Estimating lifetime income inequality using Spanish tax microdata

(October, 2016)

José Manuel Heredia-Conde
GEN-Universidad de Vigo

Jorge Onrubia
Universidad Complutense de Madrid, FEDEA and GEN

Yolanda Pena-Boquete
Instituto di Studi sulle Società del Mediterraneo

Fidel Picos
Joint Research Centre, European Commission

Abstract

In this paper we make use the 1999-2010 waves of the Spanish Income Tax Panel of Tax Returns to assess cross-sectional income inequality and to compare it to a lifecycle-adjusted measure of income, based on the age-equivalent individual-specific income suggested by Millimet et al. (2003). Under the assumption of perfect intra-cohort income immobility and using an age-equivalence scale, this approach allows adjustment of observed incomes so as to rescale each of them in any given cross-section to a single reference cohort, making them directly comparable as long as age-cohort effect has been removed. Results confirm that age-equivalent or lifecycle-stage adjusted incomes are more equally distributed than observed annual values, which is coherent with the common view about the inequality-reducing effect of the lifecycle. Moreover, we also show inequality levels being asymmetric across income deciles, the greatest figures corresponding to most extreme income levels.

JEL Codes: C81, D31, I31

Keywords: life-cycle income, income inequality, personal income tax microdata

E-mail addresses:

jheredia@uvigo.es

jorge.onrubia@ccee.ucm.es

penaboquete@issm.cnr.it

fidel.picos@ec.europa.eu

1. Introduction

In recent times a growing concern has arisen on the increasing inequality of income distribution in Spain, which is thought to have intensified as a result of the financial and economic downturn experienced in Spain since 2008. It is common the literature to link social wellbeing to mean income –the size of the cake relative to the number of guests (Lambert, 2001)–, but also to how this income is distributed among the population –an income inequality measure, which would answer the question on how 'the cake' is shared by the guests–. The most common practice is to measure inequality on the basis of annual cross-section data at a given point in time, but it has been already proved that extending the reference period alter 'yearly-based' inequality estimates, which are generally recognized to overstate 'real' long-term inequality.

In this context, obtaining the lifetime value of all incomes accruing to each individual during her whole life cycle could be regarded as the ideal situation. The best option would be the use of longitudinal databases covering complete life spans of individuals, but since such a dataset is not available for Spain, we need to recur to techniques that can estimate full life-cycle income paths.

The aim of this paper is to build a measure of life-cycle income inequality for Spain and compare it to cross-sectional measures. For this purpose we will use microdata from Personal Income Tax returns, mainly because of their reliability and richness in terms of income variables and despite the lack of many non-monetary relevant ones. This would help clarifying to what extent income inequality is currently greater than before when we extend the accounting period to the whole life cycle. In addition, it would be useful in order to prove standard theories on lifetime income distribution on the basis of relatively recent Spanish personal income tax returns microdata.

2. Literature Review

Surveys are a major data source for analysing income distribution across the life-cycle, as in Murray (1964), Lillard (1977), Moss (1978), Millimet et al. (2003) or Pijoan-Mas and Sánchez-Marcos (2010). An alternative source is the use of data from administrative registers –such as income tax registers and population censuses– or Social Security earnings histories, as well as from declarations of employers on wages. This is option has been commonly used in the Scandinavian countries; e.g. Bengtson, Holmlund and Waldenström (2012), Böhlmark and Lindquist (2005) and Böhlmark and Lindquist (2006) use a longitudinal database with tax records of the Swedish population, while tax registers for every Norwegian are used by Aaberge and Mogstad (2015) and Creedy, Halvorsen and Thoresen (2013).

For the Spanish case both types of data are available. The most used survey is Spanish version of the EU-SILC ('*Encuesta de Condiciones de Vida*, *ECV*), while there are several administrative microdata sets available for researchers, mainly from PIT returns and Social Security registers. The EU-SILC data have two main limitations for the analysis of life-cycle incomes: its rotational nature (individuals are kept only for four years) and the underreporting of capital income (pointed out by Pou and Alegre, 2002). One of the few analysis of lifetime income inequality in Spain (Salas and Rabadán, 1998) uses Spanish tax returns longitudinal microdata.

