and the early 1980s.

During the 19<sup>th</sup> and early 20<sup>th</sup> century, up until World War 1, the top 10% share is relatively stable at very high levels – between 80% and 90% of total wealth, with a slight upward trend over the period. The middle 40% share was relatively small throughout the period, e.g. slightly above 10% at the eve of World War 1, not very

much above the bottom 50% share. In a sense there was no “middle class”: the middle 40% was almost as property-less as the bottom 50%.

The top 10% wealth share started to fall following the 1914-1945 capital shocks, and the fall continued until the early 1980s, with an absolute minimum in 1983-1984 (with slightly more than 50% of total wealth). Here it is interesting to recall that the aggregate wealth-national income ratio fell hugely over the 1914-1945 period - from about 700% to less than 200% - and gradually recovered in the decades following World War II.<sup>22</sup> In this work, we are able to study the distributional trends of the wealth-income ratios. We show that the rise of the middle 40% share during the 1914-1945 period is not due to the fact that the middle class accumulated a lot of wealth during this period: this simply corresponds to the fact they lost less wealth – in proportion to their initial wealth level – than the top 10%. In contrast, during the post-war decades, the rise of the middle class corresponds to a significant rise of their absolute wealth levels (see Figures FA6 to FA8, Appendix A for detailed series).

In the recent decades, we observe a moderate rise in the top 10% wealth share, and a corresponding erosion of the middle 40% wealth share. However we also notice strong short-run fluctuations, with a large rise in top 10% share up to 2000, followed by a sharp decline. As we will see below, this is entirely due to large movements in relative asset prices (stock prices are very high as compared to housing prices in 2000, which favors the upper class relative to the middle class).

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<sup>22</sup> See Piketty and Zucman (2014) for a detailed analysis and decomposition of the aggregate wealth-income ratio between the various explanatory factors: destructions, inflation, lack of investment, and a general fall in asset price indexes as compared to consumer price indexes, partly due to rent control and other regulations.

Next, it is worth stressing that the historical decline in the top 10% wealth share is entirely due to the collapse in the top 1% wealth share, from 55%-60% of total wealth on the eve of World War 1 to 30% in 1945 and 15% in the early 1980s, back up to about 25% in the early 2010s (see Figure 2).

Finally, we compare on Figures 3-4 our wealth inequality series with the income inequality series coming from our companion paper (Garbinti, Goupille-Lebret and Piketty, 2017). The central finding is that wealth concentration is always a lot larger than labor income concentration and much more volatile. For instance, the share of total labor income going to top 10% labor income earners always fluctuates around 25%-30% over the 1900-2014 period, while the share of total wealth going to top 10% wealth holders fluctuates in the 50%-90% range (see Figure 3). The comparison is even more striking for the top 1% share: it fluctuates in the 5%-8% range for labor income, and in the 15%-60% range for wealth (see Figure 4). The concentration of total income (including labor and capital income) is intermediate between the two, and closer to the concentration of labor income (which is not too surprising, given that the labor share is typically around 65%-75% of total income).

It is striking to see that the long-run decline in income inequality is entirely due to the decline in the concentration of wealth and capital income. This makes it even more important to understand the long-run determinants of wealth concentration. Note also that the concentration of capital income is even larger than the concentration of wealth, which corresponds to the fact that higher wealth individuals tend to own assets with higher rates of return - typically equity rather than housing or deposits (more on this below).

## **Section 5. Wealth inequality breakdowns by age and assets, 1970-2014**

We now present our detailed wealth inequality breakdowns by age and asset categories for the 1970-2014 period. We begin with age decomposition and then proceed with asset decompositions.

If we first look at the age-wealth profile, we find that average wealth is always very small at age 20 (less than 15% of average adult wealth), then rises sharply with age until age 50-55, and finally stabilizes or slightly declines at very high levels (around 120%-150% of average adult wealth) at ages 60-85. This age-wealth profile appears to be relatively stable over the 1970-2014 period (see Figure 5).<sup>23</sup> The key difference with the standard Modigliani triangle (implied by a pure life-cycle model with no bequest) is that average wealth does not seem to decline at high ages: it remains stable at very high levels, which means that old-age individuals die with substantial wealth and transmit it to their offspring. Note also that old-age individuals make very substantial inter vivos gifts in France, so that average wealth at high ages would be even higher without these gifts, particularly at the end of the period. Gifts are made on average about 10 years before death, and the aggregate gift flow has increased from about 20%-30% of the aggregate bequest flow in the 1970s to as much as 80% of the aggregate bequest flow in the 2000s-2010s (see Piketty, 2011).<sup>24</sup>

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<sup>23</sup> The complete series of age-wealth profiles over the 1970-2014 period are reported in Table B21 of Appendix B.

<sup>24</sup> In other words, when we observe in Figure 5 that the average wealth of 80-year-old individuals is about 140% of average adult wealth in 2010, it is important to keep in mind that this is the average wealth of individuals who have already given away almost half of their wealth (on average).

Next, it is interesting to see that wealth inequality is almost as large within each age group than for the population taken as a whole (see Figure 6). For instance, if we look at the distribution of wealth within the individuals aged 60-year-old and over, we find a top 10% wealth share equal to 56% in 1970 (vs 59% for the population taken as a whole) and to 49% in 2012 (vs 55% for the population taken as a whole).

Before we move to inequality breakdowns by asset categories, it is important to recall that the composition and level of aggregate wealth have changed substantially in France over the 1970-2014 period (see Figures 7-8). Namely, the shares of housing assets and financial assets have increased substantially, while the share of business assets has declined markedly (due to the fall in self-employment). Financial assets (other than deposits) increase strongly after the privatization of the late 1980s and the 1990s and reach a high point in 2000 (stock market boom). In contrast, housing prices decline in the early 1990s, and rise strongly during the 2000s, at the same time as stock prices fall.

These contradictory movements in relative asset prices have an important impact on the evolution of wealth inequality, because the different wealth groups own very different asset portfolios. As one can see in Figure 9, the bottom 30% of the distribution own mostly deposits in 2012. Then housing assets become the main form of wealth for the middle of the distribution. As we move toward the top 10% and the top 1% of the distribution, financial assets (other than deposits) gradually become the dominant form of wealth. This is particularly due to large equity portfolios. We find the same general pattern throughout the 1970-2014 period, except that business assets played a more important role at the beginning of the period, particularly among

middle-high-wealth holders (see Appendix B, Figures B20 to B23). If we now decompose by asset categories the evolution of the wealth shares going to the bottom 50%, middle 40%, top 10%, and top 1%, then we see very clearly the impact of asset price movements on wealth shares, and particularly the impact of the 2000 stock market boom on the top 1% wealth share (see Figures 10-11 and Figures B24 to B28 from Appendix B). We return to this issue below.

## **Section 6. Accounting for wealth inequality: models and simulations**

How can we account for our findings? Here it is important to distinguish short-run evolutions (which can typically be driven by sharp movements in relative asset prices) from long-run trends. From a long-run, structural perspective, how can we account for the very high levels of wealth concentration that we observe in the data, as well as the variations of these very high concentration levels across the 20<sup>th</sup> century? First of all, it is clear that a life-cycle model with no bequest is not going to generate sufficient inequality. Typically, in a standard life-cycle model, wealth inequality within age group should be comparable in magnitude to the inequality of labor income within age group, which is not at all what we observe. In addition, we have seen from age-wealth profiles that decedents die with very substantial wealth. A model with precautionary saving is not going to work very well either, since this typically generates less wealth inequality than the cross-sectional inequality of labor income shocks. In order to generate substantial wealth concentration and fat Pareto upper tails for the wealth distribution, the most natural and flexible way to proceed is to use dynamic wealth accumulation models with long horizon and with multiplicative random shocks (see e.g. Aoki and Nirei (2016); Benhabib, Bisin and Zhu (2011, 2015); Piketty and Saez (2013); Piketty and Zucman (2015) and Hubmer, Krusell and Smith (2016) for a survey). In this class of models, several structural forces tend to amplify wealth inequality toward high steady-state levels, particularly the inequality of saving rates and the inequality of rates of return, together with the inequality of labor incomes.<sup>25</sup>

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<sup>25</sup> In the benchmark infinite-horizon, dynastic model with no random shock, any distribution of wealth (together with any exogenous distribution of labor income, and any exogenous correlation between the two) can be a steady-state. In effect, each dynasty saves a fraction  $g/r$  of its capital income so that all dynastic wealth levels grow at the same rate  $g$  (dynasties with no initial wealth save nothing, and



In order to illustrate this point and quantify these effects in a simple and transparent manner, we will decompose our series using the following transition equation:

$$W_{t+1}^p = (1 + q_t^p)[W_t^p + s_t^p (Y_{Lt}^p + r_t^p W_t^p)]$$

With:  $W_t^p, W_{t+1}^p$  = average real wealth of group p at time t and t+1 (for instance, group p could be the top 10% wealth group)

$Y_{Lt}^p$  = average real labor income of group p at time t

$r_t^p$  = average rate of return of group p at time t

$q_t^p$  = average rate of real capital gains of group p at time t (real capital gains are defined as the excess of average asset price inflation, given average portfolio composition of group p, over consumer price inflation)<sup>26</sup>

$s_t^p$  = synthetic saving rate of group p at time t

We define synthetic saving rates in the same way as Saez and Zucman (2016). That is, we can observe variables  $W_t^p, W_{t+1}^p, Y_{Lt}^p, r_t^p, q_t^p$  in our 1970-2014 series, and from this we compute  $s_t^p$  as the synthetic saving rate that can account for the evolution of

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dynasties with a lot of initial wealth save enough to maintain their position, hence the full persistence result). The only equilibrium condition is the well-known modified-Golden-rule steady-state condition for aggregate rate of return (and therefore aggregate capital):  $r = \theta + \gamma g$  (where  $\theta$  is the rate of time preference and  $\gamma$  the curvature of the utility function). The problem of this deterministic model is that it is too extreme (zero mobility, complete persistence of any initial wealth inequality). In effect the simple dynamic accounting model that we describe below is similar in spirit to the dynastic model, except that it allows for mobility and for any dispersion of saving rates (less extreme than in the dynastic model), as well as for any dispersion of rates of return.

<sup>26</sup> For each wealth group, the rates of returns are computed by weighting each asset-specific rate of return – such as reported in the National Accounts – by the proportion of each asset in the wealth of the group. We follow the same methodology to compute the rates of capital gains by wealth group. Tables B5a to B9 from Appendix B report saving rates, rates of return and rates of capital gains by wealth group.

average wealth of group  $p$ . We call it “synthetic” saving rate because it should be thought as some form of average saving rate of the group (taking into account all the inter-group mobility effects). It clearly does not mean that all individuals in wealth group  $p$  save exactly that much. In practice, there is always a lot of mobility between wealth groups over time.<sup>27</sup> In this paper, we do not attempt to study this mobility process as such, and instead we focus upon this synthetic saving rate approach. This allows us to do simple simulations in order to illustrate some of the key forces at play.

### Section 6.1. Understanding the evolution of top 1% wealth share (1970-2014)

The first simple simulation exercise consists of studying the structural impact of capital gains and savings, i.e stripped of large short run fluctuations, on top wealth inequality.<sup>28</sup>

Over the 1970-2014 period, Table 2 shows that housing prices have increased faster than other asset prices (on average they have increased 2.4% faster per year than consumer price inflation, vs. 0.3% faster for the general asset price index). However this structural increase in housing prices has been far from steady: the housing boom was particularly strong in certain years and not in others, thereby generating large short run fluctuations in wealth inequality.

