Intergenerational inequalities in standards of living in France

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In this article, the effects of age (or lifecycle) and generation on the standard of living are estimated using a pseudo-panel developed from the various editions of the French Household Expenditure Survey *(Budget de famille - BdF)* between 1979 and 2011. The standard of living of households is calculated using the disposable income or the private consumption per consumption unit, including and excluding expenditure on housing and imputed rent. Using the identification strategy developed by Deaton and Paxson (1994) for Age-Period-Cohort (APC) models produces two main results. Firstly, the standard of living increases significantly with age from 25 to 64 years old. For example, consumption is 35% greater for 50-54 year olds than for 25-29 year olds. From 65 years old, changes depend on the living standard indicator considered. Furthermore, the standard of living of the baby boom generations is higher than generations born before the Second World War, but lower than or equal to the generations that follow. For example, the consumption of the cohort born in 1946 is 40% higher than the cohort born in 1926, but 20% lower than the cohort born in 1976. Considering all cohorts born between 1901 and 1979, no generation has been less fortunate than its ancestors. Discussion of these results demonstrates their robustness, particularly with regard to the results of other identification strategies, including the Age-Period-Cohort-Detrended (APCD) method which removes the linear trend from variables, and an original strategy, the Life Expectancy-Period-Cohort method (LEPC) which replaces the age variable with the life expectancy at each age. It shows the significance of economic growth in increasing the standard of living of generations and confirms that no generation has consumed less than the generations preceding it.

JEL codes: C23, D12, J14.

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The subject of generations or age groups often features in public debate in the form of comparison. Some generations are considered fortunate and others are felt to have suffered. Essays on the topic attract a broad readership and generally insist on the special fortune of the post-war baby boom generation, sometimes even to the detriment of the following generations[1].

The aim of this article is to compare the standards of living of different age groups and generations in France using statistical data from the (*Budget de famille – BdF* hereafter). We will use two levels of comparison. The first assesses the standard of living as a function of age, in order to compare age groups with one another and assess whether "young people" are more or less fortunate than their elders. This first level of comparison primarily seeks to describe inequalities between age groups over a relatively long time period, eliminating the period effects, which could bias simple, cross-sectional analysis. However, it is difficult to draw normative conclusions. It is particularly unclear whether equal standards of living between age groups reflects household preference. Even in a context of complete markets, the lifecycle theory suggests that consumption increases with age if the return on savings is greater than the preference of an individual for the present (Yaari, 1965). Although the markets proposing life insurance in annuities are imperfect, it suggests that consumption follows an inverted U-shaped curve (Davis, 1981). The second level of comparison assesses standards of living as a function of the date of birth of individuals, by controlling the age and period effects. This compares generations and shows whether one generation has had a higher standard of living than others. However, it does not allow for analysis of the reasons behind any intergenerational inequalities and cannot be used to explain any cause-and-effect relationships between the good fortune of some and bad fortune of others. Despite this, comparison of inequalities by date of birth is better suited to normative discussion. It is obviously difficult to compare people born on different dates who have lived in very different contexts. Nevertheless, a first step can be taken by using the minimum sustainability rule which stipulates that the actions of present generations must not reduce the opportunities of future generations. A downwards trend in the standard of living of generations could therefore be considered unfair. It is difficult to take analysis further without drawing on ideological assumptions (Masson, 2009).

Comparison of standards of living between age groups and generations is complex for a number of reasons. The first concerns the choice of the variable of interest. Articles sometimes promote a specific variable such as youth unemployment or working income, which is important, but reflects just one aspect of the relative situation of the different generations (Gaini et al., 2013). In this article, we selected more general variables. We first use the total disposable income, which takes into account labour and capital income, and both public and private net transfer income. We also use a variable that describes private consumption. Using two variables is a pragmatic choice that avoids resolving the question of whether the standard of well-being is better measured using income or consumption. Using two variables also helps assess the robustness of our results. In addition, these two variables are broken down, specifying the share of expenditure on housing, particularly the imputed rent (rent that would be paid by occupant owners if they were renting their accommodation). This is used to analyse the robustness of results by removing rent from the variables studied. Finally, these variables are presented per consumption unit in the household. For the sake of simplicity, we use "standard of living" to refer to this set of variables.

The second difficulty concerns the data available. It would be ideal to have panels that follow individuals from various generations throughout their lives. In practice, we only have information on individuals who differ from one survey to another, which describes the behaviour of different generations at different moments in their lifecycle. We therefore use the seven editions of the *BdF* survey, carried out between 1979 and 2010, which we rework in order to develop a pseudo-panel to follow different cohorts throughout their lifecycle. This gives us 407 cohort observations, comprising an average of 164 individuals.

The third difficulty concerns the estimation method. Indeed, it is difficult to dissociate age effects from date of birth and period effects (assessed using the survey date). The sum of the estimated model's first two variables equals the third, making them collinear. We deal with this difficulty by setting restrictions on the period effects, which has been standard procedure since the article by Deaton and Paxson

1. The media success of these essays can be seen, for example, on the Guardian website, which presents data showing the loss of income for younger generations.

(1994). This identification strategy seems the most appropriate, but we nevertheless discuss our results using alternative strategies, including the Age-Period-Cohort-Detrended (APCD) method developed by Chauvel (2013) and an original strategy we propose, known as the Life Expectancy-Period-Cohort (LEPC) method. In this method, we estimate models that consider the "life expectancy at a given age" variable instead of the "age" variable. The clear advantage is that life expectancy is not collinear with the date of birth and date of observation. Introducing the life expectancy also takes into account the significant increase in length of human life (life expectancy for males at birth has increased by around 12% over the period studied). We therefore compare individuals of different ages but with the same life expectancy from one generation to another.

We obtained the following results with regard to changes in the standard of living as a function of age. Whatever the variable studied (income, consumption, including or excluding housing), a significant increase can be observed until the age of 60 if the effects of the date of birth and period are controlled. For example, the consumption of 50-54 year olds is 134.8% that of 25-29 year olds. The issue of the relative standard of living of the oldest individuals is more disputed in the literature. We show that there is no significant decline in the standard of living over 65 years old, except for consumption excluding expenditure on housing. Our estimations are generally consistent with previous work carried out for French households (Bossinot, 2007; Lelièvre et al., 2010), with profiles fairly similar to Belgian households (Lefèbvre, 2006) and quite different to American households, where the inverted U-shaped curve is more pronounced (Gourinchas and Parker, 2002; Fernández-Villaverde and Krueger, 2007; Aguiar and Hurst, 2013; Schulhofer-Wohl, 2015).

Our results clearly show an improved standard of living from one generation to another. Generations born later have a standard of living above or equal to that of the preceding generations and there are no "suffering" generations where one generation had a standard of living below that of its elders. The baby boomers therefore had a standard of living above that of generations born before the Second World War, but lower than or equal to generations born in the 1970s. For example, the consumption of the cohort born in 1946 is 40.6% higher than the cohort born in 1926, but 19.5% lower than the cohort born in 1976. However, the increase in the standard of living has not been continuous and a stagnation can be observed for cohorts born between the end of the Second World War and the end of the 1950s, who seem to have been more affected by the slowdown in economic growth from the 1970s.

Our results are consistent with those obtained by Lelièvre et al. (2010) based on tax revenue, and by Bernard and Berthet (2015) and Guillerm (2017) based on household wealth. However, our results differ from those of Chauvel (2013) and Chauvel and Schroeder (2014), who suggest that the baby boomers had a higher disposable income than other generations, once the trend of the variable of interest has been excluded. Although we are not convinced of the necessity of excluding the trend of the variable in order to compare generations, we wanted to reproduce the results of Chauvel and Schroeder (2014) using our data which have the advantage of consistency with the French System of National Accounts and covers a longer period. Using the same econometric specification, we do not find that baby boom cohorts were significantly more fortunate than the generations that followed. We get generally similar results with our LEPC identification strategy which substitutes life expectancy for age. This can be explained by the correlation between life expectancy and income. The results of Bernard and Berthet (2015) and Guillerm (2017) on wealth and our results on the standard of living suggest that the baby boomers were not more fortunate than the generations that followed.

The remainder of this article continues as follows. We begin by presenting our database, before detailing our identification strategy and then presenting and discussing our results.