When, as usually happens, there is no available individual data for whole life spans, the most common option is the estimation of an earnings function to generate age-earnings profiles for individuals (Lillard, 1977). Treatment of the consumption-saving decision problem (Deaton, 1991) is also a common pattern. Creedy (1997), Creedy (1999), Pijoan-Mas and Sánchez-Marcos (2010) and Blundell (2014) address this question within their models. Integrated models (Browning, Deaton and Irish, 1985) allow to specify individual estimated optimal consumption, saving (and even insurance) decisions.

Levell and Shaw (2015) estimate full life cycles for adults from a given birth cohort using a reduced panel dataset. Deaton and Paxson (1993) suggest the construction of groups of individuals according to their years of birth or by their ages in a fixed reference year. This approach is extended in Deaton and Paxson (1994). In a similar vein, Deaton and Paxson (1995) test the link between age and inequality, disentangling the combined effects of within and between cohort income and consumption inequality.

Abeysinghe and Gu (2011) fit separate regression models for log income of the cohort for each of three income quantiles, on age and cohort dummies. Other options involve either pooling together data from different tax years and grouping the observations only by age (Salas and Rabadán, 1998) or using a single cross-section to scale incomes from individuals observed at different age cohorts to the same reference cohort. This scheme (Millimet et al., 2003) is equivalent to project observed incomes backward and forward within the life cycle.

Harding (1994) annualized lifetime income measures reflect the average amount of income received during each year of adult life. Nevertheless, the use of present values is much more common, as in Lillard (1977), Moss (1978), Haider and Solon (2006), Brenner (2010), Bengtson, Holmlund and Waldenström (2012); and Blundell (2014). A reasonable combination between average values and present values is the discounted average lifetime income (Levell, Roantree and Shaw, 2016).

Böhlmark and Lindquist (2005), Böhlmark and Lindquist (2006) and Aaberge and Mogstad (2015) define their lifetime income measures as the annuity value of the discounted sum of real annual income. Complementarily, Aaberge and Mogstad (2010) Equally Allocated Equivalent Income is a utility equivalent annuity, closely related to the one introduced by Nordhaus (1973). Interestingly, Salas and Rabadán (1998), using Spanish Personal Income Tax Longitudinal microdata, found no significant difference regarding income inequality, depending on whether or not income values are discounted.

In order to address lifetime income inequality measurement, Blundell and Preston (1998) recur to the permanent-transitory decomposition of the variances and covariances under the assumption that, for large periods and small interest rates, individuals tend to consume their permanent income, this one being, consequently, the most relevant magnitude in assessing long-term inequalities.

Key reference measures as those proposed by Atkinson (1970) and Shorrocks (1978), along with similar ones including the (square of) the coefficient of variation and the Theil coefficient are frequently used for quantifying lifetime income inequality. Actually, the coefficient of variation and the Gini coefficient, which are among the most popular Lorenz-consistent inequality measures, are often reported jointly, as in Lillard (1977), Harding (1994), Salas and Rabadán (1998) and Creedy (1999).

The Gini coefficient is sometimes used alone as a measure of lifetime income inequality, as in Millimet et al. (2003) or in Levell, Roantree and Shaw (2016). Nevertheless, it is frequent to find earnings quantiles accompanying the inequality indices, as in Moss (1978), Slemrod (1992), Harding (1994) and Clemens, Emes and Sarlo (2015). Roantree and Shaw (2014) complement the Gini coefficient with the percentiles ratio P90/P10. Much more recently, Aaberge and Mogstad (2015) suggest the calculation of the three first moments of the scaled conditional mean curve.

Discussing the definition of an income magnitude, Murray (1964), Haider and Solon (2006) and Brenner (2010) conceive it simply as the flow of money subject to Social Security burdens. Nonetheless, the explicit aggregative definition is a much more common practice. Substantial agreement exists about earned income, primarily consisting on the sum of labor income and self-employment income, as in Lillard (1977) and in Jenkins (1987).