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<sup>27</sup> In particular, individuals saving more than the synthetic saving rate of their group will tend to move up the wealth hierarchy, while individuals saving less than the average of their group will move down. In the same way, individuals earning more than the average rate of return of their group, and/or more than the average rate of real capital gain of their group, and/or more than the average labor income of their group, will tend to move up the wealth hierarchy.

<sup>28</sup> See Appendix E (section E.1) for a complete description of the methodology and the equations used for the simulations.

Figure 12 reports the simulated top 1% wealth shares when we replace either the time varying rates of real capital gains or both the time varying rates of real capital gains and the time varying saving rates by their averages over the period 1970-2014.<sup>29</sup> By construction, all simulated series end up in 2014 at the same inequality level as the observed series. The difference is that we now see a gradual increase in inequality, rather than a sharp rise until 2000 followed by a decline. This confirms that the only reason for this inverted-U-shaped pattern is due to variations in relative asset prices, and more specifically to the stock market boom of 2000 (together with the low housing prices of 2000). Once this is corrected by our simulated series, this sharp decline disappears: in other words the structural parameters at play during this period push toward rising concentration of wealth.<sup>30</sup>

We report in Figure 13 the simulated series that we obtain by replacing time varying rates of capital gains and synthetic saving rates by their averages over the 1970-2000 period, i.e. over the period ending before the housing boom of the 2000s. We find that the top 1% share would have increased a lot more by 2012. In other words, the housing boom of the 2000s has played an important role as a mitigating force to limit the rise of inequality. More generally, the structural increase in top 10% and top 1% wealth shares over the 1984-2012 period would have been substantially larger had housing prices not increased so fast relative to other asset prices. It should be

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<sup>29</sup> The constant capital gains are equal to the average structural changes of the various asset prices over the 1970-2014 period.

<sup>30</sup> One potential concern with the capitalization method is that it can potentially overestimate the level of inequality during a stock boom in case the wealthiest individuals tend to benefit from higher returns (within a given asset class) than the rest of the population, and particularly so during booms (maybe because they pick more risky assets within a given asset class). In this case, top wealth shares and synthetic saving rates would tend to be upwardly biased, and particularly so during booms (see Bach et al (2016) on Swedish data). In the case of France, however, we show in the simulations that the huge hump-shape around 2000 is entirely due to short term price fluctuations (see Figure FE4, Appendix E). Moreover, our saving rates for the top 1 % are not increasing and turns out to be stable since the early 2000s (see table TB8, Appendix B).

noted however that rising housing prices have an ambiguous and contradictory impact on inequality: on the one hand they raise the market value of the wealth of middle class members who were able to access real estate property, thereby raising the middle 40% wealth share relative to the top 10% wealth share; but on the other hand rising housing prices make it more difficult for lower class members (or of middle class members with no family wealth at all) to access real estate property.

### Section 6.2. Simulating long-term wealth inequality

We now turn to very long term forces and simulations. Assume the relative capital gain channel disappears, i.e. all asset prices rise at the same rate in the long run (which must happen at some point, otherwise there will be only one asset left in the long run), and this rate is the same as consumer price inflation (otherwise wealth-income ratio would go to infinity).<sup>31</sup> How is the long-run, steady-state level of wealth concentration determined? By manipulating the transition equation given above for wealth group  $p$  (for instance  $p = \text{top 10\% wealth group}$ ) and the corresponding equation for aggregate wealth, one can easily derive the following steady-state equation:

$$sh_w^p = \left(1 + \frac{s^p \cdot r^p - s \cdot r}{g - s^p \cdot r^p}\right) \cdot \frac{s^p}{s} \cdot sh_{YL}^p$$

With:  $sh_w^p$  (resp.  $sh_{YL}^p$ ) is the share of wealth (resp. labor income) held by wealth group  $p$  (for instance  $p = \text{top 10\% wealth group}$ )

$g$  is the economy's growth rate

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<sup>31</sup> In Appendix E, we also extend our formula to include potential capital depreciation or appreciation and show that the intuitions and mechanisms remain the same.

$s$  the aggregate saving rate

$r$  the aggregate rate of return

$s^p$  the synthetic saving rate of wealth group  $p$

$r^p$  the rate of return of wealth group  $p$  (given their portfolio composition)

This formula can be derived very simply (see Appendix E) and is very intuitive.

For instance, if  $s^p = s$  and  $r^p = r$  (i.e. top wealth group has the same saving rate and rate of return as average), then  $sh_w^p = sh_{YL}^p$ , i.e. wealth inequality is exactly the same as labor income inequality.

But if  $s^p > s$  and/or  $r^p > r$  (i.e. top wealth group saves more and/or has a higher rate of return than average), then this can generate large multiplicative effects, and lead to very high steady-state wealth concentration.<sup>32</sup>

The important point is the strength of these multiplicative effects. In order to illustrate this, we have done the following simulations. First, we have computed the evolution of synthetic saving rates for the different wealth groups over the 1970-2014 period. The results are represented in Figure 14. As one can see, the high levels of wealth concentration that we observe in France over this period can be accounted for by highly stratified saving rates between wealth groups: while top 10% wealth holders save on average between 20% and 30% of their annual income, middle 40% and bottom 50% wealth groups save a much smaller fraction of their income.<sup>33</sup> It is also

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<sup>32</sup> The difference with the steady-state formula presented by Saez and Zucman (2016) is that they relate wealth shares to total income shares (including both labor incomes and capital incomes, which themselves depend on wealth shares), so that they do not fully capture multiplicative effects between labor income inequality and steady-state wealth inequality.

<sup>33</sup> Previous work on savings has mainly studied saving rates across income groups. They generally find that saving rate increases with current and permanent incomes (see for instance Dynan, Skyner,

striking to see that middle and bottom wealth groups use to save more in the 1970s (with a saving rate of about 15% for the middle 40% and 8% for the bottom 50%) than what we see since the 1980s-1990s (with a saving rate around 5% for the middle 40% and close to 0% for the bottom 50%). This is the key structural force which is accounting for rising wealth concentration in France over this period. This is similar to what was found by Saez and Zucman (2016) for the U.S. case.

Next, we computed the evolution of flow rates of return (excluding capital gains, which we assume to be zero in our simulations) for the different wealth groups over the 1970-2014 period. The results are represented in Figure 15. As one can see, higher wealth groups tend to have substantially higher rates of return. This large inequality of rates of return is due to the large portfolio differences that we documented earlier. In particular, top wealth groups own more financial assets like equity with higher rates of return than housing or deposits (see Table 2).<sup>34</sup>

Finally, we use these estimates of  $s^p$  and  $r^p$  by wealth group in order to simulate steady-state trajectories for the top wealth shares in coming decades. The main

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Zeldes (2004) on US data, Bozio et al (2016) on UK data, Garbinti and Lamarche (2014a) on French data). Since wealth and income are strongly correlated, these conclusions are consistent with the gradient highlighted by our estimates. Another strand of the literature has studied the marginal propensity to consume out of wealth. For instance, Elinder, Erixson and Waldenström (2016) find evidence that the rich save new wealth (bequests) while the poor consume it. Garbinti and Lamarche (2014b, Table 2, <http://www.insee.fr/fr/statistiques/1374588?sommaire=1374593>) also show a large gradient in French saving rates across wealth groups, with the same order of magnitude as our synthetic saving rates (for instance, the median saving rate equals 30% for the top 20% of wealth distribution).

<sup>34</sup> It is worth noting that on average real capital gains are relatively small (+0.3% per year) regarding personal wealth accumulation over the 1970-2014 period. In effect, the highly positive real capital gains recorded for housing assets (housing prices have increased faster than consumer price inflation) are almost entirely counterbalanced by the negative real capital gains for financial assets (particularly for deposits, bonds and other nominal assets, which by construction incur real capital losses equal to consumer price inflation). Note that average real capital gains are more substantial regarding national wealth accumulation (due to the fact that the real capital losses incurred by the personal sector on public bonds are the counterpart of the real capital gains made by the government sector). See Piketty and Zucman (2014) for detailed decompositions.

results are reported in Figure 16 for the top 10% wealth share. Additional top 10% wealth share simulations based on alternative variants for saving rates and rates of returns for the different wealth groups are reported in Appendix E.

For simplicity, we report only two simulations in Figure 16. First, we assume that the same inequality of saving rates that we observe on average over the 1984-2014 period (namely 24.5% for the top 10% wealth group, and 2.5% for the bottom 90%) will persist in the following decades, together with the same inequality of rates of return and the same inequality of labor income.<sup>35</sup> The conclusion is that the top 10% wealth share will gradually increase in the future and will finally converge toward a level of wealth inequality that is similar to that observed in the 19<sup>th</sup> and early 20<sup>th</sup> centuries (namely about 80% of total wealth).

The other simulation consists of assuming the same inequality of saving rates that we observe on average over the 1970-1984 period (namely 22% for the top 10% wealth group, and 9.5% for the bottom 90%) would have persisted between 1984 and 2012 and during the following decades, together with the same inequality of rates of return and the same inequality of labor income. The conclusion is that the top 10% wealth share would have continued the declining path observed before 1984 and would have gradually converged toward a substantially lower level of wealth concentration (with a top 10% wealth share of about 45%).

There are two main messages from these simple simulations. First, relatively small changes in the key parameters – inequality of saving rates and inequality of rates of

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<sup>35</sup> Note that the parameter  $sh_{YL}^P$  reflects both the inequality of labor income and the correlation between the distributions of wealth and labor income. For simplicity we assume both to be constant in future decades in our basic simulations. See appendix E for more details and other simulations.

return – can have enormous impact on steady-state wealth inequality. Next, these effects take a very long time – many decades and generations – before they fully materialize. This can explain why declining wealth concentration continued long after the capital shocks of the 1914-1945 period. Once some structural parameters have changed, it takes many decades to reach a new steady-state.

The main limitation of our approach is that we are not able to fully explain why saving rates and rates of return change the way they do. We can think of a number of plausible factors, but the data we use is insufficient to fully settle the issue. Regarding the evolution of saving rates, one can imagine that bottom and middle wealth groups were saving at higher rates during the high-growth postwar decades due to some form of “habit formation” effect (Carroll, Overland and Weil, 2000). It is also possible that rising top income shares in recent decades, together with growth slowdown for bottom and middle groups, has contributed to rising inequality in saving rates, and this has been exacerbated by some form of relative consumption effect (on changing income shares, see our companion paper Garbinti, Goupille-Lebret and Piketty, 2017). Finally, it is clear that changes in the tax system, and in particular in tax progressivity, can have very large impact both on the inequality of saving rates between group and on the inequality of rates of return, and therefore on steady-state wealth inequality. The inequality of rates of return can also be influenced by many other factors, including financial regulation and deregulation, rent control and the end of rent control, etc.

The other limitation is that our data series do not allow us to compute synthetic saving rates over the 1800-1970 period. However our simulations suggest that in



order to maintain the very high level of wealth inequality that we observe over the 1800-1914 period, it was necessary to have very extreme stratification of saving rates, with a magnitude comparable to what we observe over the 1984-2012 period.

Regarding the 1914-1984 decline in wealth inequality, it must be the case that the inequality in saving rates declined during this period. One can imagine that the saving rates of top wealth groups were severely affected by the capital and fiscal shocks of the 1914-1945 period. In particular, there was no progressive taxation prior to 1914, and in the interwar period, effective tax rates for top income and wealth groups quickly reached very substantial levels, e.g. 20%, 30%, 40% or even more (see Piketty 2001, 2014). In case top wealth holders reacted by reducing their consumption levels and living standards less than the increase in tax (which came in addition to a negative shock to their pre-tax capital incomes), then in effect they had to reduce their saving rate. This is an issue that we further study using individual-level inheritance registers and wealth records in Paris over this period (Piketty, Postel-Vinay and Rosenthal, 2016). The other side of the coin is the rise in bottom and middle group saving rates, which according to our wealth series started mostly in post-war, high-growth decades. More research is needed to clarify these issues.