Data and variables analysed

The *BdF* surveys

The data used are taken from the *BdF* surveys conducted in 1979, 1984, 1989, 1995, 2000, 2005 and 2010[2]. These surveys were carried

2. Surveys are sometimes carried out over two years. In these instances, we retained just one of the two years without this choice affecting our results as we adjusted our variables in line with the French Sysem of National Accounts.

out on over 10,000 households with the aim of reconstituting all household accounts by gathering information on their income and expenditure. It is worth noting that, in the survey, a household refers to a group of people, whether or not they are related, who ordinarily share a dwelling and have a shared budget. There may therefore be a number of "households-living unit" within the same dwelling. Information is collected over twelve months in order to eliminate the seasonal effects of some expenditure such as heating or certain food expenses.

In order compare data within a consistent time frame, it seems essential to adjust survey data in line with the French System of National Accounts (NA) aggregates. This adjustment is similar to the one carried out for the National Transfer Accounts (d'Albis et al., 2015, 2017) and aims to bring the consumption and aggregate disposable income of households into line with NA aggregates. In particular, we consider ordinary households residing in Metropolitan France. Before adjustment, we corrected differences in coverage and concept between the *BdF* survey and NA as much as possible[3].

Despite the quality of the surveys, it seems that the income and consumption from *BdF* surveys are different to the values in the National Accounts (NA). These differences can be explained first and foremost by the under-declaration or non-declaration of some consumption and income, and also by differences in coverage. The *BdF* survey only collects the income and consumption of individuals residing in France in ordinary households (i.e. excluding households residing in mobile or communal dwellings), whereas the NA considers all households. In addition, the *BdF* survey covers the consumption of French residents abroad, but does not include the consumption of foreign tourists in France, whereas the NA covers all consumption on French soil. The differences can also be explained by conceptual differences, particularly for some consumption items, which do not include the same types of expense. For example, for the housing item, the *BdF* survey only counts rent actually paid by tenants whereas the NA adds the imputed rent that homeowner households would have to pay if they were renting to their consumption.

Tables 1 and 2 show the *BdF* survey coverage rates compared to the NA for disposable income, which represents all income minus direct taxes, and consumption. Calculations take into account corrections associated with coverage and conceptual differences between the *BdF* surveys and NA data[4]. The disposable income of households was significantly underestimated in the *BdF* surveys before 1990, but coverage has improved since the 1995 survey. The trend is less clear for consumption.

The variables studied

Four variables are studied in this article.

- The first is the *disposable income of households*. The NA defines this as income after deduction of taxes and social security contributions. It therefore represents the income used by the household for consumption and savings. Income includes: *(i)* working income: salaries, self-employed income, etc.; *(ii)* income from household worth: dividends, interest, rent, etc. to which we add the imputed rents; *(iii)* social security benefits, including pensions and unemployment benefits; *(iv)* current transfers, particularly insurance indemnities minus premiums and transfers between households. We obtain the disposable income by adding all these sources of income and deducting any direct taxes paid (income tax, council tax, property tax). Note that the income declared in the *BdF* surveys is net of social security contributions (including CSG and CRDS payments).

- For the purposes of comparison, we also study the *disposable income excluding imputed rent.*

- The third variable is the private *consumption* of households. This is the sum of the 12 consumption items under the COICOP (*Classification of Individual Consumption by Purpose*). It excludes taxes, major maintenance work and loan repayments, but includes imputed rent.

- The final variable studied is *consumption excluding housing*, which represents the private consumption of households excluding expenditure on housing.

All the variables are deflated using the consumer price index.

Housing is an important aspect of the standard of living. In order to create consistent age and period comparisons, it is vital to take into account the value associated with the service provided by the housing of occupant

3. The corrections made and intermediate adjustment results are presented in the online supplement C1.
4. See the online supplement C1.

homeowners. Ignoring this variable would result in underestimating the standard of living of homeowner households. Imputed rent is the estimated rent that homeowners would have to pay if they were renting their accommodation. It can be considered both an income and additional consumption. Unfortunately, the *BdF* surveys from 1979 to 1995 do not provide figures for imputed rent. We had to estimate them using the characteristics of housing. The procedure is similar to the one used in Marquier (2003), Driant and Jacquot (2005) and d'Albis et al. (2015, 2017). Homeowners' imputed rent is calculated using the following equation:

$$loyer_i = exp(X_i' \hat{\beta} + residu_i)$$

where X_i is the vector of the variables (region, urban units, surface area, number of rooms, housing type, etc.) of the rent equation for observation i and where β is the vector of the estimated coefficients of the rent equation. In order to obtain correct rent distribution, the imputed residual must have the same distribution as the residuals taken from the rent equation. As the rent equation residuals are heteroscedastic and non-Gaussian, they cannot be expressed as a normal distribution. The appropriate residual imputation method is the Hot Deck method, which involves randomly selecting an estimated residual using the estimation from the rent equation. This residual is then imputed to housing "similar" to the one from which we selected the estimation residual and for which we have to calculate the imputed rent.

The surveys provide the level of income and consumption of households. During a lifecycle, changes to income and consumption particularly

Table 1
Comparison of the disposable income from the French Household Expenditure (*BdF*) surveys and National Accounts

	Disposable income in *BdF* (in billions of euros in nominal terms)	Disposable income in NA (in billions of euros in nominal terms)	Coverage rate (in %)
1979	168.1	250.0	67.2
1984	338.2	438.2	77.2
1989	437.0	588.6	74.2
1995	637.0	735.4	86.6
2000	784.4	867.4	90.4
2005	877.6	1045.9	83.9
2010	1104.67	1216.4	90.8

Note: data was adjusted for comparison between the BdF *surveys and NA.*

Reading note: the coverage rate is the ratio between the BdF *disposable income and the NA disposable income.*
Coverage: private households living in Metropolitan France.
Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - BdF*), French System of National Accounts, authors calculations.*

Table 2
Comparison of consumption from the French Household Expenditure (*BdF*) surveys and National Accounts

	BdF consumption (in billions of euros in nominal terms)	NA consumption (in billions of euros in nominal terms)	Coverage rate (in %)
1979	181.2	200.9	90.2
1984	352.4	369.5	95.4
1989	452.7	515.1	87.9
1995	605.0	620.0	97.6
2000	669.9	739.5	90.6
2005	785.7	894.7	87.8
2010	855.0	1024.3	83.5

Note: data was adjusted for comparison between the BdF *surveys and NA.*

Reading note: the coverage rate is the ratio between consumption in the BdF *and the NA surveys.*
Coverage: ordinary households living in Metropolitan France.
Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - BdF*), French System of National Accounts (NA), authors calculations.*

reflect variations in the size of households, which changes according to the marital status and birth rate of the household. The size of the household throughout the lifecycle initially increases, reaching its maximum when the reference individual is approximately 40 years old, before decreasing. However, this trend varies from one survey to another (see the figure in Appendix 1). In order to better measure standards of living, we correct household income and consumption in line with these demographic variations, dividing the variables by the number of consumption units in the household. These consumption units give each member of the household a weighting depending on the age, in order to take into account economies of scale within households. This scale has changed over time in the *BdF* surveys. From 1979 to 1995, the Oxford scale was used (giving a weighting of 1 to the reference individual, 0.7 to individuals over 14 and 0.5 to individuals under 14), whereas from 2000 to 2010, the OECD-modified scale was used (1 for the reference individual, 0.5 for individuals over 14 and 0.3 for individuals under 14)[5]. It seemed more appropriate to use the same scale for all surveys in order to produce robust comparisons over time. We therefore weighted the variables from the surveys from 1979 to 1995 using the OECD scale. The decision to use the OECD scale is based in particular on the reasoning of Hourriez and Olier (1997) who show that the OECD scale is more appropriate than the Oxford scale in the 1990s for taking into account economies of scale[6]. However, the choice of scale is not insignificant and can influence estimations. Later in this article we test robustness by analysing the instances where the consumption unit is defined, as in the *BdF* surveys (Oxford scale from 1979 to 1995 and OECD-modified scale from 2000 to 2010), and as the square root of the number of individuals in the household. We also study instances where the variables are not weighted and where the number of consumption units is a control variable for the estimated model.

For the sake of simplicity, we refer to all four of our variables weighted by the number of consumption units using the term "standard of living", despite the fact that this terminology is usually used to refer to the disposable income per consumption unit. We are also well aware that our variables are an imperfect measure of "well-being" and that other variables such as health or environment are important. We also know that these are only mean values for each age, which do not take into account spreads that may affect the perception of the standard of living at each age.