Regarding interest income, Blundell (2014) excludes interests from his income measure. Moss (1978) adds several components such as income from property and other assets, transfer payments and private pensions. Nevertheless, capital gains are excluded. In contrast, Böhlmark and Lindquist (2005) and Böhlmark and Lindquist (2006) include capital income and capital gains, although they deduct negative flows. In fact, capital losses are generally excluded except for Harding (1994), Creedy (1997), Aaberge and Mogstad (2010) and Aaberge and Mogstad (2015).

3. Data

We use the Spanish Panel of Tax Returns 1999-2010 (the panel, in what follows), which is a panel representative of the population of taxpayers of the Spanish Personal Income Tax in each of the successive years it covers. This dataset is an expanded panel, meaning that, for each of the covered years, people previously under study are followed and, furthermore, new people are incorporated to the sample in order to keep representativeness of the population. The base year is 2003 and the sampling method is, for each period, a minimum variance stratified random sampling, the strata being defined according to the geographic region, predominant income source and income level. The original design of the panel is described in Onrubia, Picos and Pérez (2011), who provide methodological specifications, as well as useful procedures and advice on how to use the dataset. These authors describe the database up to 2007; an updated version, up to 2010, is used here and was described in Burgos et al. (2014).

Given the structure of the Spanish PIT, each observation of the panel may corresponds to a tax declaration, which may correspond to an individual or a married couple (who can choose between individual and joint taxation). Since we are interested in analysing individuals, a method for assigning to each of the spouses a proportion of the total income of the household has been used. We have also excluded observations belonging to individuals either younger than 18 years old or older than 85 when observed[1]. After this adjustments we still have slightly more than seven million observations available, which are not symmetrically distributed across years (from around 475,000 in 2003 to slightly over 700,000 in 2009). These observations correspond to somewhat less than one million different individuals in the overall sample, because the panel is not fully balanced.

Once we have selected the observations, we have identified five different income components according to the Spanish PIT law, as follows:

[1] The lower bound has been set according to the age from which any person in Spain becomes an adult, because until then individuals should declare jointly with her parents. The upper limit is defined according to the current life expectancy at birth estimates for males and females, which does not reach such age in the former case and barely noticeably leaves it behind in the latter.

- **Gross Labor Earnings** (‘*Rendimientos Íntegros del Trabajo*’): This category refers to all income deriving from dependent labour, before deducting any related cost or expense, including the monetary value of those earnings satisfied in kind and excluding any sort of business income or self-employment income.

- **Non-Rental Capital Income** (‘*Rendimientos Íntegros del Capital Mobiliario*’): This concept refers to capital income in its broad sense, including not only interests earned from financial assets held by the taxpayer but even rents from non-real-estate properties, such as goods, businesses or mines. This category excludes rents from real estate, whereas it includes subleases of it.

- **Real Estate Capital Income** (‘*Rendimientos Íntegros del Capital Inmobiliario*’): The main components of this income source are gross income from rental of real estate properties –unless such rents constitute an economic activity, in which case they are classified as self-employment income– and imputed income derived from the ownership of dwellings distinct from the first residence of the taxpayer and not affected to economic activities.

- **Net Self-Employment Income** (‘*Rendimientos Netos de Actividades Económicas*’): It involves business and self-employment income which must not be subject to the corporate income tax. The concept include certain imputed incomes, as well as incomes from entities in the Special Regime of Income Attributions, which are likely to be primarily derived from business activities. As earnings are not gross but net, all necessary expenses incurred for obtaining them are deducted. Nevertheless, income reported is prior to any deduction applied on the taxable base.

- **Net Positive Sum of Capital Gains and Losses** (‘*Saldo Neto Positivo de Ganancias y Pérdidas Patrimoniales*’): This component refers to the net positive result of compensating positive and negative incomes from the sale or withdrawal of assets, either physical or financial. Coherently, it includes certain imputed incomes, as the ones resulting from the participation in Collective Investment Institutions based in tax havens.

For our analysis we use the algebraic sum of the four first categories. The net positive sum of capital gains and losses is purposely excluded from the income concept because both its quantification process and –especially– its imputation to one tax year or another are quite arbitrary according to the Spanish tax law. For that reason, this concept does not accurately reflect the real time periods during which net capital gains are effectively generated. In turn, including this income source introduces a level of income volatility which is probably far from reflecting any real-world income flow behavior.