## **Section 7. International comparisons**

We now compare our findings to available estimates for other countries. Existing wealth inequality series for the U.K. and Sweden suggest that our French findings (with extreme levels of wealth concentration in the 19<sup>th</sup> and early 20<sup>th</sup> centuries, a sharp decline between 1914 and the late 1970s-early 1980s, and a moderate rise since then) are representative of a more general form of European pattern (see Piketty 2014, chapter 11). On-going work on these two countries should allow us to clarify this in the near future and to provide more systematic comparisons.

We can also compare our French series to the U.S. series recently constructed by Saez and Zucman (2016). As one can see from Figure 23 (where we also report the U.K. series recently constructed by Alvaredo, Atkinson and Morelli, 2017), wealth inequality used to be substantially larger in France and the U.K. than in the U.S. in the early 20<sup>th</sup> century, while in recent decades it has become a lot higher in the U.S. Using our framework, one can interpret the lower U.S. wealth inequality level in the early 20<sup>th</sup> century as the consequence of some kind of “New World” effect (population was still growing very fast in the U.S. so that wealth concentration was very far from its steady-state level). Regarding the recent decades, the fact that top labor income shares increased a lot more in the U.S. than in France can easily translate into much higher steady-state wealth inequality levels, and could also contribute to exacerbate the inequality in saving rates. In particular, the complete stagnation of bottom 50% incomes in the U.S. in recent decades can contribute to explain the very low saving rates found by Saez and Zucman (2016). It is clear however that we would need

more systematic comparison using data series for more countries in order to better understand these important issues.

In our view, one particularly promising avenue of future research is to combine homogenous series on income shares, wealth shares and synthetic saving rates for several countries, and to develop the type of simulations that we presented in the previous section. For instance, it is interesting to note that top wealth shares apparently did not rise more strongly in the U.K. than in France since the 1980s, given that top income shares did increase a lot more in the U.K. than in France (although less than in the U.S.). One explanation could be that the inequality of saving rates did not evolve in the same manner in the various countries, which might itself reflect various factors, including institutional differences (e.g. the role of pension funds and the generosity of the public pension system). The comparison between France, the U.K. and the U.S. also illustrates the role played by country-specific asset price movements, as well as the role of differences in portfolios compositions. E.g. the peak in the top 1% wealth share observed around 2000 in France and not in the other two countries (see Figure 23) corresponds to a particularly strong peak in the equity vs. housing relative price in France around that time, and also to the fact that equity ownership is particularly concentrated among top wealth holders. In order to analyze these issues in a more systematic manner, we need to collect homogenous series on synthetic saving rates, portfolio compositions and asset prices for a larger number of countries.

## **Section 8. Concluding comments and research perspectives**

In this paper, we have shown that it is possible to combine data sources and methods in order to improve our capacity to measure the long-run evolution of wealth distribution (using the case of France as an illustration), and in turn that the new resulting series can be used to better understand the long-run determinants of wealth concentration. We have found that small changes in the key structural parameters – in particular the inequality in saving rates and rates of return across wealth groups – can have very large long-run effects on steady-state wealth inequality.

We hope that this work can be extended to other countries. Note that the exact method will need to be adapted to each country, depending on the quality of the various data sources (income tax returns, inheritance registers, wealth survey, billionaire lists and other sources) in the different countries. We stress again that there is no perfect data source or method, and that they all need to be combined in a pragmatic and transparent way. Wealth measurement is still in its infancy, and in order to make progress we need to combine all the bits and pieces of knowledge that we have. The resulting series can then be used to perform simulations based upon dynamic wealth accumulation models and allow us to reach a better understanding of the long-run determinants of wealth inequality.

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**Table 1. Wealth thresholds and wealth shares in France, 2014**

<b>Wealth group</b>	<b>Number of adults</b>	<b>Wealth threshold</b>	<b>Average wealth</b>	<b>Wealth share</b>
Full Population	51 721 509	0 €	197 379 €	100,0%
Bottom 50%	25 860 754	0 €	25 048 €	6,3%
Middle 40%	20 688 603	97 069 €	189 377 €	38,4%
Top 10%	5 172 000	393 643 €	1 075 954 €	54,5%
<i>incl. Top 1%</i>	<i>517 200</i>	<i>1 985 551 €</i>	<i>4 614 491 €</i>	<i>23,4%</i>
<i>incl. Top 0.1%</i>	<i>51 720</i>	<i>7 466 915 €</i>	<i>16 193 499 €</i>	<i>8,2%</i>
<i>incl. Top 0.01%</i>	<i>5 172</i>	<i>26 162 421 €</i>	<i>54 666 102 €</i>	<i>2,8%</i>
<i>incl. Top 0.001%</i>	<i>517</i>	<i>87 227 640 €</i>	<i>180 329 356 €</i>	<i>0,9%</i>

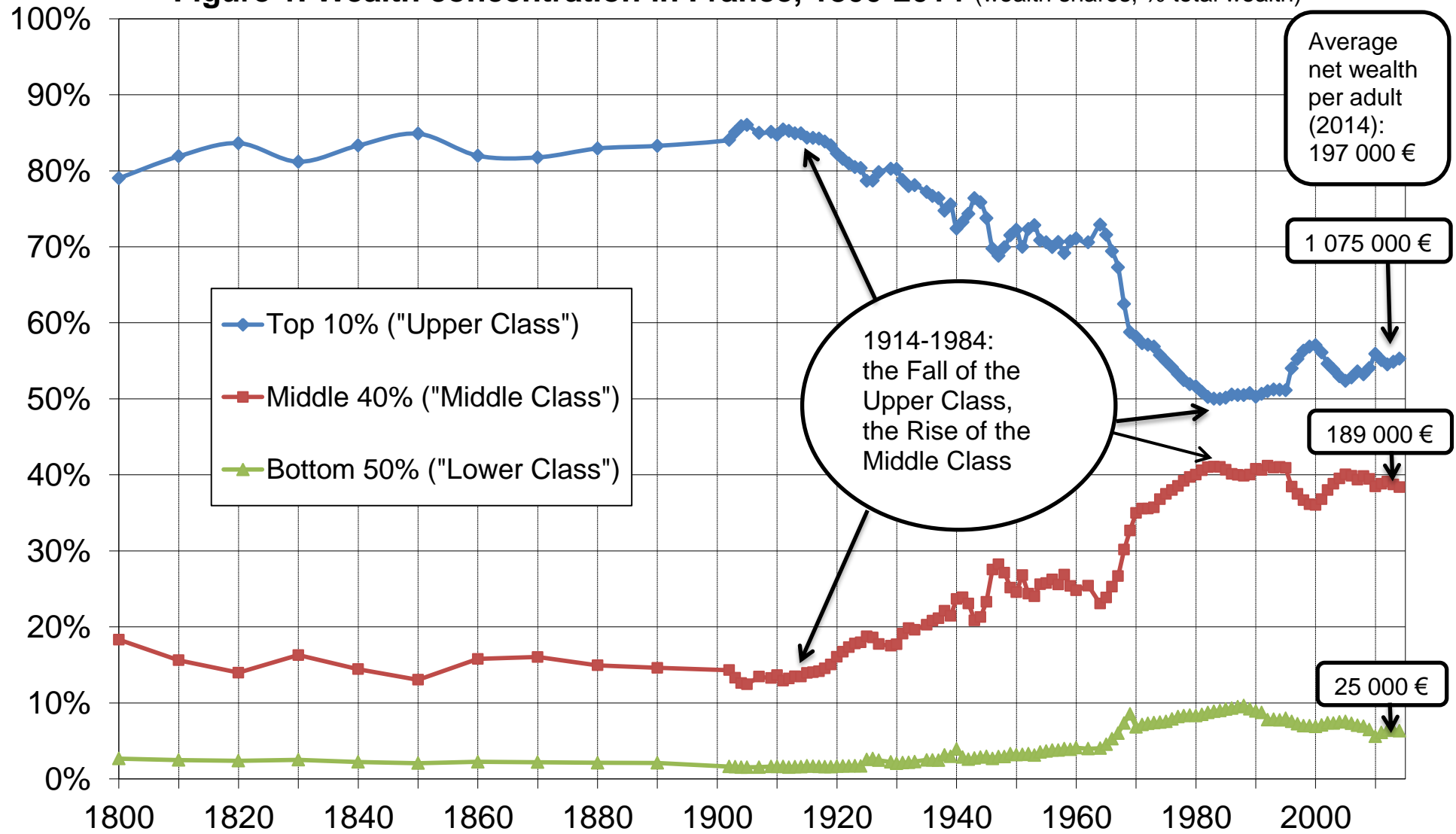
**Notes:** This table reports statistics on the distribution of wealth in France in 2014 obtained by capitalizing income tax returns. The unit is the adult individual (20-year-old and over; net wealth of married couples is splitted into two). Fractiles are defined relative to the total number of adult individuals in the population. **Source:** Appendix Table B1-B2.

