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Abstract: We use the National Transfer Accounts methodology to calculate the lifecycle deficit in France for the years 1979-2005. During this period, consumption profiles were roughly constant over age, while labor income profiles shifted to higher ages. The share of the aggregate lifecycle deficit in GDP rose sharply in the 1980s due to an increase in the mean age of the population. In contrast, the per capita shares of the lifecycle deficit attributed to the population under 20 and over 60 varied little during this period, even though the relative weights of these two age-segments has shifted continuously in favor of the latter.

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Le déficit de cycle de vie en France entre 1979 et 2005

Résumé : Nous utilisons la méthodologie des Comptes de Transferts Nationaux pour calculer le déficit de cycle de vie en France pour les années allant de 1979 à 2005. Pendant cette période, les profils de consommation ont été à peu près constants, au contraire des profils de revenus du travail qui se sont déplacés vers des âges plus élevés. La part du déficit de cycle de vie agrégé dans le PIB a fortement augmenté au cours des années 1980 du fait de l'accroissement de l'âge moyen de la population. A l'inverse, les parts des déficits de cycle de vie par tête des moins de 20 ans et des plus de 60 ans ont peu varié au cours de la période, même si les poids relatifs de ces deux parts se sont continuellement déplacés en faveur des plus âgés.

1. Introduction

The intergenerational distributions of income and public resources are recurring issues in national public debates. In France, the economic slowdown, growth of public debt, and uncertainty regarding the long-term sustainability of the pay-as-you-go pension system take center stage in intergenerational debates. Some authors describe an increasing inequality between generations, articulating the emergence of so-called "golden" generations that benefited from economic growth between 1950 and 1970 at the expense of later generations (Chauvel, 1998; Kotlikoff and Burns, 2012). A clear picture of the economic flows between ages over the life course helps to better ground this debate.

Although it is imperfect, the most appropriate indicator for comparing the welfare of successive generations is lifecycle consumption. Generational accounting exercises have already been made for France (Bonnet, 2002; Accardo, 2002), concluding that if tax and social policies remained constant an intergenerational imbalance would emerge. These studies also warn that the magnitude of this imbalance is highly sensitive to the assumptions made. The latter accounting approach, initiated by Auerbach et al. (1991), is based on only the inter-temporal government budget constraint. The National Transfer Accounts (NTA) method of Lee and Mason (2011) provides a more thorough accounting of age-specific resource allocation. An informative index falling out of this method is the lifecycle deficit, defined as the difference at each age between consumption and labor income. It indicates the ages at which resources obtained from labor are not sufficient to cover consumption needs. The natural next step is then to measure the reallocation of resources between age groups, and how the lifecycle is funded.

In this article, we present lifecycle deficit estimates for France according to NTA methodology. The originality of our study is the time window, covering the period from 1979 to 2005. This allows us to determine how the profiles have evolved as the result of both economic changes and changes in the age structure of the French population with the advance of the baby-boom generation. This time-perspective is coupled with a comparative approach to other countries for which NTA accounts have been implemented, in order to highlight any specifics in France.

The primary advantage of a study over a long period is how it reveals the constants that structure society. In particular, we find that the allocation of consumption between ages has remained relatively unchanged over the period. Across ages, the total consumption profile is relatively stable after 17 years, although substitutions between private and public consumption take place during the lifecycle. Moreover, the share of lifecycle deficit per capita for the young or the elderly in the GDP has held roughly constant during this period. These developments reflect a certain social preference for equality in terms of consumption between ages in France. However, the gap between shares received by the elderly and by the young has steadily increased, reflecting the increasingly predominant weight of the elderly in French society.

This paper is presented as follows. Section 2 describes the methodology and data sources used to construct the consumption and income profiles by age. The results for year 2005 are subject to detailed analysis in Section 3, including an international comparative perspective. Section 4 explores the changes in the income and consumption profiles between 1979 and 2005, and analyzes changes in the balance between large age groups. Section 5 provides some concluding remarks.

2. Construction of consumption and income profiles by age

Consumption and labor income profiles for France were constructed following the NTA methodology, as described in the latest version of the Reference Manual (UN, 2013). This is based on the combination of two elements: survey data to determine the age profiles for selected flows (consumption and income), and aggregates calculated from the national accounts to adjust the results from survey data to sum to the total flows in the economy for a given year.