4. Methodology

4.1. Generation of cohort-age income profiles

As explained in the previous section, our database covers twelve successive years, quite a little fraction of the typical lifetime of an individual. According to the reviewed literature, it is possible to estimate lifetime income paths recurring to quite well-established econometric procedures based on regression models and step-by-step forward prediction.

However these techniques require the use of socio-demographic information. Our database is very rich in terms of income variables and their level of reporting detail, but it is much weaker in terms of socio-demographic information. As it is very difficult to model individual heterogeneity while ignoring differential personal circumstances among individuals, one approach could be no longer to speak in terms of individuals but instead in terms of income levels by decile for each cohort defined by the year of birth. Nonetheless, as pointed by Abeysinghe and Gu (2011) when facing a similar situation, we cannot follow neither individuals nor birth cohorts income streams during the entire life-cycle of any individual or birth cohort. In fact, we have individuals and cohorts of ages all over the life-cycle but once we restrict ourselves to a given cohort, grouping individuals born in a certain year, we can only follow each cohort for at most 12 years of its life. This situation is symmetric to the one experienced for the individual-based approach.

A possible solution for this problem is to rescale incomes corresponding to individuals from different age cohorts observed in a given annual cross-section to make them directly comparable. This accounts for adopting the Millimet et al. (2003) approach for constructing an upper bound for lifetime income inequality under the assumption of no within age-cohort mobility. As in their original work, we apply to each individual observed income in each of the annual samples integrating the Panel of Tax Returns an age equivalence scale in order to express each monetary measure in terms of the mean income of those being 34 years old in the cross-section original data. These individuals are taken as the reference cohort arbitrarily, since such a choice does not affect the resulting lifetime income inequality levels.

Let us consider

$\bar{Y}_a$ to be the mean income of a given age cohort, a, and

$\bar{Y}_r$ to be the mean income of an age cohort, r, taken as the reference one.

Then, the age equivalence-scale we are referring to would be denoted by e, where

$$e = \frac{\bar{Y}_r}{\bar{Y}_a}$$

The exercise we perform consists on translating each individual observed income into an age-equivalent income. In our scheme, such an income is the one each individual would have at the age of 34, given her relative position in the observed income distribution for the age group (a) he or she actually belongs to at the moment of observation and provided that complete intracohort immobility is assumed.

That is to say,

$$\bar{Y}_r = \bar{Y}_{a=34}$$

So, let age-equivalent income of an individual i (Y_{ir}) be defined by rescaling her observed income when belonging to the age cohort a (Y_{ia}) through the age equivalence scale e previously defined, as described in the equation below.

$$Y_{ir} = Y_{ia} * e$$

Provided that we have taken the 34 years old age cohort as the reference one, the equation just above is equivalent to the following one:

$$Y_{ir} = Y_{ia} * \left(\frac{\bar{Y}_{r(r=34)}}{\bar{Y}_a} \right)$$

Now we can hypothesize, for each individual in the annual cross-sectional sample taken as a starting point, an age-income profile for all ages across the life cycle, based on the age-equivalent income, the age equivalence scale and each age within the life cycle.

Considering that the equivalent income is obtained by dividing the income value observed at a given age (Y_{ia}) by the corresponding age-group mean income ($\bar{Y}_a$) and multiplying it by the reference cohort mean income ($\bar{Y}_r$), hypothesized income at any given age a^* ($\hat{Y}_{ia^*}$) arises from dividing the individual-specific age-equivalent income (Y_{ir}) by the reference cohort mean income ($\bar{Y}_r$) and then multiplying it by the corresponding age group (a^*) mean income ($\bar{Y}_{a^*}$).

$$\hat{Y}_{ia^*} = \frac{Y_{ir}}{\bar{Y}_r} * \bar{Y}_{a^*}$$

Alternatively, we can consider the fact that the age equivalence scale reflects the proportion the reference age cohort mean income represents over each age cohort mean income. Such proportion is unique at any given age for all individuals. Consequently, the hypothesized income at a given age a^* ($\hat{Y}_{ia^*}$) would result from dividing each individual-specific age-equivalent income (Y_{ir}) by the age equivalence scale (e_{a^*}) which would have corresponded to the age (a^*) at which we aim to obtain the hypothesized income –not to the age (a) for which we actually observed the individual annual income.