Descriptive analysis

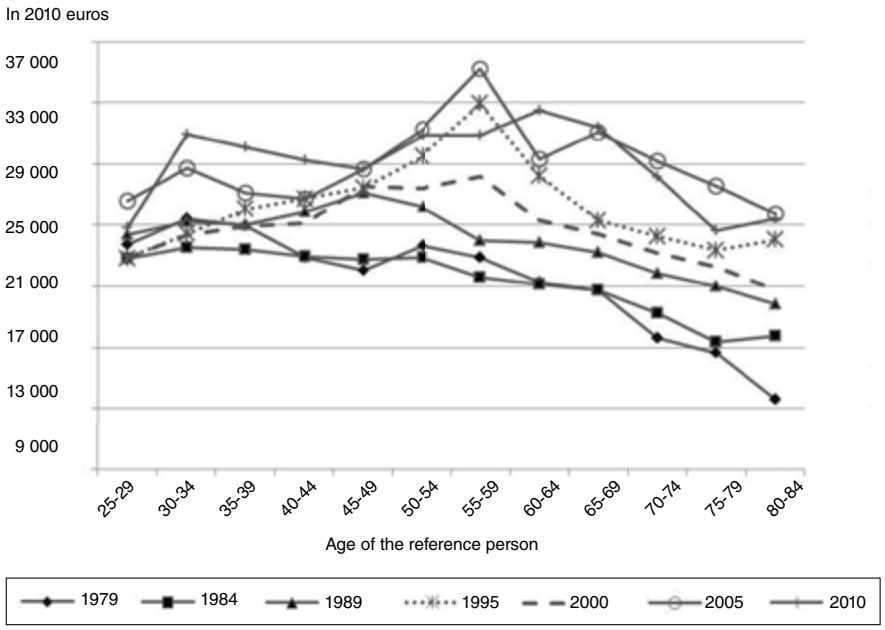
Reprocessed data may be presented synchronically or diachronically. Firstly, Figures I and III represent the standard of living (i.e. disposable income and consumption, both expressed by consumption unit) as a function of the age of the reference individual on the dates of the various surveys. This is used to compare the relative standards of living of the different age groups on a given date. Secondly, Figures II and IV represent the standard of living by age for 16 generations. These generations were constructed using seven cross-sectional databases (created from the seven *BdF* surveys). We first constructed 79 annual cohorts, defined according to the reference individual's date of birth, from the cohort born in 1901 to the cohort born in 1979. The generations were then defined using the mean of five consecutive cohorts (except for the first generation which consists of 4 cohorts).

Figures I and II regarding the disposable income per consumption unit firstly show a significant increase in the standard of living over the period considered. From one date to another, particularly between 2005 and 2010, a decrease in income can be observed for a given age, but across the entire period, the increase remains positive regardless of the age considered. However, the increase is very heterogeneous depending on the age groups. While the disposable income of 45-49 year olds increased by around 30%, it almost doubled for 70-74 year olds. The figures also seem to show relative stability in the standard of living as a function of age. Whatever date is considered, there are no major differences in income between the age groups. Between 25 and 74 years old, income is within a margin of 20% above or below the income of 45-49 year olds. For older age groups, the difference was initially greater, but has fallen throughout the period.

Analysis of consumption, with Figures III and IV confirms the analysis of income. A significant rise in consumption is observed over time, which increases as the individual grows older. In addition, the profile by age is fairly similar from one date to another and is characterised by

5. On equivalence scales, see the article by Martin in this issue.
6. A robustness test for our results regarding this choice is presented in the online supplement C3.

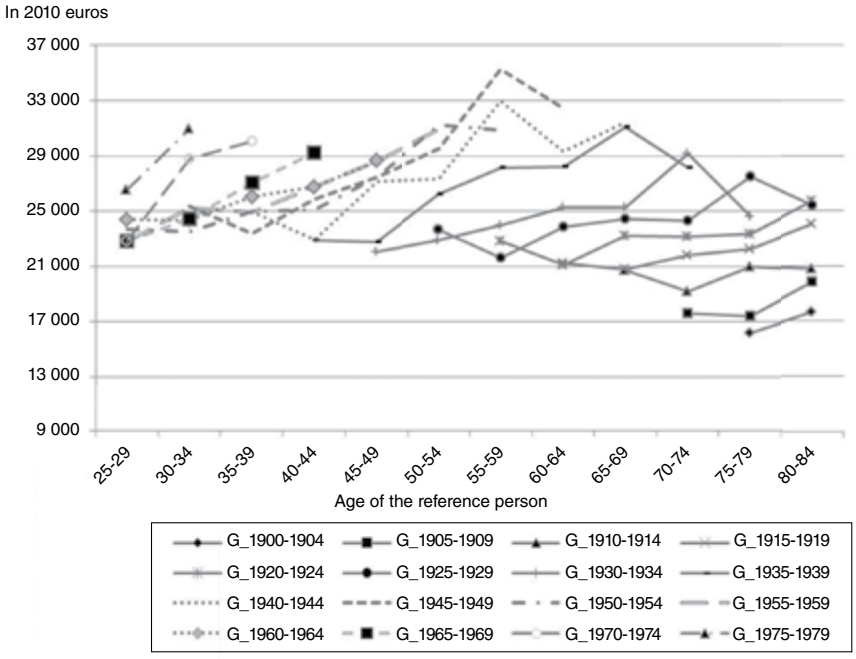
Figure I
Annual disposable income per consumption unit by age of the household reference person and the survey date



Note: disposable income is all household income (including imputed rent) after deducting taxes and social security contributions. Consumption units are calculated using the OECD-modified scale.

Reading note: in 2010, the mean disposable income per consumption unit for 25-29 year olds was €25,000.
Coverage: private households living in Metropolitan France.
Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - BdF*), authors calculations.*

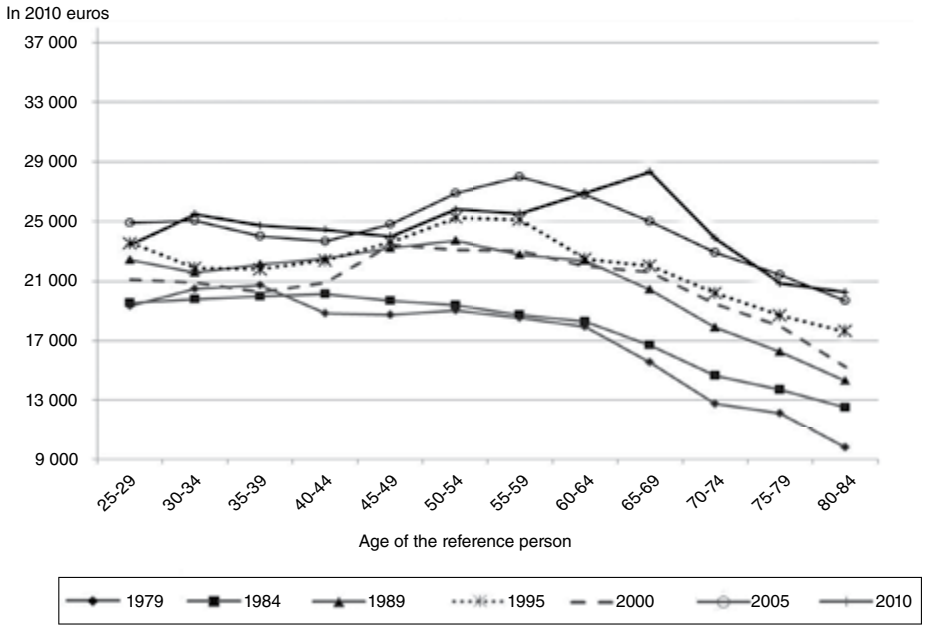
Figure II
Annual disposable income per consumption unit by the age and generation of the household reference person



Note: disposable income is all household income (including imputed rent) after deducting taxes and social security contributions. Consumption units are calculated using the OECD-modified scale.