**Table 2. Average annual rates of return by asset categories in France, 1970-2014**

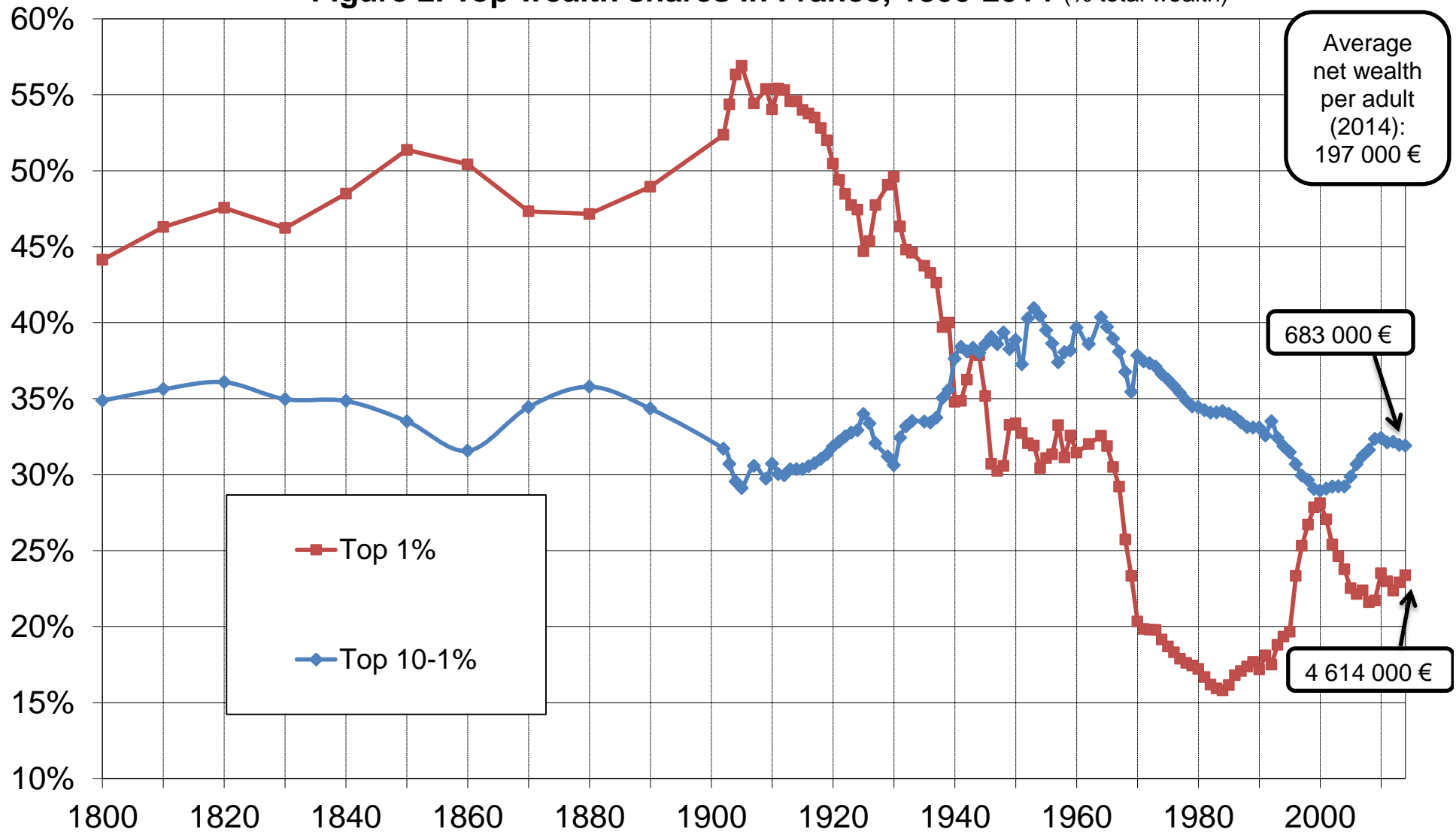
<b>Asset categories</b>	<b>Flow return</b> (rent, interest, dividend, etc.)	<b>Real capital gains</b>	<b>Total return</b>
<b>Net personal wealth</b>	<b>5,9%</b>	0,3%	<b>6,2%</b>
<b>Housing assets</b>	<b>3,6%</b>	2,4%	<b>6,1%</b>
<b>Business assets</b>	<b>5,4%</b>	0,1%	<b>5,6%</b>
<b>Financial assets (excl. Deposits)</b>	<b>12,0%</b>	-3,4%	<b>8,2%</b>
<b>Deposits</b>	<b>4,1%</b>	-4,1%	<b>-0,2%</b>
<b>Financial assets</b>	9,3%	-3,7%	5,3%
<i>incl. Equities/Shares/Bonds</i>	12,3%	-2,5%	9,4%
<i>incl. Life insurance/Pension funds</i>	11,2%	-6,7%	3,7%
<i>incl. Deposits/Saving accounts</i>	4,1%	-4,1%	-0,2%
Debt	7,1%	-5,6%	1,0%
Housing net of debt	2,8%	4,7%	7,6%

**Notes:** This table reports the average total returns on personal wealth by asset categories over the 1970-2014 period. The total returns are the sum of the flow returns and of the real rates of capital gains from the national accounts. The returns are gross of all taxes but net of capital depreciation. Real capital gains correspond to asset price inflation in excess of consumer price inflation. Source: See our companion paper Garbinti, Goupille-Lebret and Piketty (2017), Appendix A Table A23a, A24a and A25a.

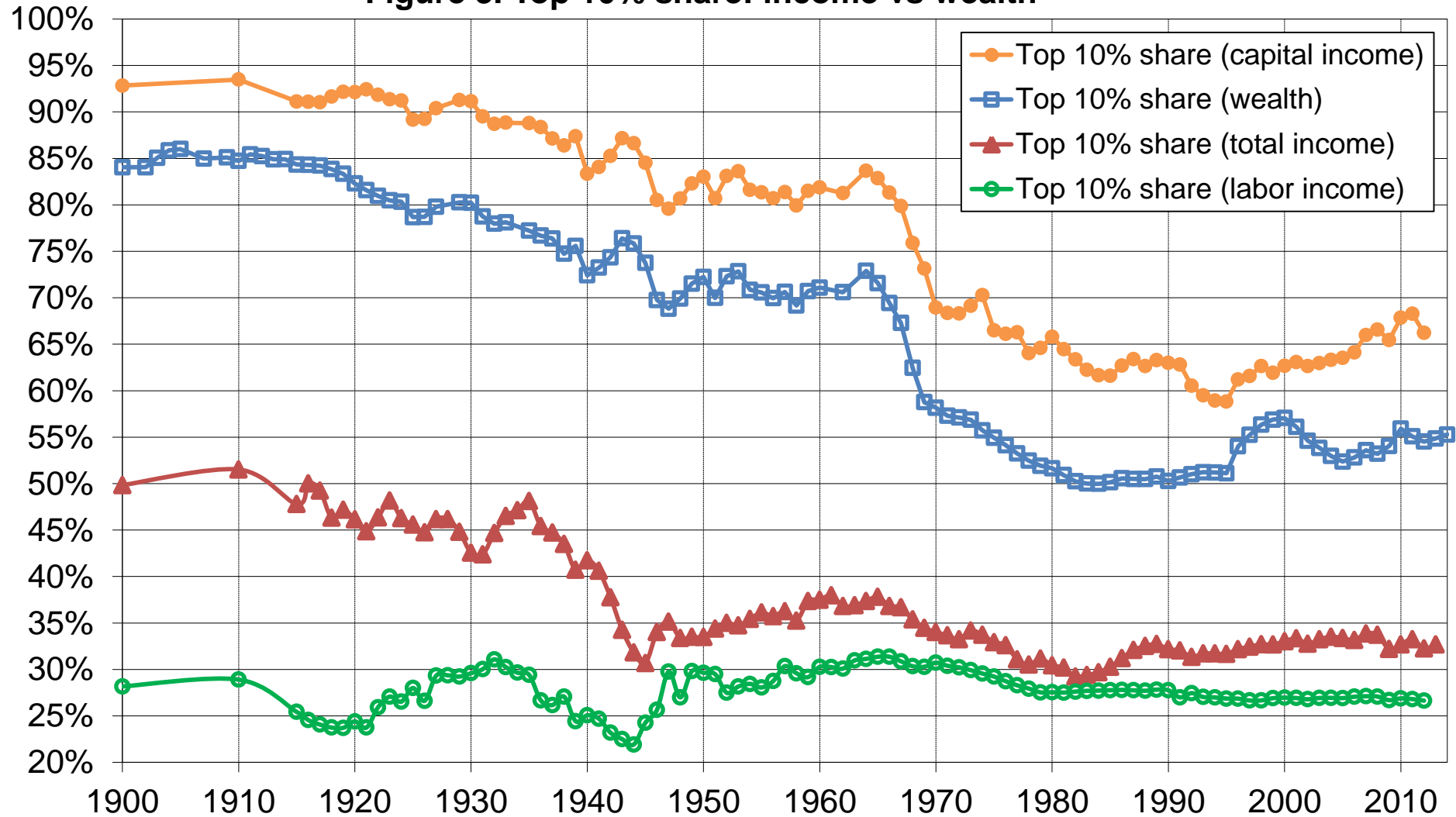
**Figure 1. Wealth concentration in France, 1800-2014** (wealth shares, % total wealth)



**Figure 2. Top wealth shares in France, 1800-2014** (% total wealth)



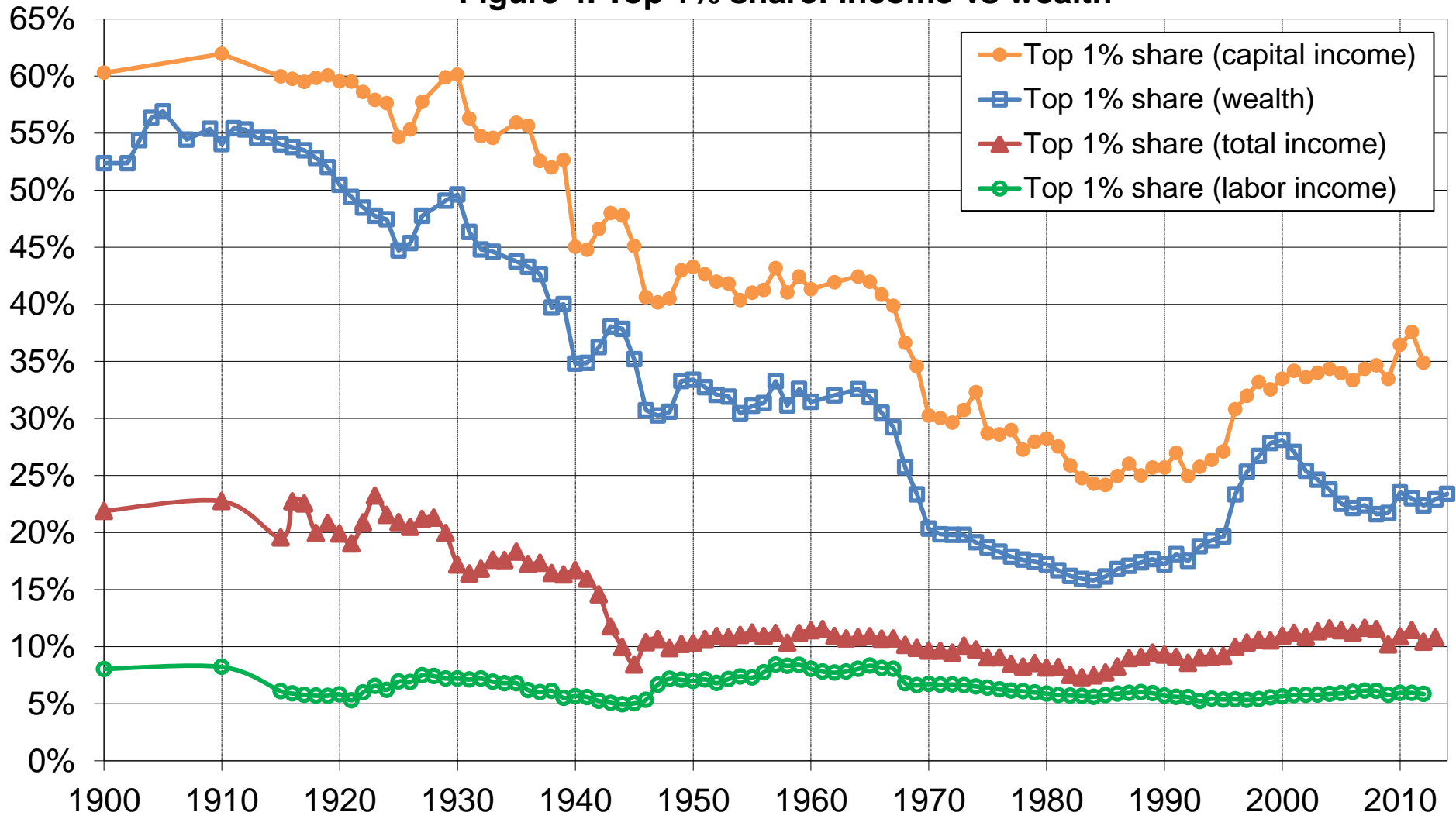
**Figure 3. Top 10% share: income vs wealth**



Distribution of total income, labor income, capital income and net wealth among adults.  
Equal-split-adults series (income and wealth of married couples divided by two).