For private consumption, the age profiles are composed of three parts — education expenditure, health expenditure, and other expenditures including imputed rents — obtained from the Family Budget Surveys (*Enquêtes Budget des Familles*). These surveys, conducted at regular intervals in France (1978-1979, 1984-1985, 1989, 1994-1995, 2000-2001, and 2005-2006), are based on a sample of approximately 10,000 households. They describe the structure of household expenditures on the basis of similar questionnaires over the period, which ensures comparability

of results between surveys. Private education and health profiles are obtained by regression methods — taking into account single ages 0 to 28 for education, and five-year age groups for health, except for the first year of life (which is treated separately). The allocation by age of other consumption is determined according to the piecewise linear profile suggested by Mason et al. (2011, p. 62), which is based on person-weights within households. Age profiles of labor income (including wages and income from the self-employed) are also constructed from the Family Budget Surveys.

Public education consumption profiles are calculated for each year from the French Education Account (*Compte de l'Éducation*), a satellite of the national accounting system. The data used to determine the number of students at each age and level of education are taken from the National Institute of Statistics (INSEE) and the Ministry of National Education (*Ministère de l'Éducation Nationale*). It is assumed that individual public consumption is the same for all students of a given level. Public health expenditure profiles are estimated using data from the French Permanent Sample of National Insurance Beneficiaries (*Echantillon Permanent d'Assurés Sociaux*), based on a sample of nearly 80,000 insured persons under the scheme for employees for the years 2000, 2002, 2004 and 2006. For the years 1992, 1995, and 1997, data are taken from Health and Social Protection Surveys (*Enquêtes Santé et Protection Sociale*), which are subsamples of the above sample. Other public consumption expenditures (defense, justice, etc.) are distributed uniformly over the population, resulting in an age profile that is then assumed to be constant.

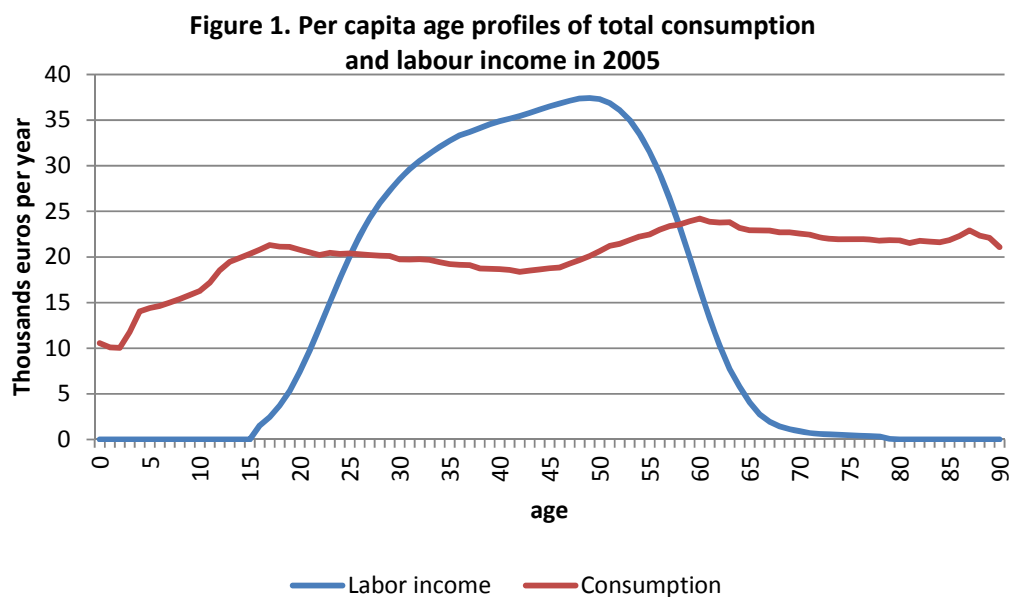
Once calculated, each profile is smoothed across ages using the Friedman (1984) method recommended in the NTA methodology (UN, 2013, Appendix B, p. 199-205). Because not all profiles are available for each year between 1979 and 2005, we interpolate the values for all ages in missing years using cubic splines. This allows us to interpolate the piecewise data using a polynomial of degree 3. The age pattern of health expenditures prior to 1992 is taken as the age-specific mean of the profiles from 1992 to 1995.