Reading note: the mean disposable income per consumption unit for individuals born between 1975 and 1979 was €26,000 when they were 25-29 years old.
Coverage: private households living in Metropolitan France.
Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - BdF*), authors calculations.*

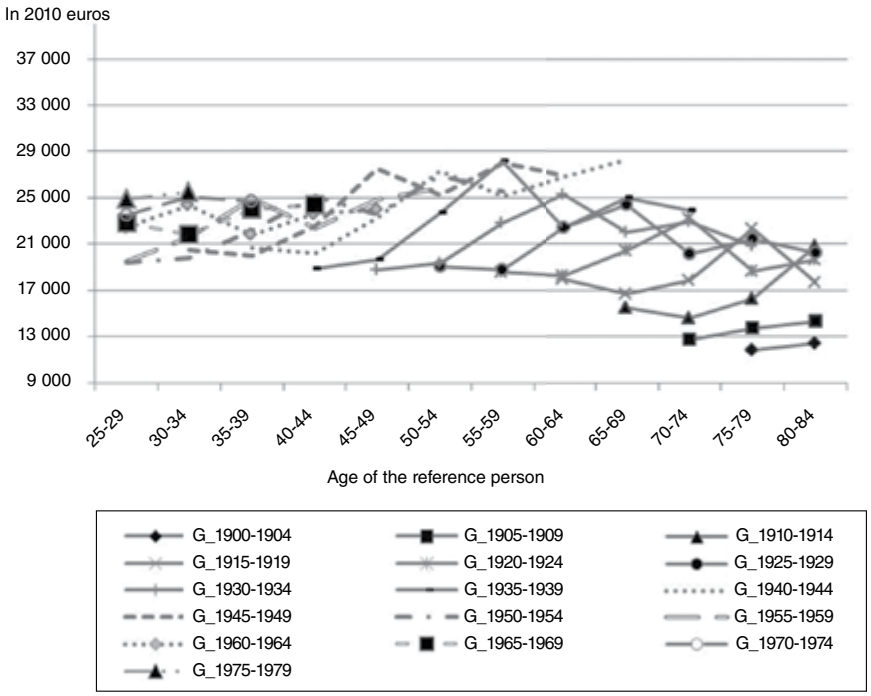
Figure III
Annual consumption per consumption unit by the age of the reference individual and the survey date



Note: Private consumption, including imputed rent. Consumption units are calculated using the OECD-modified scale.

Reading note: in 2010, the mean consumption per consumption unit for 25-29 year olds was €24,000.
Coverage: private households living in Metropolitan France.
Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - BdF*), authors calculations.*

Figure IV
Annual consumption per consumption unit by the age and generation of the reference individual



Note: private consumption, including imputed rent. Consumption units are calculated using the OECD-modified scale.

Reading note: the mean consumption per consumption unit for individuals born between 1975 and 1979 was €25,000 when they were 25-29 years old.
Coverage: private households living in Metropolitan France.
Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - BdF*), authors calculations.*

a greater drop towards the end of life than for income. The propensities to consume by age are fairly similar from one date to another, but tend to fall throughout the lifecycle.

Method and identification strategies

Estimation with pseudo-panel data

In order to dissociate the effects of age, cohort and period, it can be useful to use panel data as they follow households throughout their entire lifecycle. Our data are cross-sectional and we therefore established pseudo-panels. The idea is to identify households belonging to the same cohort and to monitor the mean behaviour of the cohorts established. As Bodier (1999) stresses, the results from pseudo-panels are not necessarily of lower quality than results obtained using panel data. The use of pseudo-panels has the advantage of avoiding selection biases associated with attrition effects (which increase with the number of periods) and biases associated with learning effects. Guillerm (2017) provides a recent and comprehensive presentation of the method.

We use the estimation technique proposed by Deaton (1985). Let us begin by stating that the estimation model used to control the individual effects that are constant over time for panel data is written as follows:

$$y_{it} = \beta_0 + \beta_1 x_{it} + \theta_i + \varepsilon_{it}$$

where y_{it} and x_{it} are explained and explanatory variables associated with individual i on date t and where θ_i is used to capture the effect of fixed individual characteristics over time. In some instances, these individual effects might correlate with the explanatory variables. It is therefore necessary to specify the type of effect (fixed or random) to include in the model. In the event of correlation between the individual effects and the explanatory variables, the fixed effects model is more appropriate. However, if the individual effects are orthogonal to the model's explanatory variables (i.e. no influence of non-observable individual characteristics on determining the level of the explanatory variables), using the random effects model is recommended. We used the Hausman test to choose between the fixed effects model and the random effects model.

Similarly, the estimation model to control individual effects for pseudo-panels is written as follows:

$$\bar{y}_{jt} = \beta_0 + \beta_1 \bar{x}_{jt} + \bar{\theta}_{jt} + \bar{\varepsilon}_{jt}$$

where $\bar{y}_{jt}$ and $\bar{x}_{jt}$ are the mean values of the explained and explanatory variables of individuals from cohort j on date t. Two types of problem tend to be generated by estimations made using pseudo-panels. The first concerns measurement errors for the different variables, which can lead to estimation biases. The model variables are not directly observed but are mean values calculated using survey data. Nevertheless, these are close to their true values when there is a large number of individuals in the cohort. Verbeek and Nijman (1993) show that measurement errors and estimation biases are negligible if the size of cohorts reaches 100. However, establishing large cohorts involves reducing the number of observations used (here the number of cohorts) across a given sample, which leads to less precise estimations. Reducing the number of cohorts can also increase the heterogeneity of individuals in a single unit and can therefore increase the variance of estimators, making them less effective. A compromise needs to be struck between sufficiently large cohorts to limit measurement errors, sufficiently homogeneous cohorts, and a sufficient number of observations to obtain adequately precise estimators.

We have seven cross-sectional databases (the 1979, 1984, 1989, 1995, 2000, 2005 and 2010 *BdF* surveys), each formed of 10,000 observations. We defined our cohorts using the "date of birth" variable, and thereby constituted 79 annual cohorts. The first cohort comprises households born in 1901 and the last cohort is formed of households born in 1979. Our pseudo-panel includes 407 observations of our cohorts, because not all cohorts are observed in each survey, and the mean size of an observed cohort is over 164 individuals (Table 3). Small numbers of observations mainly affect cohorts born up to 1917 (see detailed data in Appendix 2).

The second difficulty associated with the use of pseudo-panels concerns variation in the cohort effects which cannot be observed over time, unlike the individual effects of panel data, which, by definition, are constant. This is explained by the fact that the individuals observed from one survey to another are not the same. In order to apply the panel data estimation technique

to pseudo-panels, the cohort effects must be assumed to be fixed over time. The acceptability of this assumption is based on the criteria used to define the cohorts, which must be stable over time. From this point of view, using the year of birth is optimal.

However, the simultaneous introduction of the "age", "cohort" and "period" variables creates a collinearity problem because the survey year is equal to the sum of the "age" and "cohort" variables. Various solutions are proposed in the literature to resolve this problem. The first solution is to measure the three variables using different units by, for example, expressing the age in decades and the other two aspects in five-year periods. This is a fragile solution as it bypasses the collinearity problem without really resolving it. The results of this method have been proven unstable as they depend heavily on the units selected (Bodier, 1999). The second possibility involves replacing one of the three variables with a variable that is not collinear to the other two (Fienberg and Mason, 1985). For example, Bodier (1999) estimates consumption by replacing the date of survey variable with income, which captures economic changes over time (and is a key determiner of consumption). Nevertheless, this solution also has some limitations as income only partially reflects period effects. For the example of consumption, any changes to household consumption preferences would not be taken into account. In the discussion of our results, we propose an original identification strategy which involves replacing the age variable with a variable that measures life expectancy at each age, calculated using mortality tables of the time. This means that the three variables can be integrated simultaneously (life expectancy at each age, cohort, period) in the model without encountering collinearity problems.

The most common identification strategy involves placing restrictions on the estimated parameters. In this approach, Deaton and Paxson (1994) propose restricting period effects by assuming that the sum of the period effects is zero and that said effects are orthogonal to the long-term trend. Implicitly, the authors assume that macro-economic change can be broken down into a trend and a cycle. The cycle is fully imputed to the period effect whereas the trend is captured by the age and cohort effects. Nevertheless, their strategy has some limitations. In particular, the age and cohort effects incorporate the long-term trend due to the assumption made for the period effect. This therefore makes it difficult to isolate the age and cohort effect. Furthermore, the authors underline the fact that this procedure is risky if there are few surveys or if it is difficult to distinguish trend from transitory shocks. Despite its limitations, the Deaton and Paxson (1994) method seems the most appropriate for meeting our objectives.

Equations for the estimated models

We assume that the three effects (age, cohort and period) that we are seeking to estimate are additive. The model equation is written as follows:

$$log\bar{y}_{jt} = \mu + \sum_i \alpha_i 1_{a_{jt}} + \sum_c \beta_c 1_{j=c} + \sum_t \gamma_t 1_{t=p} + \bar{\varepsilon}_{jt}$$

where $\bar{y}_{jt}$ represents the explained variable associated with individuals from cohort j = 1901, 1902,…, 1979 on survey dates t = 1979, 1984,…, 2010 divided by the number of consumption units defined using the OECD-modified scale, $1_{a_{jt}}$ represent the indicators of the five-year age brackets from 25-29 years old to 80-84 years old[7] associated

7. We exclude people aged under 25 and over 84 as they are less representative of their generation in the BdF *survey than intermediary age categories. This is because the proportion of these people living in an institution or other household is greater and numbers in the various databases are lower.*

Table 3
Size of observed cohorts

Number of cohort observations	407
Mean size of cohorts observed	164.2
Minimum size of cohorts observed	30
Maximum size of cohorts observed	307
Proportion of cohorts observed larger than 100	85.7 %

Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - *BdF), French System of National Accounts (NA), authors calculations.*

with cohort j on date t, $1_{j=c}$ represent the indicators of the cohorts (the fixed effects therefore correspond to the term $\sum \beta_c 1_{j=c}$), and $1_{t=p}$ represent the indicators associated with survey dates t.