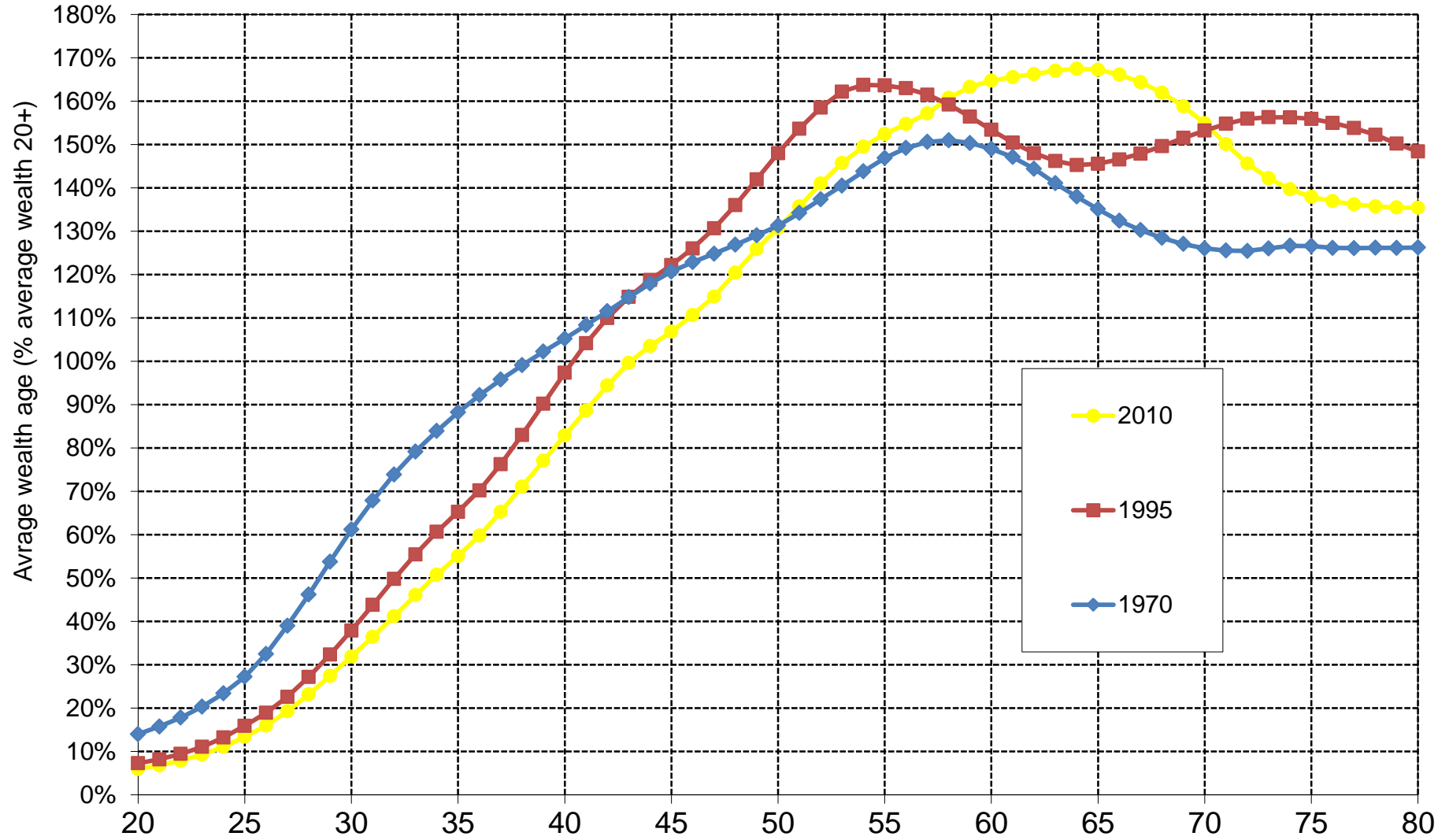


**Figure 4. Top 1% share: income vs wealth**

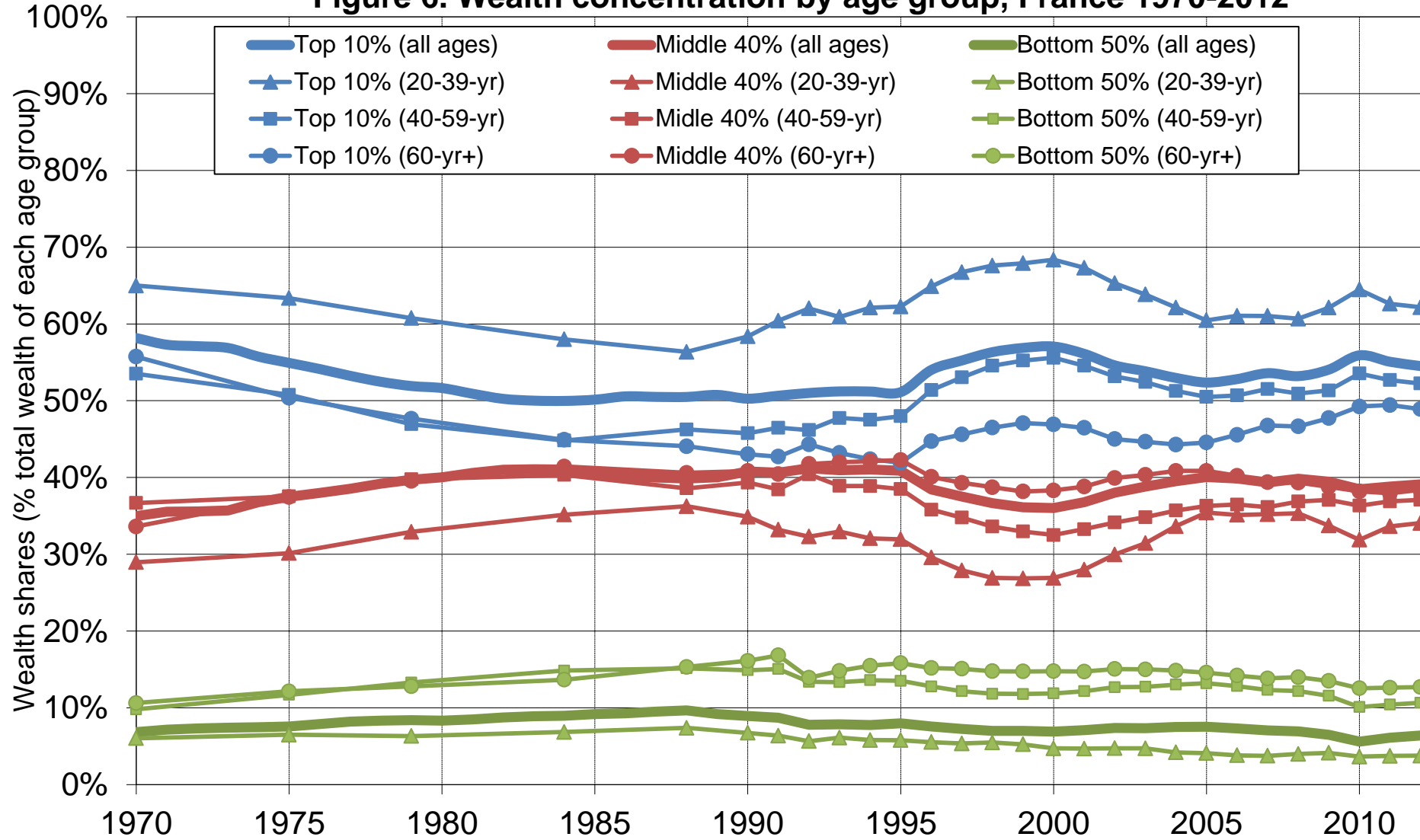


Distribution of total income, labor income, capital income and net wealth among adults.  
Equal-split-adults series (income and wealth of married couples divided by two).

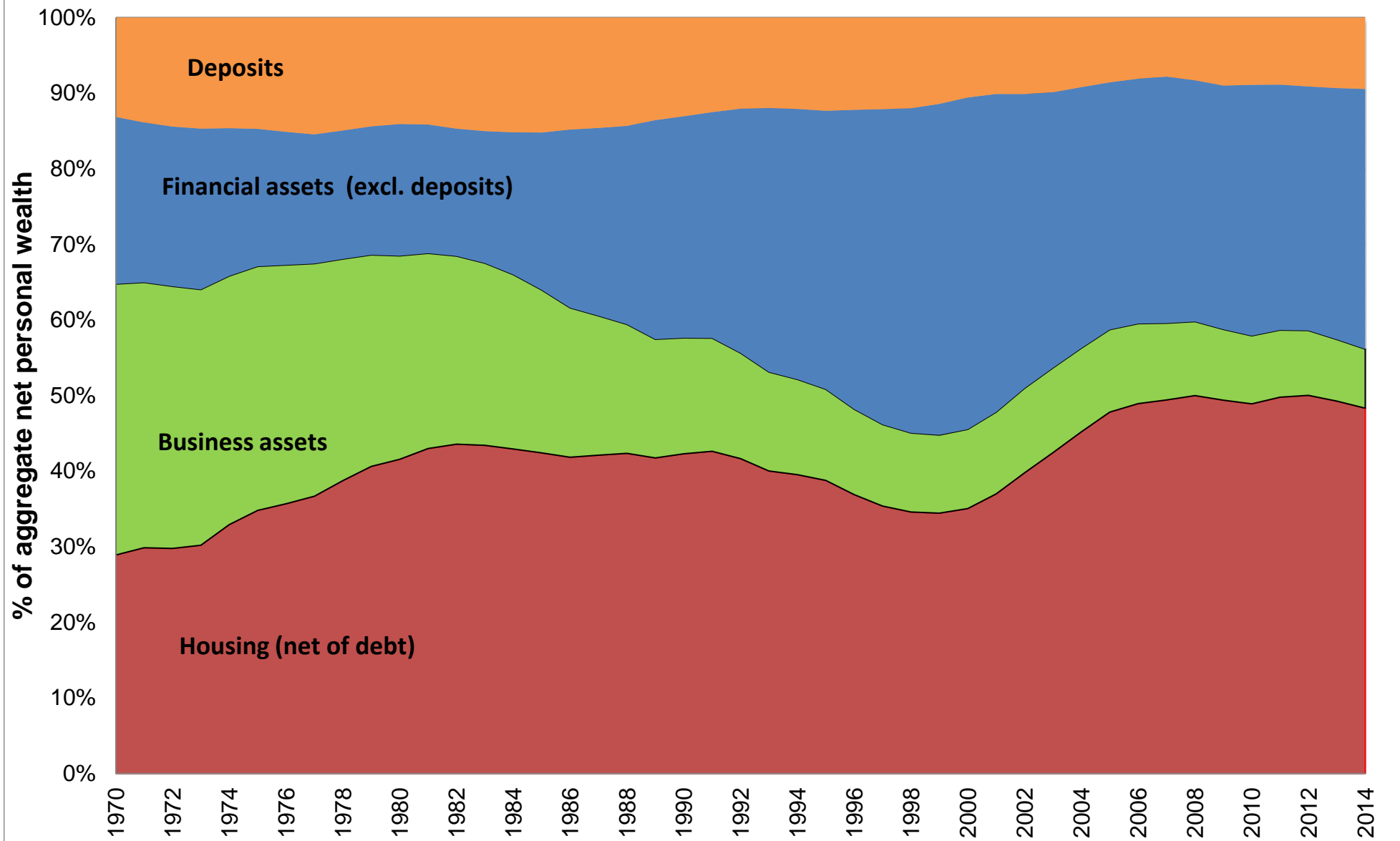
Figure 5. Age-wealth profiles in France, 1970-2012