$$\hat{Y}_{ia^*} = \frac{Y_{ir}}{e_{a^*}}$$

Monetary values belonging to income variables are inflated by the inter-annual increase rate of the Consumer Prices Index (CPI) to 2010 constant euros, in order to obtain real incomes. The CPI was favored against other prices or production indices because we are primarily interested in assessing the taxpayer consumption capacity, so variations in the prices of consumption goods are the most relevant ones.

Our proposal involves the estimation of a different age-income profile for the whole lifetime 18-85 for each individual in the annual sample of the Panel of Tax Returns taken as a starting point. Each of the twelve annual samples configuring our longitudinal dataset is used successively for generating independent sets of hypothesized age-income profiles over the life cycle and so evaluating the evolution of results depending on the input data used. By construction, it is indifferent to assess inequality on the basis of each individual equivalent income –which is constant for her whole life cycle– or to calculate it on an individual-specific lifetime wealth measure obtained by aggregating all hypothesized incomes across each individual life-cycle profile.

4.2. Aggregation of annual incomes across time

Provided that our aim is to compare cross-section inequality to life-cycle inequality measures, we need to summarize the stream of annual incomes accruing to an individual during her whole life-cycle in one single value. The most frequent approaches for building lifetime income magnitudes are reviewed in Creedy (1997) and have also been already discussed in our literature review. As stated there, one common method involves calculating the present value of real incomes. Another one refers to average values of annual incomes across the life cycle and it is even possible to find combinations of these two alternatives as the annual average discounted sum of annual incomes over the life cycle.

Provided that our simulated age-income profiles cover, for each individual, the same whole interval from 18 to 85 years old, it is not necessary for us to calculate annually-averaged values for lifetime incomes, as the 'lives' we are considering last exactly the same time for all analysed individuals and then the effective number of annual periods becomes totally irrelevant for inequality analysis.

Even though we find not necessary to average lifetime incomes across years, we could certainly have considered discounting incomes, either at a fixed or at a market interest rate, in order to reflect that income is more valuable when obtained earlier in life; at least for the fact that there is a possibility for taking a profit from early-earned incomes through the collocation of these resources in the financial markets, earning an interest from them. However, provided that we are already working with inflation-corrected income values and mainly for simplicity reasons, we assume the hypothesis that the real gross income inter-annual growth rate and the real rate of interest cancel out each other (Harding, 1994). We favour this approach against more sophisticated ones based on present values calculations, to a great extent in attention to the conclusions reached by Salas and Rabadán (1998), who, among others, found no significant differences in inequality measures depending on whether incomes were discounted or not.

Consequently our measure of lifetime income is more exactly a lifetime wealth indicator ($W_{i,lifetime}$) and accounts for the sum of all hypothesized annual incomes for each individual ($\hat{Y}_{ia^*}$) across her life cycle (from 18 to 85 years old, both inclusive).