Finally, in order to correct the heteroscedasticity potentially generated by the variation of numbers between the cohorts and, within the same cohort, from one date to another, the variables are multiplied by the square root of the size of cohorts.

In order to cancel out the collinearity relationship, we use the Deaton and Paxson (1994) method and require the sum of the period effects to be zero and orthogonal to the long-term trend. Formally, this gives:

$$\sum_t \gamma_t = 0 \text{ et } \sum_t (t \times \gamma_t) = 0$$

In concrete terms, this method involves introducing variables noted here as d^*_{ts}, rather than period indicators, into the estimated equations These variables are obtained using period indicators and the following relation:

$$d^*_{ts} = d_{ts} - \frac{ts - t1}{t2 - t1} \times d_{t2} + \frac{ts - t2}{t2 - t1} \times d_{t1} \text{ with } s \geq 3$$

and $d^*_{t1} = d^*_{t2} = 0$

where d_{ts} represent the survey years and ts represent the indicators relating to the different survey dates.

We estimated our equation for each of the four variables of interest. As shown in Table 4, in all instances, tests for fixed individual effects (cohort effects for pseudo-panels) are positive, which justifies our choice of a fixed effects model. More precisely, we estimate a Least Square Dummy Variable type fixed effects model.

Results

In the following section, we present our estimations of the effect of age on the standard of living and then our estimations of the effect of the cohort on the standard of living. Estimations of the period effect are not discussed here as they do not enter into the field of this study[8].

Comparison of standards of living between age groups

Our estimations of the standard of living as a function of the age of the reference individual are shown in Figure V[9]. The results are expressed in relation to a reference age group, 45-49 year olds.

Firstly, our estimations reveal an initial increase in the standard of living. There is significant growth in income at each age bracket until the 55-59 age bracket, and in total consumption until the 65-69 age bracket (consumption excluding housing only increases until 50-59 years old). There is a relatively large cumulative effect. For example, the consumption of 50-54 year olds is 134.8% that of 25-29 year olds. Housing slightly increases the differences between age groups. The difference in the previous example falls to 129.7% when expenditure on housing (imputed or otherwise) is removed. This increase in the standard of living does not appear in the descriptive statistics shown in Figures I and III, which, instead, suggest profile stability at the start of the lifecycle. This is an initial indication of the extent of the cohort effects that we study later in this article. After 55 years old, the standard of living does not decline, unless it is measured by

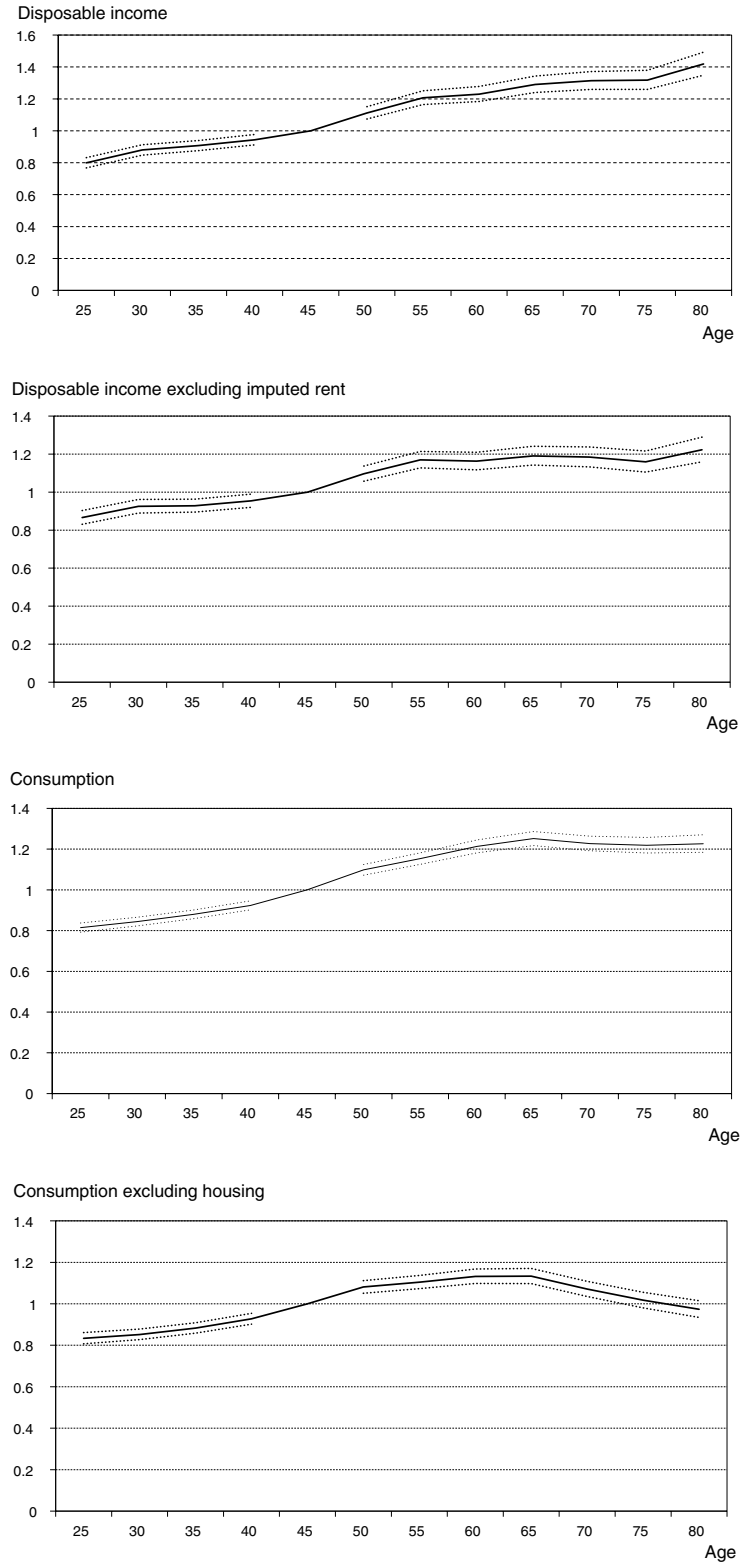
8. They are presented in the C2 online supplement (Table C2-3).
9. The coefficients are given in the C2-1 table in the C2 online supplement.

Table 4
Test for fixed individual effects and the Hausman test

	Individual effects test		Hausman test	
	F-statistic	P-value	F-statistic	P-value
Disposable income	15.21	0	297.79	0
Disposable income excluding imputed rent	8.77	0	250.4	0
Consumption	35.79	0	336.23	0
Consumption excluding housing	19.73	0	299.87	0

Reading note: the first two columns give the results of the test for individual effects. A P-value < 0.05 shows that the test for individual effects is positive at the 5% threshold. The next two columns give the results of the Hausman test. The fixed effects model is suitable for a P-value of < 0.05.

Figure V
Change to the standard of living as a function of the age group
(model controlled by the date of birth and the period)



Note: the standard of living is assessed using four variables (disposable income, disposable income excluding imputed rent, private consumption and private consumption excluding housing expenses), divided by the number of consumption units. The consumption unit is defined using the OECD-modified scale. Variables are standardised to 1 for the 45-49 age group. The dotted curves show the confidence intervals at 95%.

Reading note: the disposable income per consumption unit at 60-64 years old is 1.19 times higher than for 45-49 year olds.
Coverage: private households living in Metropolitan France.
Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - BdF*), authors calculations.*

consumption excluding housing expenditure. In this case, a significant decline is observed, which remains nonetheless moderate in size. Consumption excluding housing for 50-54 year olds is 11% greater than for 80-84 year olds.

Our estimations are similar to some results from the literature. For France, we can observe the decline in the consumption of nondurable goods at higher ages obtained by Boissinot (2007), but not the decline obtained by Lelièvre et al. (2010) for tax revenue. Our results are therefore consistent with Bodier (1999) and Herpin and Michel (2012) who demonstrated the decline in the propensity to consume after retirement. In comparison with other countries, our age profiles are fairly similar to those obtained for Belgium (Lefèbvre, 2006), but quite different to those obtained for the USA, which are characterised by a much sharper decline towards the end of the lifecycle (Gourinchas and Parker, 2002; Fernández-Villaverde and Krueger, 2007; Aguiar and Hurst, 2013; Schulhofer-Wohl, 2015).