For each year of the period studied, National Accounts data for France are used to calculate the NTA accounting identity, according to which the sum of consumption, savings, and transfers is equal to the sum of labor and financial incomes. The aggregate counterpart for the income of

the self-employed is derived using the method proposed by Askenazy et al. (2011), which is based on decomposition by sectors. Within each sector considered, this method assigns the fraction of labor income observed among employees to the self-employed. The resulting breakdown of Gross Mixed Income differs from the 2/3 – 1/3 rule typically used to separate the share of capital and labor in total earnings; for the self-employed, we determined that the share of labor earnings fluctuated between 0.59 and 0.83 over the period studied. Finally, each age profile is readjusted based on the corresponding aggregate.

3. Consumption, labour income and lifecycle deficit in 2005

In this section we present a decomposition of the lifecycle deficit for the year 2005 in France. Figure 1 represents the per capita age profiles of total consumption (i.e., the sum of private and public consumption) and labor income.



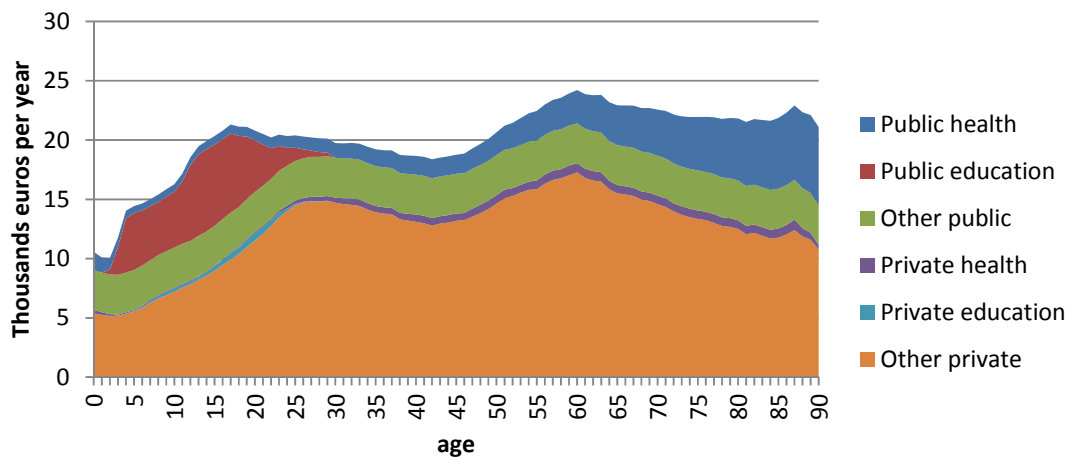
The total consumption profile for France shows a special feature compared to the profiles of the set of countries studied by Tung (2011): relative stability over age. The French consumption curve increases until age 17, after which it stabilizes at between 18,000 and 24,000 Euros until

the highest ages. In this respect, France differs from the United States and many other developed countries, where per capita consumption increases after age 60 or 65.

3.1 Public and private consumption

The relative stability of the French consumption profile over age can be explained by offsetting changes in the composition of consumption by public and private expenditures. Figure 2 represents the decomposition of total consumption by selected public and private components. On one hand, private consumption decreases significantly after age 60, declining approximately 25% by age 80. On the other hand, public consumption tends to increase due to rising health costs with age, as one would expect. In the case of France, these changes roughly balance each other, resulting in a stable profile through older ages. Unlike in the United States, here we do not see the massive private health expenditures in older age groups that cause consumption profiles to increase with age.

Figure 2. Decomposition of the per capita age profile of total consumption in 2005



In France, public consumption accounts for 33.90% of total consumption. This is close to that of Finland in 2004 (34.64%), and lower than Sweden in 2003 (42.37%), but higher than most other countries — Germany, Spain, the United States, and Japan are all around 26%. Health expenditure represents 12.29% of total consumption, which corresponds to the average of high-

income countries — 10.18% in Austria in 2000, and 18.52% in Sweden in 2003, for example. Public and private education expenditure represents 7.45%, which is below the average for high-income countries.

An alternative method of analyzing the differences in consumption profiles between countries is to calculate the population-weighted mean age of consumption, which can be thought of as the average age at which a euro is consumed within the population. This age therefore depends both on individual consumption profiles and on the age-structure of the population, which is used to reweight these profiles. In France, the average age at which a euro is consumed within the population is 41.61 years. This is quite close to the averages of other high-income countries, such as the United States (41.43 years) or Austria (40.81 years).