$$W_{i,lifetime} = \sum_{a^*=18}^{a^*=85} \hat{Y}_{ia^*}$$

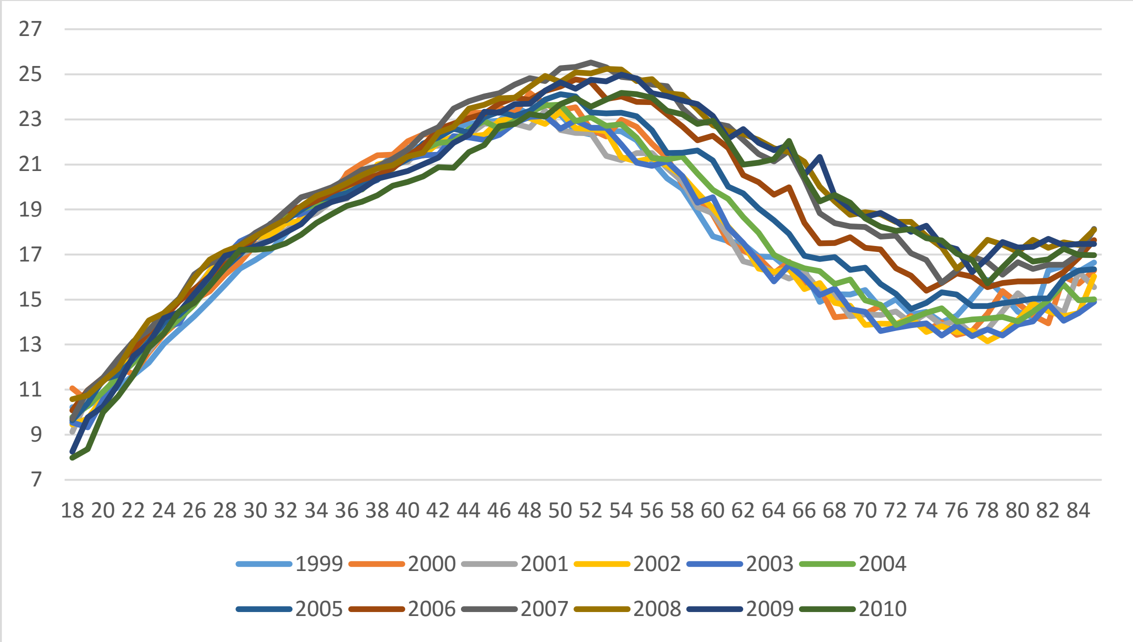
5. Results

5.1. Simulation of age-income profiles

The Millimet et al. (2003) methodology we have applied for obtaining age-equivalent incomes and then deriving age-income profiles could have been applied to a single annual cross-section of data. Nevertheless, having the opportunity to successively apply the same methodology to different annual samples in our panel makes it possible to observe to what extent the hypothesized profiles are different from each other depending on what tax year the input data belong to, and therefore on the underlying economic conditions.

Figure 1 represents real mean income –in 2010 constant thousand euros– by age group, for the simulated age-income profiles obtained from each of the twelve annual samples of the 1999-2010 Spanish Income Tax Panel of Tax Returns. Mean values for the real gross income magnitude are calculated, within the dataset resulting of the simulation process for each year of the panel, separately for each age 18-85.

Figure 1. Age-Group Means for Simulated Incomes from each Annual Sample in the Panel Data (thousand EUR)



We can clearly appreciate the typical inverted U-shape of the age-income profiles from the age of 18 until, at least, the late seventies. As it is common in the literature, we observe how incomes grow sharply from the early twenties to –approximately– the middle fifties and then decline until the late seventies. This decline at the end of the life cycle is particularly intense until the late sixties, which is specifically the age around which most people retire in Spain. Thereafter, it seems that a certain income stabilization takes place for all the simulated sets of individual age-income profiles. Arguably, this pattern is linked to the Spanish transfers system and, particularly, to the contributory public retirement pensions perceived by elderly former employees.

Another possible explanation for the income pattern in the late stages in the lifecycle is the relevant share of capital income at such ages. As far as returns to capital –for instance, via interest payments or dividends– are more volatile than earned income and also less predictable, this fact can help to explain the flat income pattern at the end of the mean age-income profile.

Regarding the simulated amounts, the minimum value accounts for about €8,200 (2010 constant euros) for 18 years old individuals from the 2010 annual sample. The maximum mean value is reached by 52 years old taxpayers from the 2007 sample, at slightly over €25,500. Mean income at the legal retirement age in Spain –65 years old– ranges from roughly €16,000 for individuals from the 2001 sample to just above €22,000 for the simulation based on the 2010 annual sample.

More generally, it is easy to notice that the 2010-based mean age-income profile is the lowest one from the age of 18 to approximately the middle of the lifecycle. Nevertheless, at the same time, it is also –along with the 2008 and 2009 ones– one of the highest profiles after the fifties. Conversely, the 1999-based age-income profile, as the ones for 2001 and 2003, are the lowest ones at the second half of the life cycle. It might be highlighted that divergence among profiles is considerably more marked during the second half of the age-income profile than in the first one, suggesting that the input data actually matters more when modelling mature individuals than when addressing early ages.