Intergenerational comparison of standards of living

Our estimations of the standard of living as a function of the reference individual's date of birth are shown in Figure VI[10]. The results are expressed as a deviation from a reference cohort. We chose the cohort born in 1946, the date of the start of the baby boom. Although the birth rate remained high until the mid-1970s, baby boomers are generally considered to have been born between 1946 and, depending on the authors, 1955 or 1965. Furthermore, the 1946 cohort is one of the cohorts observed throughout all the surveys we have. All cohorts born between 1926 and 1954 are observed seven times (see Appendix 2). The further we move away from this group towards older or younger cohorts, the fewer observations we possess over their lifecycle. In particular, cohorts born up to 1905 and those born after 1975 are only observed twice. We will therefore naturally be more careful in interpreting the cohort effects the further we move away from the group of cohorts born between 1926 and 1954.

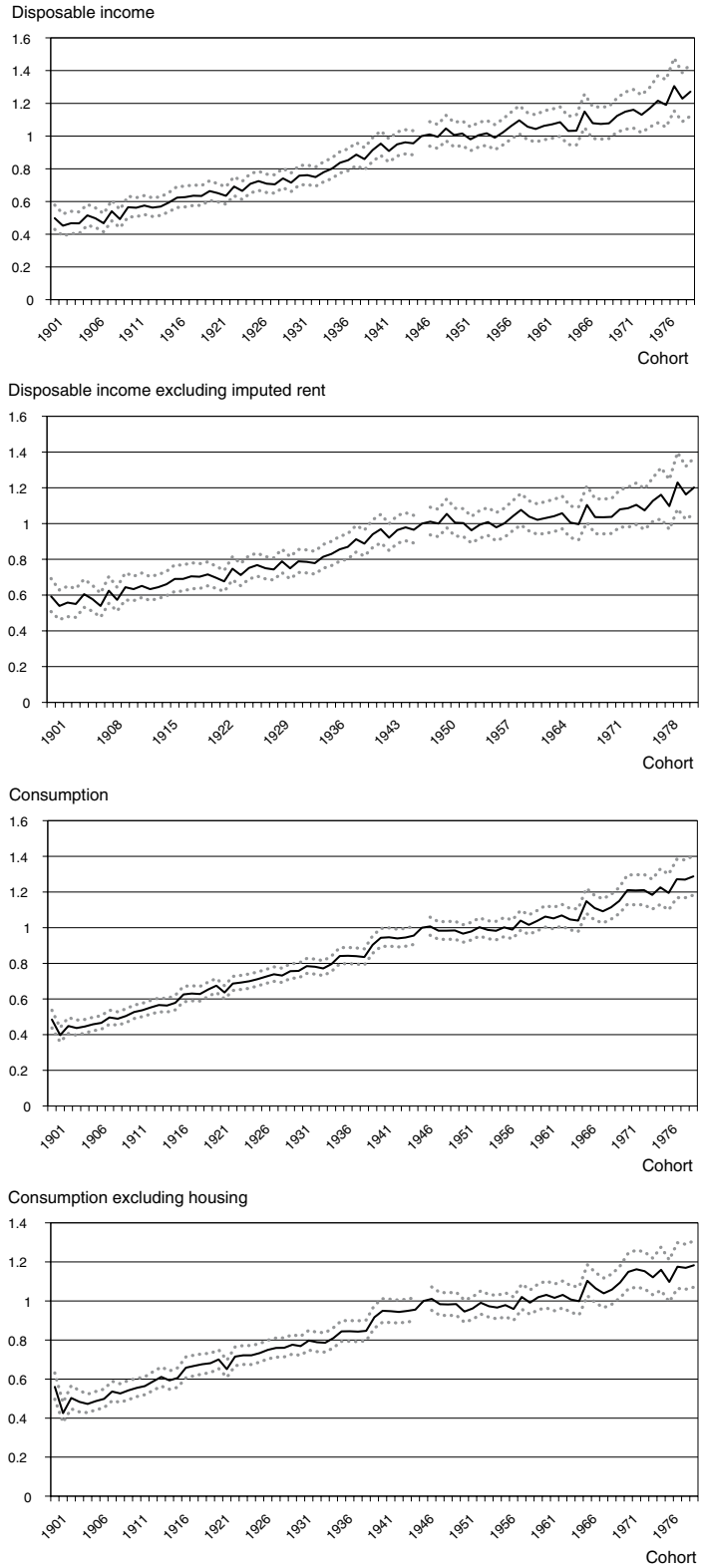
Figure VI clearly shows an improvement in the standard of living over time. Whatever variable is used, cohorts born later have a standard of living at least as high as the cohorts born before them. More detailed analysis reveals three phases in the development of the standard of living. In the first phase, the cohorts experienced a continuous increase in the standard of living. This is true of all cohorts born before the Second World War. The second phase sees a stagnation in the standard of living of cohorts, which, nevertheless, remains higher than that of the cohorts born before the war. This phase affects all cohorts born between 1945 and the end of the 1950s, if total consumption is used as the indicator, or until the end of the 1960s if income or consumption excluding housing are used as the indicator. It is therefore evident that the baby boomers and cohorts that immediately followed them had a higher standard of living than cohorts born before the war. The consumption of the cohorts born in 1926 and in 1936 at each age is estimated to represent 71.1% and 84.1% of the consumption of the cohort born in 1946, respectively. The third phase covers younger cohorts who once again saw an increase in the standard of living. The consumption of the cohorts born in 1966 and in 1976 is estimated to represent 114.9% and 119.5% of the consumption of the cohort born in 1946, respectively. Not taking into account housing only marginally modifies the differences between the generations. Furthermore, the differences are less pronounced when considering income rather than consumption. All things considered, this improvement in the standard of living is fairly consistent with the descriptive statistics presented above.

Careful interpretation of our results, only taking into account the cohorts observed seven times, concludes that the standard of living increased for all cohorts born up to the war, and then stagnated for those born later.

Our results are to be read against the backdrop of literature which had failed to reach a real consensus. The descriptive analyses of the late 1990s (Legris & Lollivier, 1996; Insee, 1998; Hourriez & Roux, 2001) found an increase in the standard of living of cohorts born before the war and observed a changing trend for those born in the 1950s. On the other hand, more recent studies (Bonnet, 2010; Clerc & Monso, 2011) show that the standard of living stopped falling for cohorts born after 1965. Furthermore, many recent articles have sought to estimate the cohort effect by differentiating it from the age and period effects. Lelièvre et al. (2010) use the French Tax Revenue Surveys (*enquêtes Revenus Fiscaux*) from 1996 to 2005. They found that cohorts born between 1942 and 1953

10. The estimated coefficients are given in Table C2-2 of the C2 online supplement.

Figure VI
Change to the standard of living as a function of the date of birth
(model controlled by the age group and the period)



Note: the standard of living is assessed using four variables (disposable income, disposable income excluding imputed rent, private consumption and private consumption excluding housing expenses), divided by the number of consumption units. The consumption unit is defined using the OECD-modified scale. The variables are standardised to 1 for the 1946 cohort. The dotted curves show the confidence intervals at 95%.

Reading note: the disposable income per consumption unit of the 1975 cohort is 1.2 times higher than the 1946 cohort.
Coverage: private households living in Metropolitan France.
Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - BdF*), authors calculations.*

were slightly more fortunate than the preceding and succeeding cohorts. However, this good fortune is reduced when transfers are taken into account. Chauvel and Schroeder (2014) use the *BdF* surveys provided by the Luxembourg Income Study (LIS) between 1985 and 2005. They state that the disposable income of baby boom cohorts is higher than for pre-war cohorts and cohorts born around 1970. We compare our results in greater detail with those of Chauvel (2013) and Chauvel & Schroeder (2014) later on. Our results are, however, consistent with those obtained by Bernard & Berthet (2015) and Guillerm (2017) for household wealth. Using the Deaton and Paxson (1994) method, they show that gross wealth increased for all cohorts born before the baby boom, before stagnating. In particular, they did not find that baby boomers were more fortunate than the generations that followed.

Robustness analysis

We assess the robustness of our results in two stages. Firstly, we check whether they are sensitive to our assumptions concerning the age group categories and the definitions of consumption units, while retaining the Deaton and Paxson (1994) method. We then discuss the implications of other identification strategies.