However, the age-distribution of consumption can vary greatly for the same mean age of consumption. It is revealing to compare the average consumption of the population under age 20 and the population 65 and over to that of persons aged 20-64 (Tung, 2011). Regarding total private consumption (see profiles in Figure 2), the average consumption of those under 20 years relative to those aged 20-64 is 0.514, while the average consumption of those 65 and over relative to those aged 20-64 is 0.946. France's consumption corresponds to the average of high-income countries. The same ratios calculated for health expenditure are 0.383 for those under 20, and 2.319 for those aged 65 and over. As is typically observed, the bulk of health expenditures accrue to the elderly. This ratio for France tracks closely with most high-income countries, with similar values to those obtained for Germany, Spain, and Finland. For public consumption (part of which is uniformly distributed), the ratios are 1.608 and 1.459, and again France falls close to other countries. These ratios are very similar to, for instance, Finland and Austria, but are lower than those of the United States, Sweden, and Japan. Public expenditure is clearly an important component of lifecycle consumption for both younger and older age groups. Finally, for consumer expenditure as a whole, the ratios are 0.805 for the average consumption of the younger group and 1.083 for the elderly. These two ratios are close to the average for high-income countries; this is explained largely by the fact that public consumption in France has an important weight relative to private consumption, which in general favors these age groups.

3.2 Labor income

The average age profile of income depends on several factors (Lee and Ogawa, 2011). Resources obtained at each age depend on the rate of employment, working hours, the effect of seniority on wages, and more generally on the institutional, social, and cultural factors that influence the functioning of the labor market. In particular, the ages of graduation and retirement set the start and end of individual labor income trajectories, respectively, such that the means of these two ages anchor the bounds of average labor income profiles. France is characterized by a small proportion of total lifecycle income earned by persons under age 20 (1%) or ages 65 and over (1.3%). This is explained by a relatively long duration of education and a relatively low senior employment rate. The age profile for income is divided into three main phases: strong growth from ages 20 to 35 followed by slow growth with a peak at age 49, and finally a sharp decline until around age 60. The modal age of the income profile in France is higher than that of other high-income countries. In the United States and Japan — countries also characterized by a relatively late peak—the age at which the average person reaches a maximum level of income is around 47.

Does this mean that in France income is received later in the lifecycle? Paradoxically, this is not the case. For the hypothetical person in France that lives their entire life according to the average labor income profile of 2005, a euro is earned at age 42.36 on average; in comparison, the United States and Japan are characterized by a significantly higher mean ages of 46.2 and 44.8 years, respectively. If we consider instead the population-weighted average profile of labor income (which gives the average age at which a euro is earned in the country, instead of the average age at which an individual earns a euro) the result changes very little: the average age of earnings for France is 42.04.

Thus, it is not the entire distribution of average labor income that makes France unique, but rather the higher modal age of the income distribution. Beyond the mode, the decline in average income is much faster in France than in other European countries. This is explained by the relatively early exit of older workers from the labor market: according to Eurostat, the average exit age from the labor force was 59 in France in 2005. This kind of profile is not found in the other countries for which the NTA method has been applied. The average age at exit from the

labor force is usually significantly higher, even in other European countries. It is at age 63.6 in Sweden, for example.

3.3 Lifecycle deficit

The difference between labor income and consumption profiles provides the lifecycle deficit by age, and so allows us to calculate the two age thresholds that characterize the passage between contributing ages and beneficiary ages. For France, based on individual profiles, these ages are 25 and 57, with a maximal contribution at age 46—labor income is higher than consumption during 32 years of the average lifecycle. This relatively short period of surplus results, at the aggregate level, in a deficit of about 10% of GDP.

Despite France's unique consumption and income profiles, these threshold ages differ little from those of other countries surveyed. In general, the first age threshold is between 24 and 27 years, with some exceptions. For China and Austria, characterized by early entry into the labor market, income first exceeds consumption at age 21. Conversely, this age is higher for Mexico and Brazil due to a higher ratio of consumption to income. In Senegal surplus does not occur until age 36 because of the great difficulty experienced by younger generations integrating into the labor market (Dramani and Ndiaye, 2012).

The second age threshold — age 57 in France — is generally between ages 53 and 59 for countries that have NTA accounts. Some exceptions appear, however, such as in Sweden where the age is 62 years — explained by a higher average exit age from the labor force.