The fact that 2008 to 2010-based profiles were the lowest ones at the first half of the life cycle and also among the highest ones during the second half seems to be pointing towards a differential impact of the most recent economic and financial crisis in Spain, in the sense that younger taxpayers appear more damaged than the elderly when the income data taken as an input for the simulation comes from annual samples within the crisis developing time period.

5.2. Inequality analysis

In this subsection we compare inequality measures when considering observed annual incomes to those arising from our calculated individual-specific age-equivalent incomes, by using the Gini coefficient.

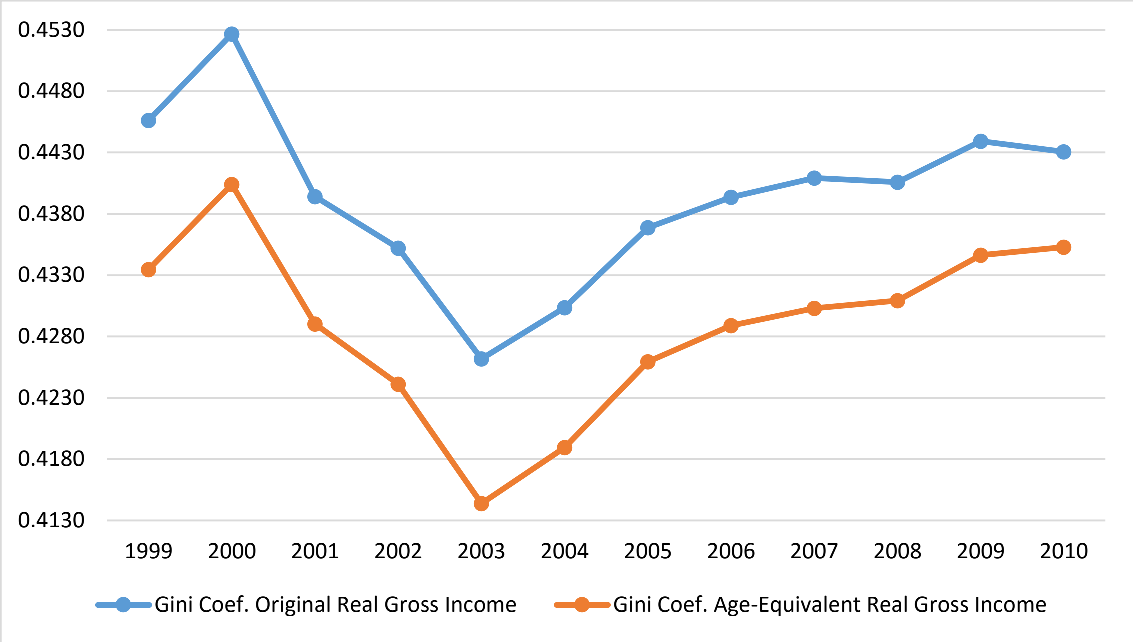
It is important to bear in mind that age-equivalent incomes reflect each individual observed income in a given annual cross-section once such income has been corrected in order to take into account the age of the individual at the moment of observation and so remove the ‘portion’ of such observed income value which is purely due to the stage the individual is at in her lifecycle when observed. Correcting incomes involves translating them according to the mean income values of a given reference age cohort.

As complete within-cohort income immobility is assumed, inequality based on equivalent incomes referred to a fixed reference age cohort equals that arising from a hypothetical lifetime wealth magnitude which aggregates each individual incomes across her life cycle. This circumstance necessarily implies that inequality on the basis of age-equivalent incomes from a given cross-section reflects the portion of total inequality which is not due to age and which constitutes an upper bound for lifetime income inequality, as long as it relies on the assumption of no income mobility or persistence of income ranks as the individuals ages.

Taking into account that age-equivalent incomes, as defined in Millimet et al. (2003), are income measures based on individuals’ annual incomes and corrected for the effect of the stage in the lifecycle where each individual is placed when observed, it is clear that the difference in terms of the value of a given inequality index between observed annual and age equivalent ‘lifetime adjusted’ incomes actually constitutes an estimate of the portion of total annual cross-sectional income inequality which would disappear provided that the whole income stream from 18 to 85 years of age were considered for each analysed individual.