We checked if our results changed when individuals were not categorised by age group and if we used the age squared as a control, as per Guillerm (2017). We also checked their sensitivity if results were sensitive to the different ways of taking into account household size. Indeed, the literature is very disparate on the topic. Some authors use variables divided by consumption units, which can be defined in various ways (Clerc et al., 2010, use the *BdF* survey scales, whereas Chauvel, 2013, uses the square root of the number of individuals in the household). We also studied the case where variables are not weighted and the number of consumption units is a control variable of the estimated model, like Bodier (1999), Boissinot (2007) or Aguiar and Hurst (2013). Qualitatively, our results remain unchanged[11]. Improvement of the standard of living of generations appears to be very robust. In some instances, improvement of the relative situation of recent generations seems even more clear.

We then checked whether our results were dependant on our identification strategy. In particular, Chauvel and Schroeder (2014), who demonstrate that the baby boom generations had more disposable income than other generations and whose results differ from our own, use a different strategy based on Chauvel (2013). This is called the *Age-Period-Cohort-Detrended* (APCD) method and focuses on the fluctuations in the age, cohort and period effects around their respective linear trend. It cannot be used to compare cohorts with one another, only in relation to an unknown coefficient. We present this method in the C4 online supplement and we used the APCD module (available on Stata) with our data in an attempt to reproduce their results. Our disposable income excluding imputed rent variable is the closest to the variables they use. We find[12] that there are generally no significant differences between the cohorts born between 1920 and 1977. Only cohorts born between 1957 and 1960 have a disposable income that is (ever so slightly) significantly higher than the trend. Although the coefficient assigned to the baby boom cohorts is not significant, their income level is actually below the trend. One of the main reasons explaining the differences between the results of Chauvel and Schroeder (2014) and the results we reproduce in the C4 online supplement is the fact that the LIS *BdF* surveys do not seem to have been adjusted and that the 2010 *BdF* survey was not taken into account. When we apply the APCD method to our other variables (disposable income with imputed rent, private consumption and private consumption excluding housing expenses), we find that the only cohorts (slightly) more fortunate are those born in the late 1950s. We also find that the pre-war generations were less fortunate in terms of consumption.

One plausible explanation of the difference between the results we obtain using the Deaton and Paxson (1994) method and those we obtain with the APCD method is as follows. The first method allocates the cycle to the period effects and spreads the trend between the age and generation effects. On the other hand, the second method seeks to eliminate the trend to focus on non-linearities. The different estimations generated by implementing the Deaton and Paxson strategy therefore show that economic growth has benefited recent generations who have seen a rise in their standard of living. However, if the trend is removed, far fewer differences in the standard of living are detected between the

11. The figures concerning comparisons between cohorts for the different specifications are given in the C3 online supplement.
12. Our results are presented in Table C4-1 of this C4 online supplement.

generations, but no decline in the standard of living is observed. We explored this argument by proposing an original identification strategy.

Our idea is to replace the age variable by the life expectancy at a given age. This is a relatively simple way of eliminating the traditional problem of collinearity. We estimate the following LEPC model:

$$log\bar{y}_{jt} = \mu + \sum_i \alpha_i 1_{ev_{jt}} + \sum_c \beta_c 1_{j=c} + \sum_t \gamma_t 1_{t=p} + \bar{\varepsilon}_{jt}$$

where $1_{ev_{jt}}$ represent the indicators of life expectancy at each age associated with cohorts *j* and dates *t*. As previously, the individuals are broken down into age groups, but these are no longer defined by calendar age, but by life expectancy. Due to the increase in life expectancy, we place individuals of different (calendar) ages into the same age group when they belong to different cohorts. Individuals from a given cohort will therefore be older than individuals from cohorts born before them and younger than the cohorts born afterwards. This is not incongruous as an individual aged 70 is currently much "younger" than an individual of the same age thirty years ago (d'Albis & Collard, 2013) and life expectancy influences economic decisions throughout the lifecycle (Sánchez-Romero et al., 2016). Our estimations of the standard of living as a function of the reference individual's date of birth are given in Figure VII.

In terms of consumption, we find the same strong growth that characterises the pre-war cohorts, before a long stagnation. For income, the profile is quite different than the profile obtained using the Deaton and Paxson (1994) method as there are practically no longer any significant differences from one cohort to another. These results are relatively close to those obtained using the APCD method. This is due to the fact that life expectancy is strongly correlated with mean income. By controlling the life expectancy, the model allocates economic growth to the period effects. The benefits of economic growth for the generations are no longer taken into account. Removing growth clearly has a differing effect on consumption and income, which suggests a change to the propensity to consume over the generations.

The APCD and LEPC methods are ways of dealing with the collinearity problem without restricting the estimated parameters. However, they partially eliminate the effect of economic growth on the relative standard of living of cohorts. We therefore prefer the Deaton and Paxson (1994) approach, which appears the most relevant. Nevertheless, with these three identification strategies, we obtain the common result that the baby boom cohorts were not significantly more fortunate than the cohorts that followed.

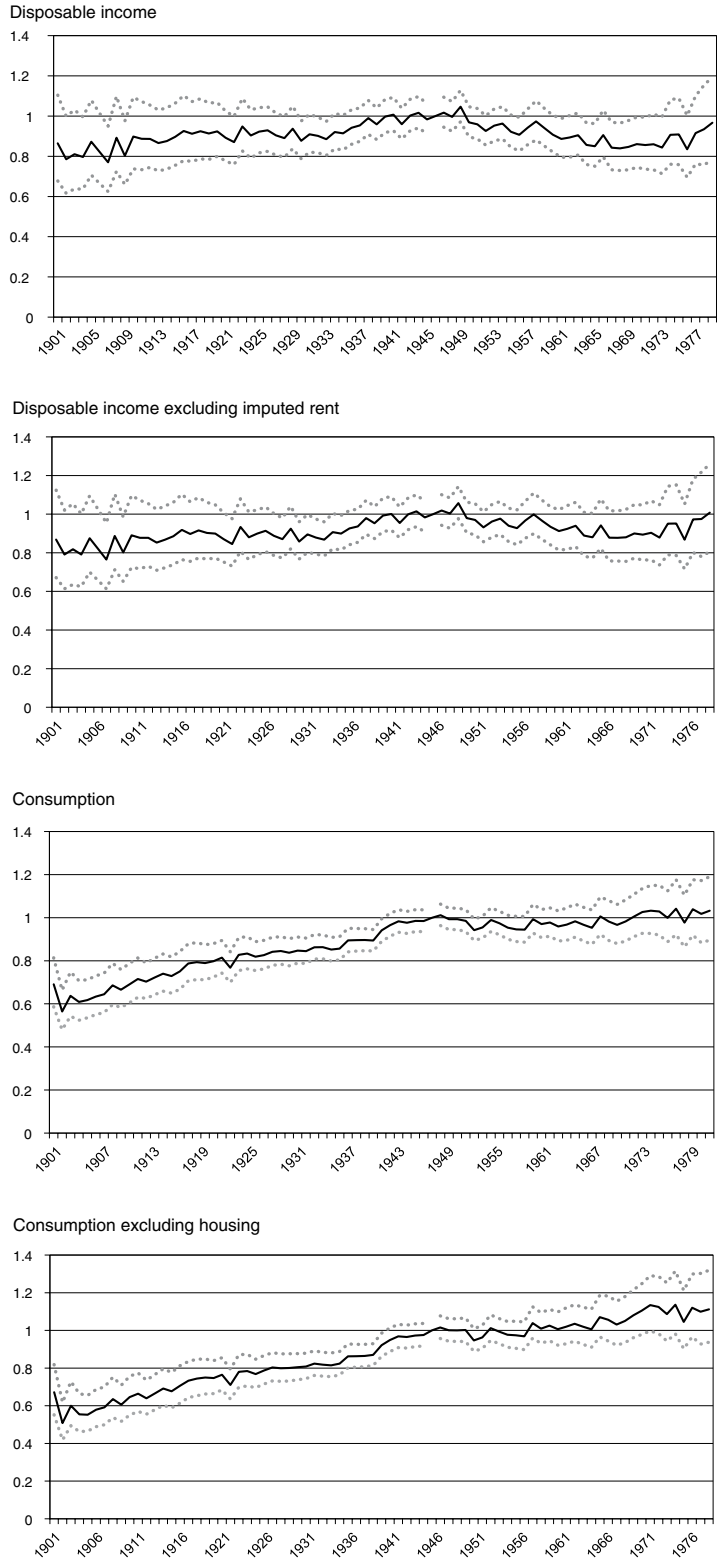
* *
*

Using the *BdF* surveys conducted between 1979 and 2010, we estimated different models describing changes to the standard of living as a function of the age and date of birth of the reference individual. The aim was to measure inequalities between the age groups and generations in order to inform debate surrounding generational policies.