4. Persistence and changes during the period 1979-2005

4.1 Labor income, consumption, and lifecycle deficit

To date, few countries have applied NTA methodology to a time series, except the United States with the work of Lee et al. (2011). Data available for France describe changes in age profiles for total consumption and income over the period 1979-2005, with key statistics reported in Table 1.

In a context characterized by societal changes that should influence the duration of the lifecycle deficit, such as significant gains in life expectancy and an increase in the average duration of studies, it is reasonable to expect that the earlier-discussed threshold ages will have changed.

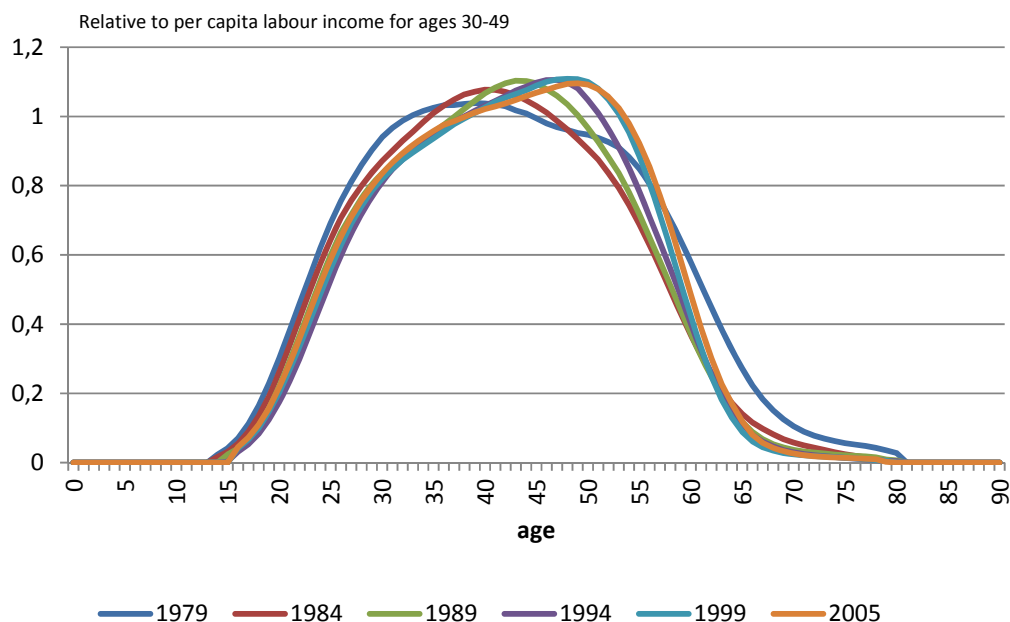
Table 1. Key statistics over the period 1979-2005

Year of survey	1979	1984	1989	1994	1999	2005
<u>Labor income</u>						
Modal age	39	40	43	47	48	49
Mean age to earn one euro	42.50	41.24	41.63	42.22	42.22	42.36
Mean age to earn one euro (weighted by population)	40.23	39.36	39.82	40.64	41.18	42.04
Mean age to earn one euro population as of 2005	41.75	40.87	41.30	41.91	41.96	42.04
<u>Consumption</u>						
Mean age to consume one euro (weighted by population)	36.61	37.29	38.31	39.69	39.96	41.61
Mean age to consume one euro with population as of 2005	40.35	40.55	41.01	41.63	40.93	41.61
<u>Lifecycle deficit</u>						
Lower threshold age	22	23	24	25	25	25
Upper threshold age	60	57	57	57	57	57
Number of years of surplus	38	34	33	32	32	32
Modal age of deficit	40	41	42	45	46	46

Figure 3 shows the evolution of the normalized age profile of labor income (sum of wage income, self-employed income, and payroll taxes). The mode of the distribution shifts by 10 years during the period, from 39 years in 1979 to 49 in 2005 (see also Table 1). The largest share of labor income is captured increasingly by older workers, as cohorts born after World War II age.

We can then ask whether this increase in the modal age has led to changes in the average age at which a euro is earned during the lifecycle. However, Table 1 indicates that the average age remained relatively stable over the period, from 42.5 years in 1979 to 42.36 in 2005. Two effects must be taken into consideration to understand this paradox. First, labor income depends on both the fraction of the population in the labor market and the income earned. A reduction in the share of employed senior workers, due particularly to the many measures implemented for earlier retirement in the early 1980s, underlies the shift in the latter half of the distribution. This is why we first observe a decrease in the average age of 42.50 years in 1979 to 41.24 years in 1984, and then an increase to 42.22 years in 1994. Since then, this age has changed little.