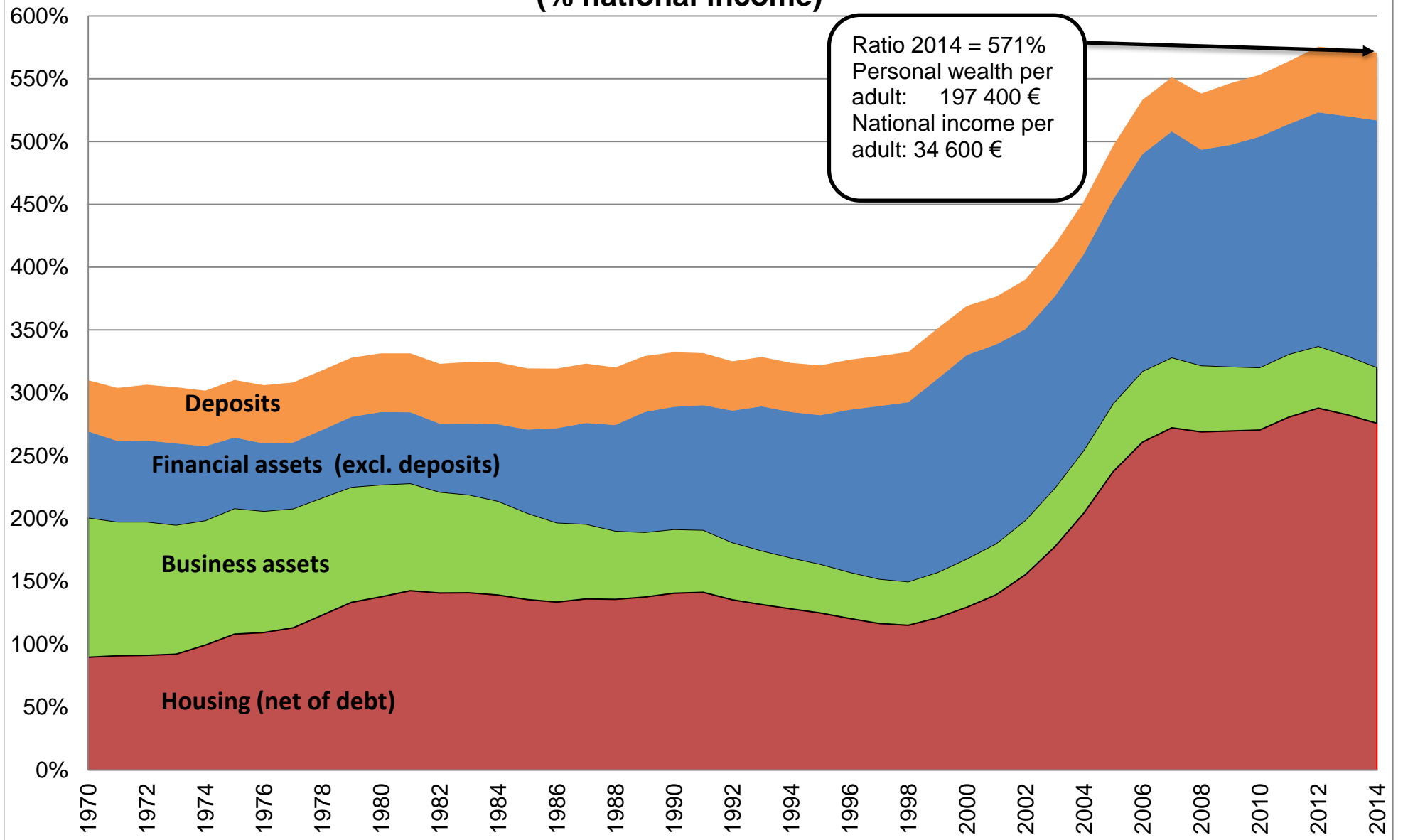
**Figure 6. Wealth concentration by age group, France 1970-2012**



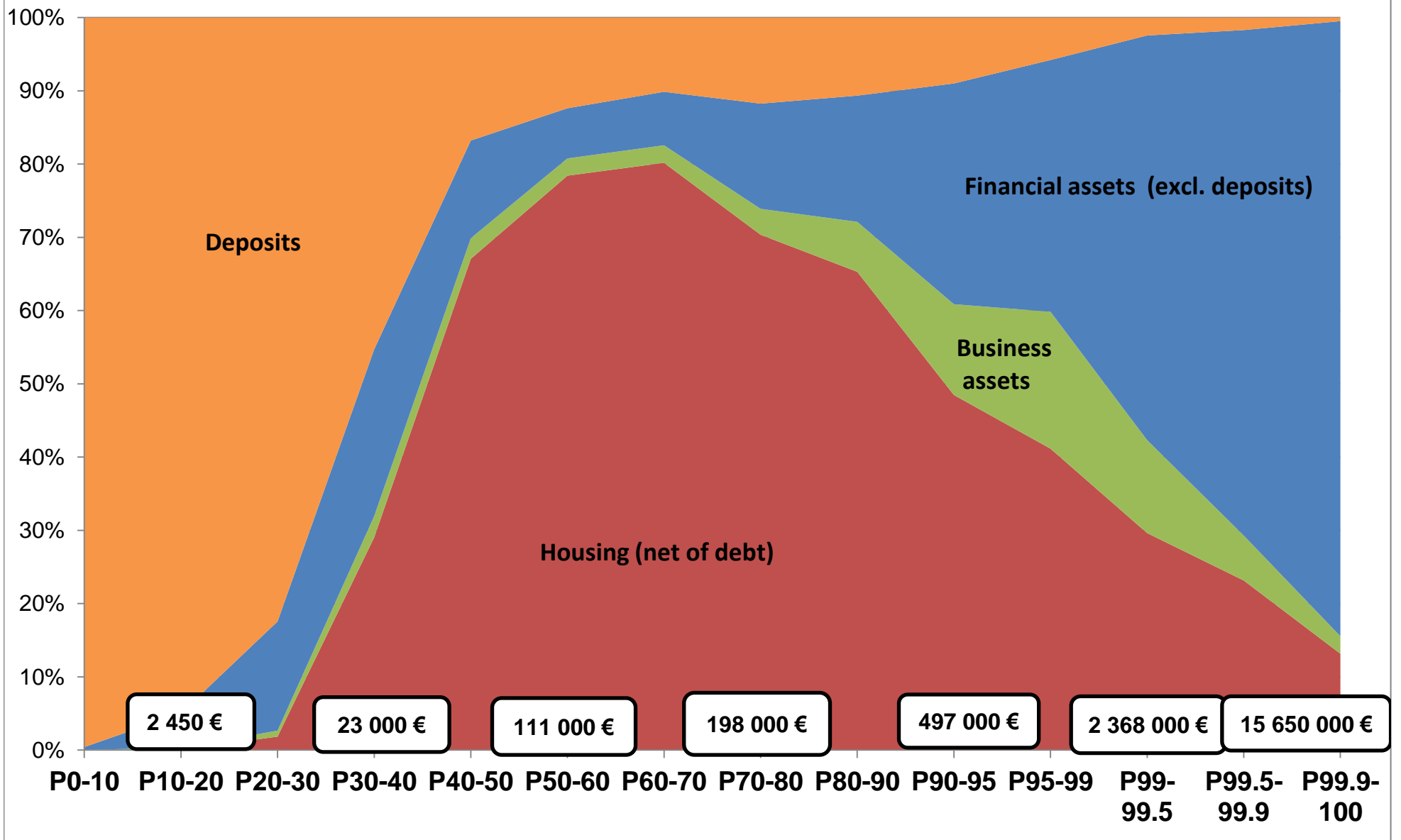
**Figure 7. Composition of aggregate personal wealth, France 1970-2014**



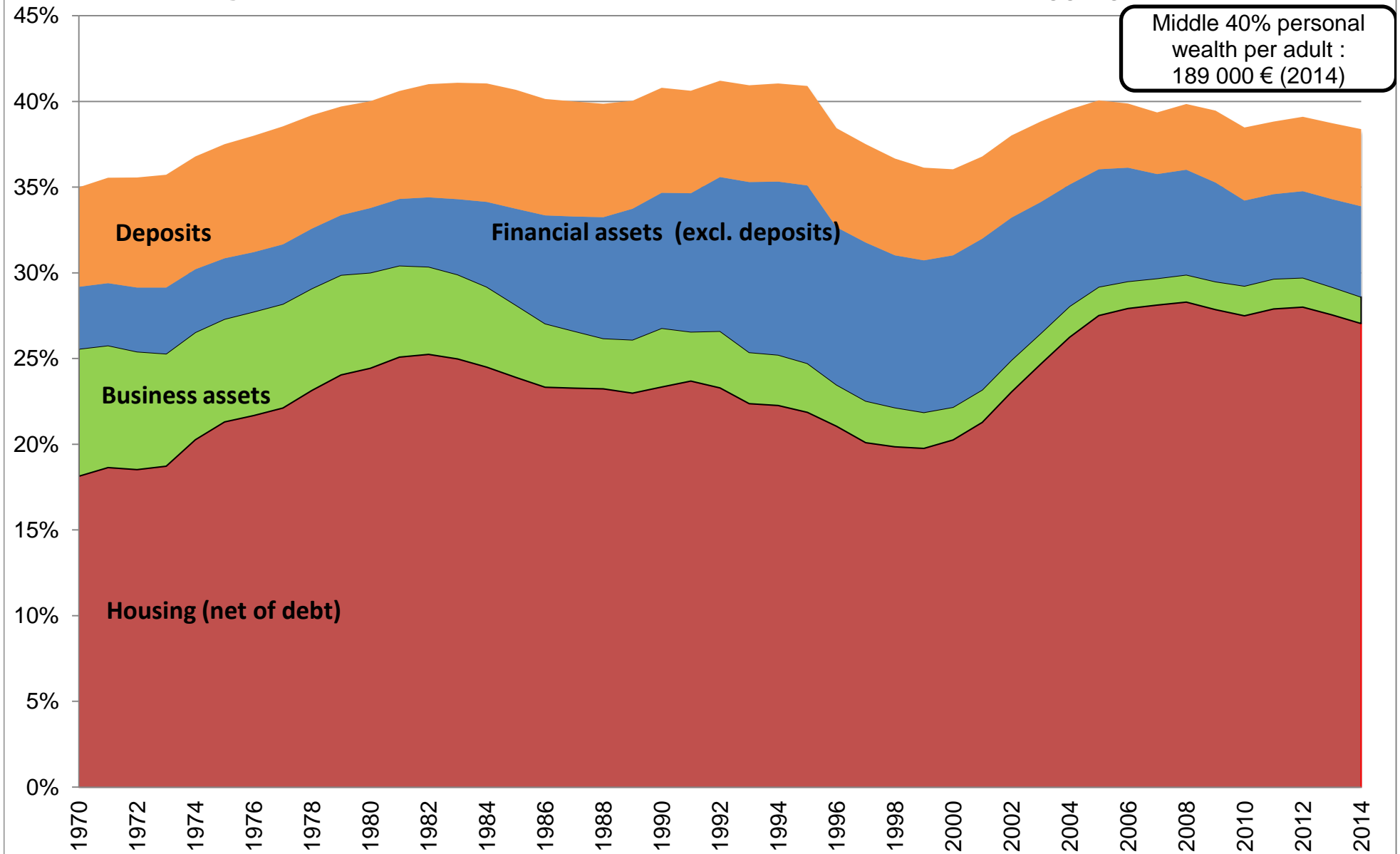
**Figure 8. Level and composition of personal wealth, France 1970-2014**  
 (% national income)