By analysing changes to the standard of living as a function of age, we move away from considerations concerning generations or the observation period. In line with previous studies on the topic, we demonstrated that the standard of living increases with age until around 60 years old. The dynamic then depends on the variable considered, as disposable income continues to rise whereas consumption stagnates. This change is strongly influenced by whether or not housing is included in the analysis. Imputed rent generates an increase in disposable income after retirement, which, otherwise, stagnates. Similarly, private consumption excluding housing expenditure (and imputed rent) falls after the age of 65.

By analysing changes to the standard of living as a function of the birth cohort, we move away from considerations of age or period. We showed that no generation had a level of consumption lower than the preceding generation. Regardless of the econometric specification selected, we found that no generation has "suffered" for the sake of its ancestors. In particular, we have not found that the baby boom generation had a higher level of consumption than the generations that followed. The result seems quite natural. Between 1979 and 2010, real consumption per head increased in France by over 85%. Individuals born later therefore live in an economy with higher average consumption. There would have needed to be considerable redistribution in favour of the baby

Figure VII
Change to the standard of living as a function of the date of birth
(model controlled by the age group defined using the life expectancy and the period)



Note: the standard of living is assessed using four variables (disposable income, disposable income excluding imputed rent, private consumption and private consumption excluding housing expenses), divided by the number of consumption units. The consumption unit is defined using the OECD-modified scale. The variables are standardised to 1 for the 1946 cohort. The dotted curves show the confidence intervals at 95%.

Reading note: the disposable income per consumption unit of the 1975 cohort is not significantly different to that of the 1940 cohort.
Coverage: private households living in Metropolitan France.
Source: Insee, 1979, 1984, 1989, 1995, 2000, 2005 and 2010 French Household Expenditure survey (enquêtes Budget de famille - BdF*), authors calculations.*

boomers to counterbalance this effect caused by economic growth.

Our findings could be explored further by work on two areas, the first of which is prospective. Debates around generational issues often feature the argument that the social welfare system is unsustainable, particularly its old-age and health insurance components primarily aimed at older people. It is clear that a decline in this transfer income could, in the future, call into question the estimated standard of living of generations born since the 1970s. Similarly, the increase in public debt or all the factors that have led to sustained slow growth may also compromise their standard of living. A second area for research would focus on inequalities within generations. It is possible that changes to intergenerational inequalities have been heterogeneous. Proof of an increase in inequalities among young people today could be one means of explaining the discontent often expressed by young people. □

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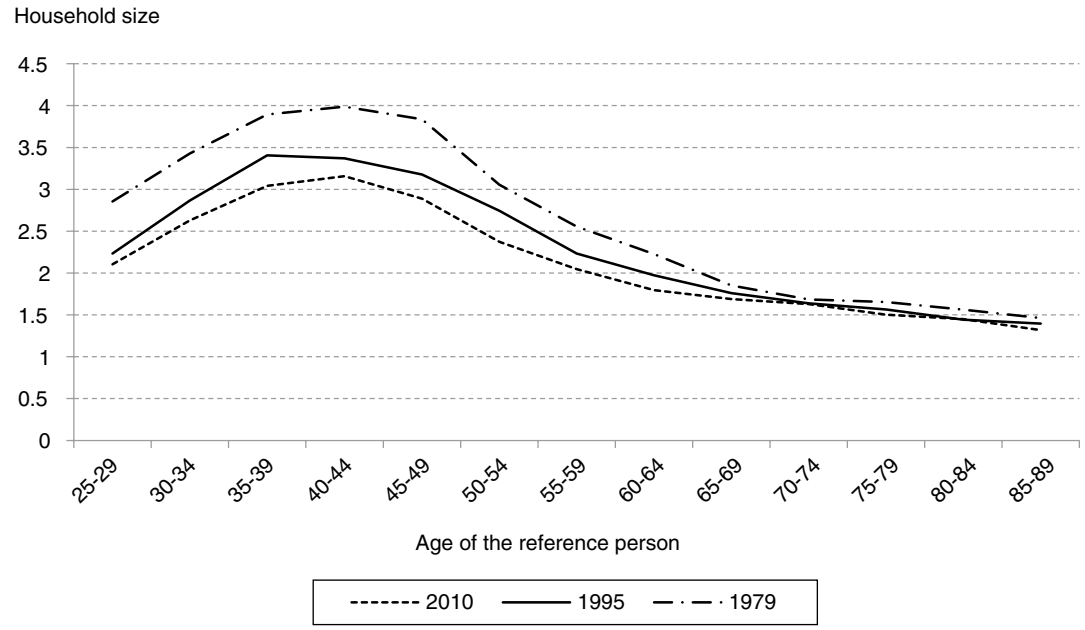
APPENDIX 1

HOUSEHOLD SIZE BY THE AGE OF THE REFERENCE INDIVIDUAL

Figure
Household size by the age of the reference individual in the 1979, 1995 and 2010 *BdF* survey



Reading note: the household size increases and then decreases in line with the age of the reference individual.
Coverage: private households living in Metropolitan France.
Source: 1979, 1995 and 2010 French Household Expenditure survey (enquête Budget de famille - *BdF), authors calculations.*

APPENDIX 2

SIZE OF COHORTS BY DATE OF *BDF* SURVEY

Generation	1979	1984	1989	1995	2000	2005	2010
1901	82	40					
1902	64	62					
1903	63	71					
1904	88	71					
1905	80	81	45				
1906	103	89	40				
1907	87	104	54				
1908	99	100	80				
1909	114	142	89				
1910	124	128	79				
1911	130	110	96	48			
1912	157	160	89	55			
1913	139	150	109	55			
1914	150	159	99	73			
1915	115	147	72	52	38		
1916	82	95	56	46	30		
1917	90	93	66	52	39		
1918	113	106	74	52	49		
1919	130	111	84	61	108		
1920	232	133	139	94	121		
1921	196	203	139	146	112	54	
1922	240	217	164	148	118	56	
1923	232	221	167	128	114	81	
1924	231	223	138	135	140	90	
1925	217	212	138	127	138	79	
1926	251	204	133	138	135	98	68
1927	234	232	159	161	168	116	73
1928	232	207	146	152	147	107	72
1929	240	210	145	145	138	121	101
1930	240	213	150	143	144	118	112
1931	251	220	130	154	150	110	97
1932	243	195	174	146	142	123	103
1933	224	243	134	149	164	96	125
1934	221	216	138	149	160	117	118
1935	235	193	156	147	124	118	125
1936	212	191	152	156	145	124	132
1937	216	201	140	127	146	138	119
1938	202	179	145	151	140	135	105
1939	221	192	129	138	139	137	133
1940	179	218	138	133	130	118	114
1941	184	191	131	129	153	95	100
1942	218	160	126	122	169	130	124
1943	228	203	150	120	185	133	132
1944	215	217	164	155	163	141	131
1945	192	208	157	144	199	118	180
1946	265	226	201	156	215	171	193

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Generation	1979	1984	1989	1995	2000	2005	2010
1947	289	289	194	213	236	203	214
1948	276	307	214	251	213	219	206
1949	236	291	223	222	214	204	191
1950	241	277	218	223	254	187	189
1951	201	288	214	212	245	200	181
1952	204	269	213	217	196	212	230
1953	195	277	220	195	198	213	195
1954	177	273	208	225	209	251	220
1955		277	205	244	196	211	217
1956		259	203	202	245	187	219
1957		269	194	217	242	207	226
1958		221	159	208	219	228	192
1959		192	219	197	227	212	218
1960		187	159	206	192	195	214
1961			166	212	203	199	200
1962			138	199	209	216	216
1963			144	235	204	196	228
1964			130	179	198	226	210
1965				188	174	230	210
1966				176	189	223	220
1967				154	163	213	196
1968				130	167	214	212
1969				144	180	202	202
1970				116	172	207	183
1971					164	219	204
1972					141	179	196
1973					120	206	174
1974					91	194	169
1975						178	154
1976						145	154
1977						137	143
1978						143	149
1979						129	137

Reading note: in 1979, there are 82 observations in the cohort of individuals born in 1901.
Coverage: private households living in Metropolitan France.
Source: 1979 - 2010 French Household Expenditure surveys (enquêtes Budget de famille - BdF*), authors calculations.*