Figure 3. Evolution of the per capita age profile of the labour income

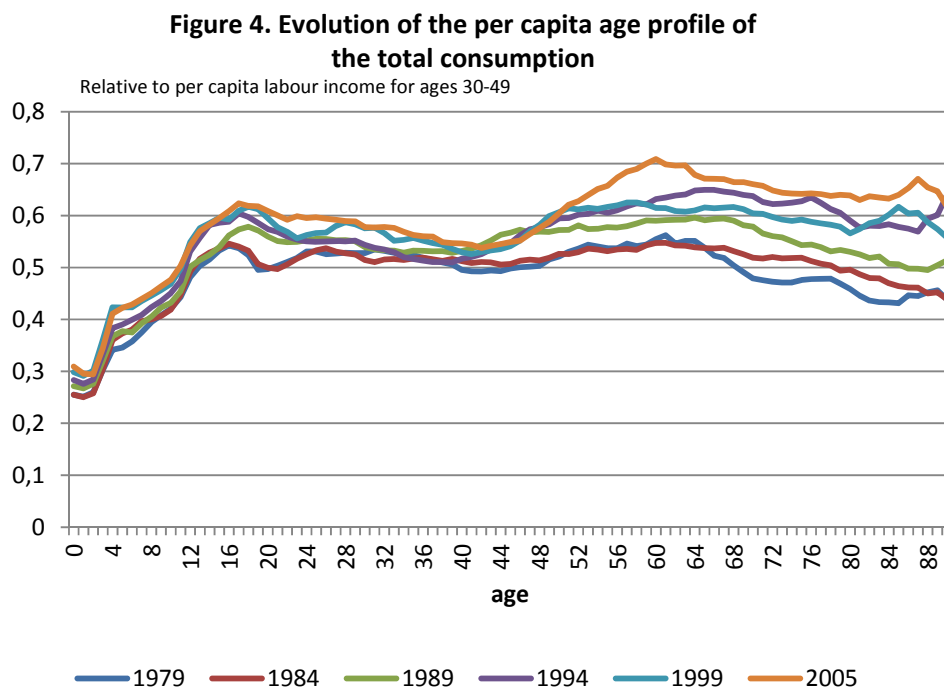


The method proposed by Lee et al. (2011) allows comparison of the changes in the French and American profiles. By weighting a given income profile by a standard population age structure, we can calculate the average age at which a euro is earned within a country in a given year. The evolution of this age over time thus depends on both the age profiles and the standard age structure. To isolate the specific changes relating to changes in the age profile, we can determine the respective contributions of each age group to the total for the population. For the United States, Lee et al. retain the structure of the population numbers observed in 2003.

We apply this method for France, using the 2005 population as the standard. Neutralization of the effect of the change in the demographic structure does not meaningfully change the average age at which a euro is earned: changes are very small over the period, from 41.75 years in 1979 to 42.04 in 2005. In comparison, the average age increases by nearly two years over the same period in the United States. From 1984 to 2005, the average age in France increased by 1.17 years, still below that observed in the United States. At the same time, displacement of the modal age for income is much more pronounced than in the United States, where the movement is about five years, half that observed in France. The stability we observe in France is

the result of the decline in employment of older workers despite a sharp increase in the modal age of income.

Changes in the consumption profile over time do not follow those of the income profile. We distinguish two main attributes of this distribution. First, for the period studied, the consumption profile remains relatively stable over age; we observe nevertheless a slight shift upward of the profile for people aged 60 and over compared to the younger population. This is different from what is observed for the United States, which is instead characterized by very strong growth in consumption by the elderly (driven primarily by private health expenditure). Second, there is a global upward change in consumption curves over the period due to the choice of normalizing the profile with the labor income earned by those aged 30-49, as the ratio of aggregate consumption to aggregate labor income among ages 30-49 increased between 1979 and 2005.



Using the method proposed by Lee et al. (2011), we calculate the average age at which a euro is consumed for each year. In Table 1, we see that this age varies very little during the period: it increases from 40.35 years in 1979 to 41.61 years in 2005. The average ages have increased by about one year in the United States during the same period.