**Figure 9. Asset composition by wealth level, France 2012**



**Figure 10. Decomposition of middle 40% wealth share (% aggregate wealth)**



**Figure 11. Decomposition of top 1% wealth share (% aggregate wealth)**

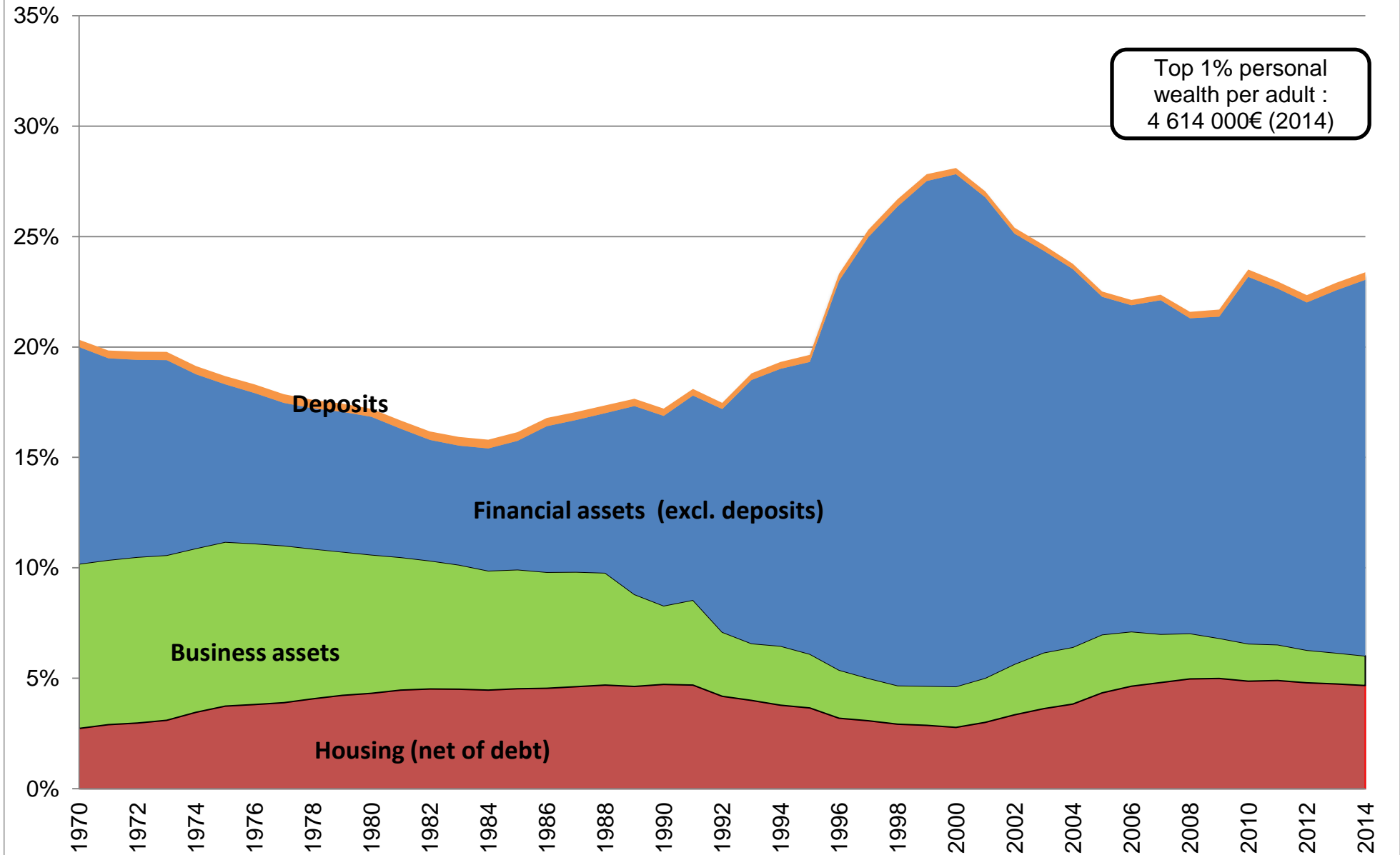




Figure 12. Simulating the evolution of top 1% wealth share (1)

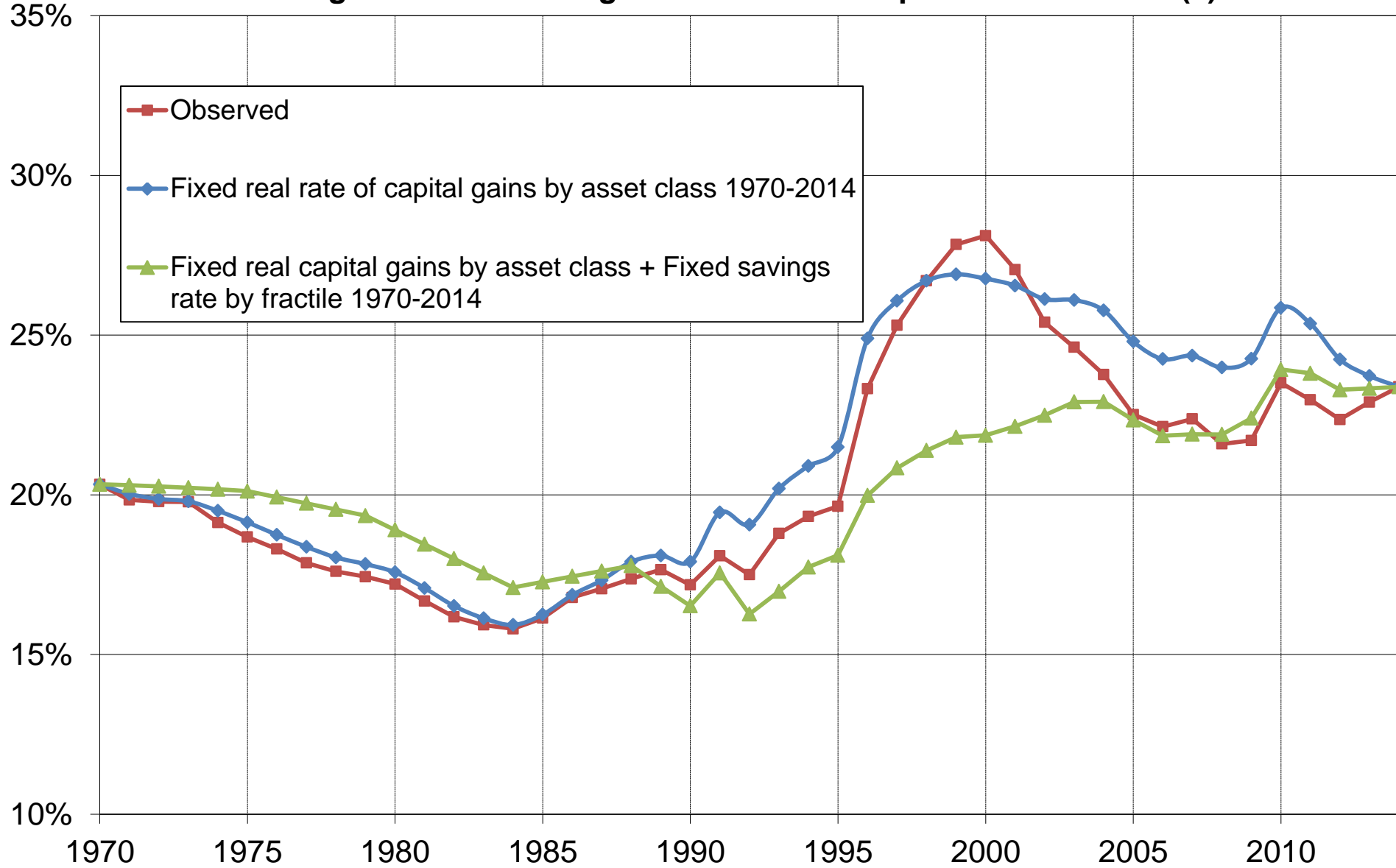


Figure 13. Simulating the evolution of top 1% wealth share (2)

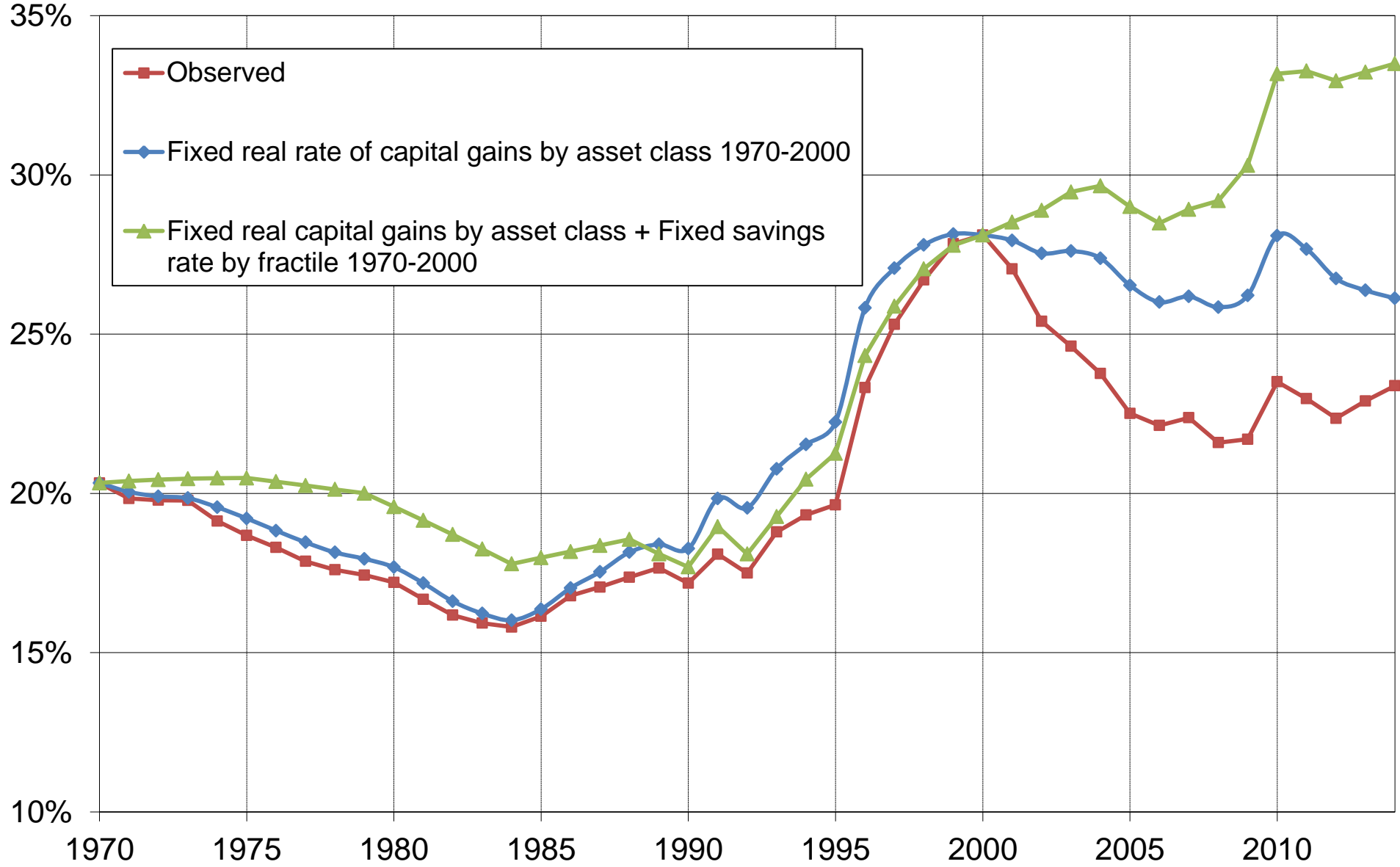
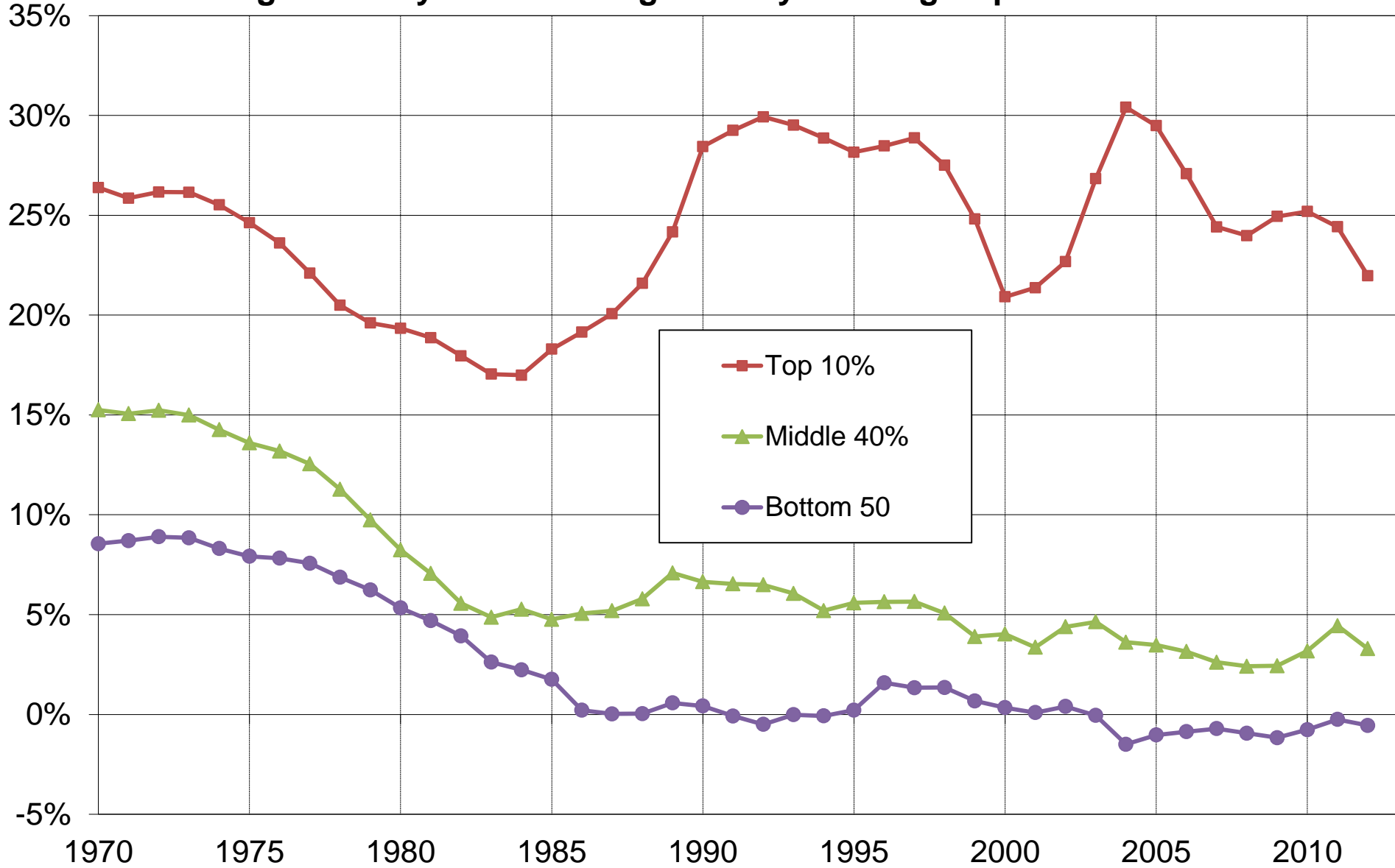
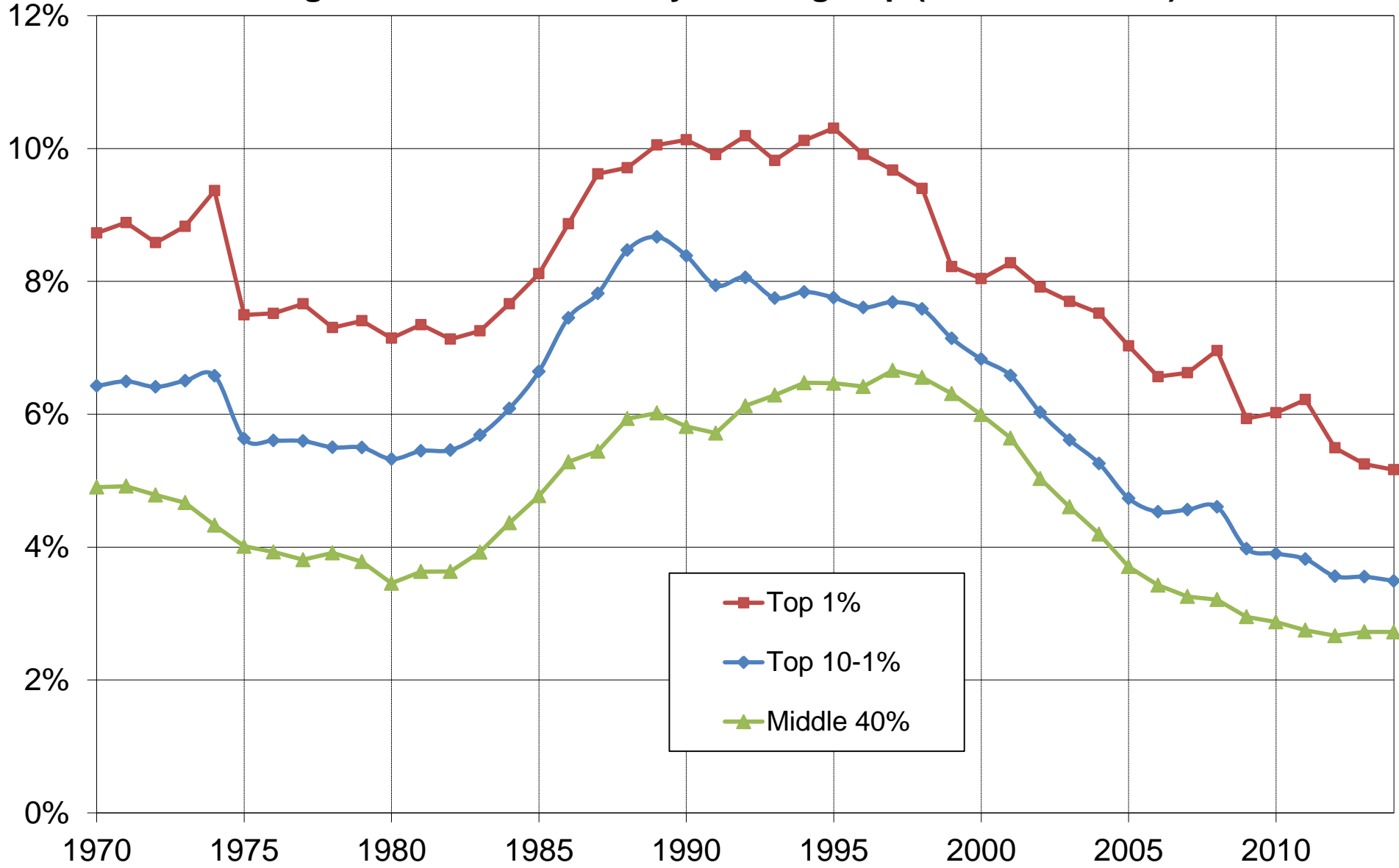


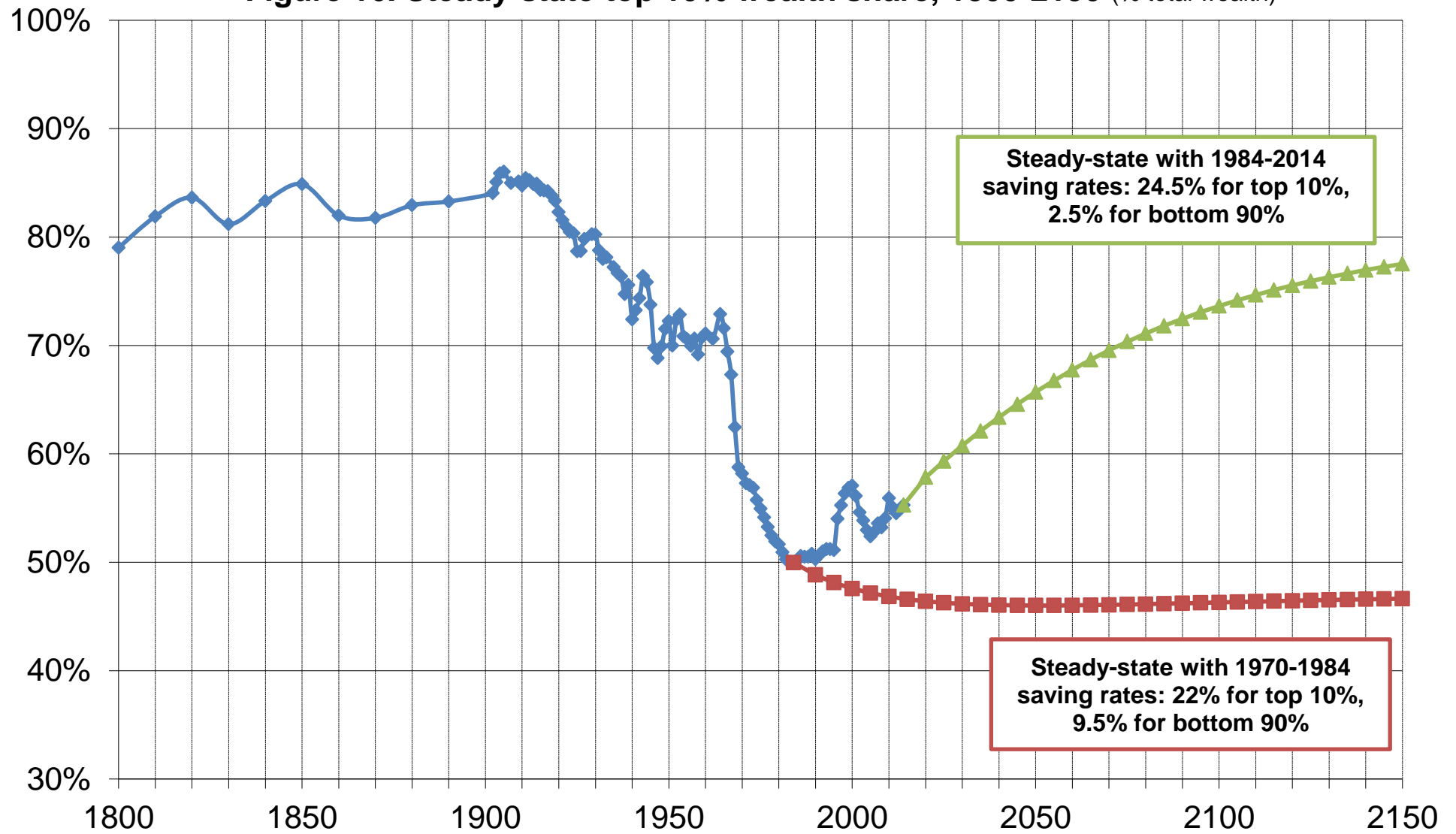
Figure 14. Synthetic saving rates by wealth group



**Figure 15. Flow returns by wealth group (before all taxes)**



**Figure 16. Steady-state top 10% wealth share, 1800-2150** (% total wealth)



**Figure 17. Wealth concentration: France, US, UK 1900-2014** (wealth shares, %)