The changing age profile of the lifecycle deficit results mechanically from the two trends explained above. The displacement of the two age thresholds over time entails a shortening of the period during which an individual is a net contributor. As indicated in Table 1, the age at which the average individual moves from a deficit to a surplus rose significantly early in the period, from 22 years in 1979 to 25 in 1994 (with an increase of one year every five). At the same time, the age at which the average individual fell back into a deficit decreased from 60 in 1979 to 57 in 1984, due to the combined effects of decrease in the legal retirement age from 65 to 60 years and an economic downturn. Since 1984, this threshold has remained invariant. The period of surplus during the lifecycle decreased between 1979 and 1994, from 38 to 32 years, and has remained constant since then. Thus, we see a reduction of productive ages, resulting primarily from an increased duration of studies and from difficulties for young people integrating into the labor market, as well as from an earlier exit of older workers from the labor market. The range of productive ages has tightened around the age where the minimum of the deficit distribution is observed, which itself has moved significantly. The modal age corresponding to a maximum surplus increased from 40 years in 1979 to 46 in 2005. The movement observed over the period is the result of both a stable profile of average total consumption and an increase in the modal age of the labor income distribution.

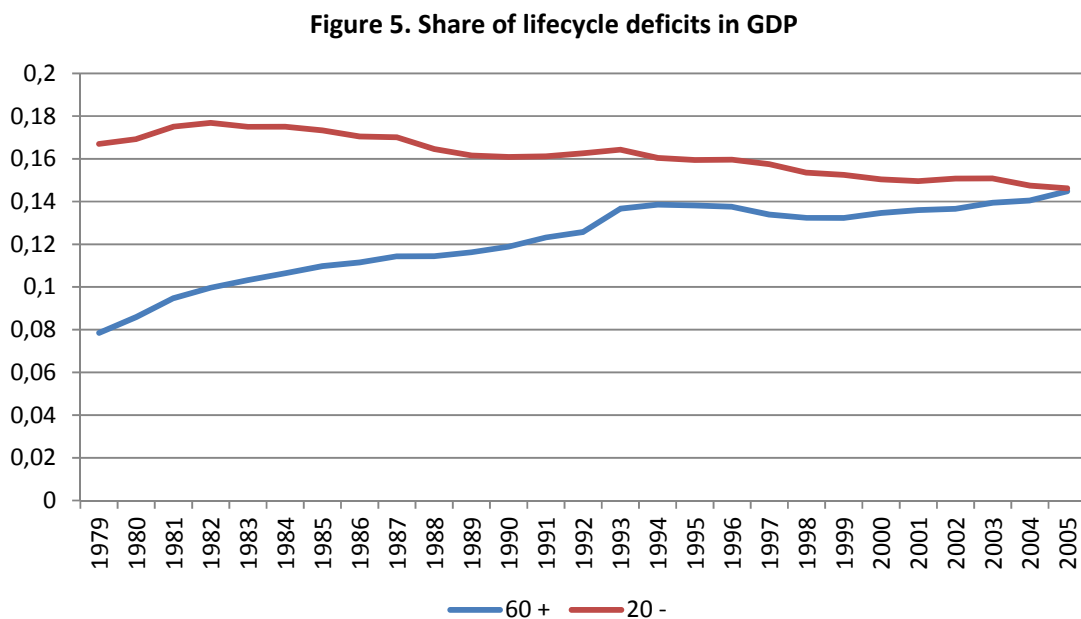
These developments should also be considered alongside the improvements in mortality observed during this period. In France, life expectancy increased from 78.3 years for women in 1979 (70.1 for men) to 83.9 years in 2005 (76.8 for men). For both males and females, much of this increase in life expectancy was due to mortality improvements in ages 60 and higher (52% for males and 68% for females). From 1994 to 2005, when the number of years of surplus remained constant (at 32 years), life expectancy at birth increased by 2 years for women and 3.1 for men.

In summary, between 1979 and 2005 the lifecycle period of surplus decreased while the duration of the deficit increased, coupled with increases in survival at all ages — especially old ages. As a consequence, the reduction of the productive period and increases in survivorship into and through post-retirement ages induced an increase in the aggregate lifecycle deficit, which in 2005 reached 10.23% of GDP against only 0.47% in 1979. This feature is common to

most high-income countries (Mason and Lee, 2013), although the theoretical relationship between increased survival and deficit is not necessarily clear.

4.2 Resource allocation by age

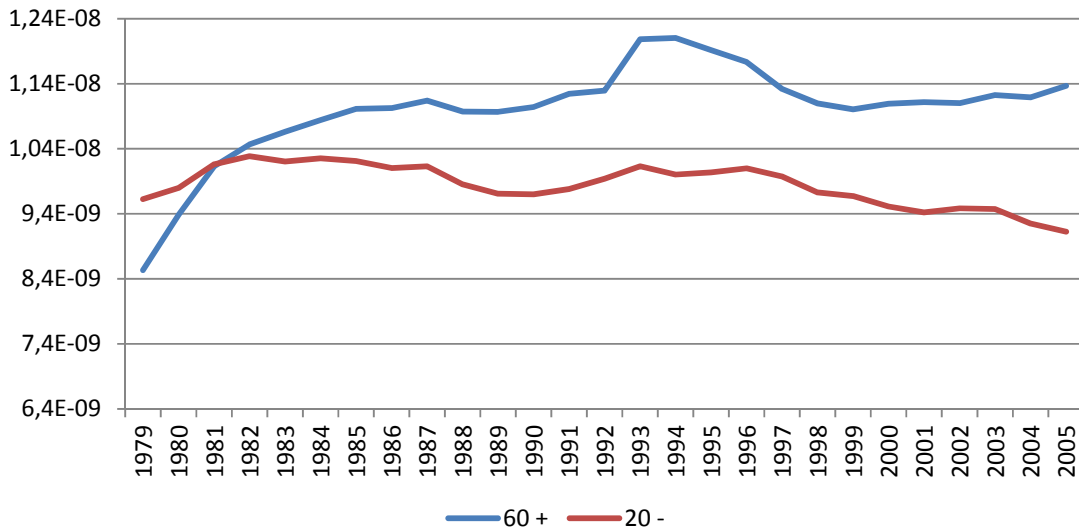
Given the overall tightening of the income distribution and the shift in its modal age, the relative stability of the consumption distribution must therefore result from redistribution between ages, including the baby boomers (active during the period studied), to the young and the elderly. We first calculate the share of GDP deficit to those aged 60 and higher versus under age 20 (Figure 5). The former fraction steadily increased over the period, while the latter steadily decreased, coming to the verge of crossover by the year 2005.



We then divide these shares by the numbers of individuals aged 60 and higher and under age 20, respectively (Figure 6); these shares have varied less over the period, except in the beginning of the period for the 60 and over. This reflects the fact that the increase from the deficit of those over 60 was due largely to their population growth. The weakness of the trend in the reported actual share is remarkable given the significant political, economic, and demographic changes that France experienced during these years. However, the gap between the share of those over

60 and those under 20 has increased continuously, reflecting the increasingly predominant weight of the elderly in French society.

Figure 6. Share of Lifecycle deficit in GDP per capita



5. Conclusion

We have highlighted some aspects of the interplay between population structure, lifecycle income and consumption in France between 1979 and 2005. These data offer a first glimpse at some fundamental characteristics of the French population and economy of doubtless utility to the public debate on intergenerational welfare. Comparisons of the relative welfare between generations are nonetheless difficult, since aggregate indicators such as those given here can only summarize one abstract dimension of reality. Although it offers only a partial account of this reality, the use of consumption as an indicator of welfare is still fruitful.

The NTA data for France highlight both the relative equality of consumption between ages and an increase in consumption profiles (normalized to the labor income of ages 30-49) over time, but the shift in favor of older persons is not as large as that observed in the United States. Moreover, the reduction in the period during which individuals consume less than their labor income has not led to significant changes in reallocations that benefit the young and the elderly.

As a percentage of GDP, deficits for those under age 20 or aged 60 and higher have remained roughly constant. However, the gap between the share received by those aged 60 and higher and those under age 20 has increased steadily.

Our current research focuses on a breakdown by sex of the consumption and income profiles and on the introduction of time transfers generated by unpaid domestic production. In addition, we aim to analyze how the lifecycle deficit is financed, and to assess whether the role of the economic mechanisms used for age reallocations (transfers and asset-based reallocations) has changed over the past decades. Further, since 2005 the arrival of the baby boomers at retirement age is a major demographic shift that should be documented and analyzed by updating our data.

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