Figure 2 compares income inequality, as measured by the Gini coefficient, in the distribution of annual observed incomes –conveniently inflated to 2010 constant euros– and in the distribution of age-equivalent incomes –also expressed in 2010 constant euros–. This comparison is made separately for each year from which we have income data in the Panel 1999-2010. Results for the original income magnitude previously defined and for the age-equivalent one are reported in the figure below.

Figure 2. Gini Coefficients: Original vs. Age-Equivalent Real Gross Income



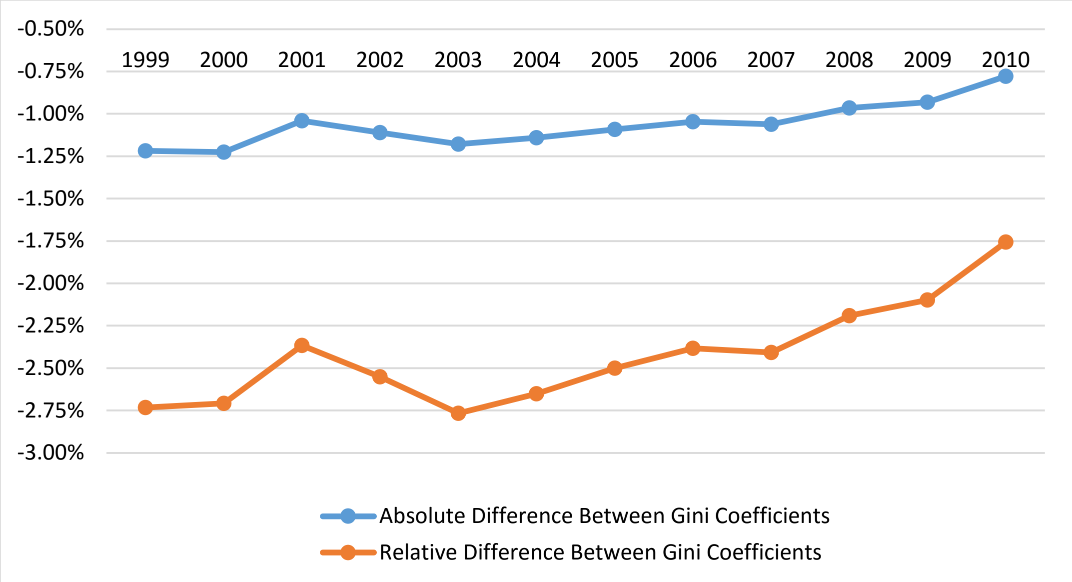
The Gini coefficient for the original –observed– annual real gross income ranges from 0.428 in 2003 to almost 0.453 in 2000. In contrast, the age-equivalent real gross income concept reaches its minimum value at roughly 0.41 and peaks at 0.44. Both the peak and the fall take place for age-equivalent income in the same years reported for the original concept. As expected, age-equivalent income inequality is always below its original annual income counterpart. This is true regardless which year of the panel data we were considering. Furthermore, the difference between overall Gini coefficients appears to be nearly the same, in absolute terms, for any of the annual samples in the Panel.

The Gini coefficients, both for the observed annual incomes and for the age-equivalent ones, show quite a clear pattern. Inequality rises in 2000 respective to 1999. Then, it substantially decreases until reaching its minimum value in 2003. In 2004 and 2005, the Gini coefficients grow sharply. Thereafter, they rise steadily up to 2009.

It should be noted that, in 2010, the age-equivalent income Gini increased its value with respect to the previous period, whereas cross-sectional inequality declined. This means that the portion of inequality due to age decreased while the 'relevant' lifecycle-adjusted inequality actually grew. The former fall was intense enough to compensate the latter growth in terms of total cross-sectional inequality.

Figure 3 reports the absolute and relative differences between the Gini coefficients of Figure 2.

Figure 3. Absolute and Relative Differences in Gini Coefficients: Original vs. Age-Equivalent Real Gross Income



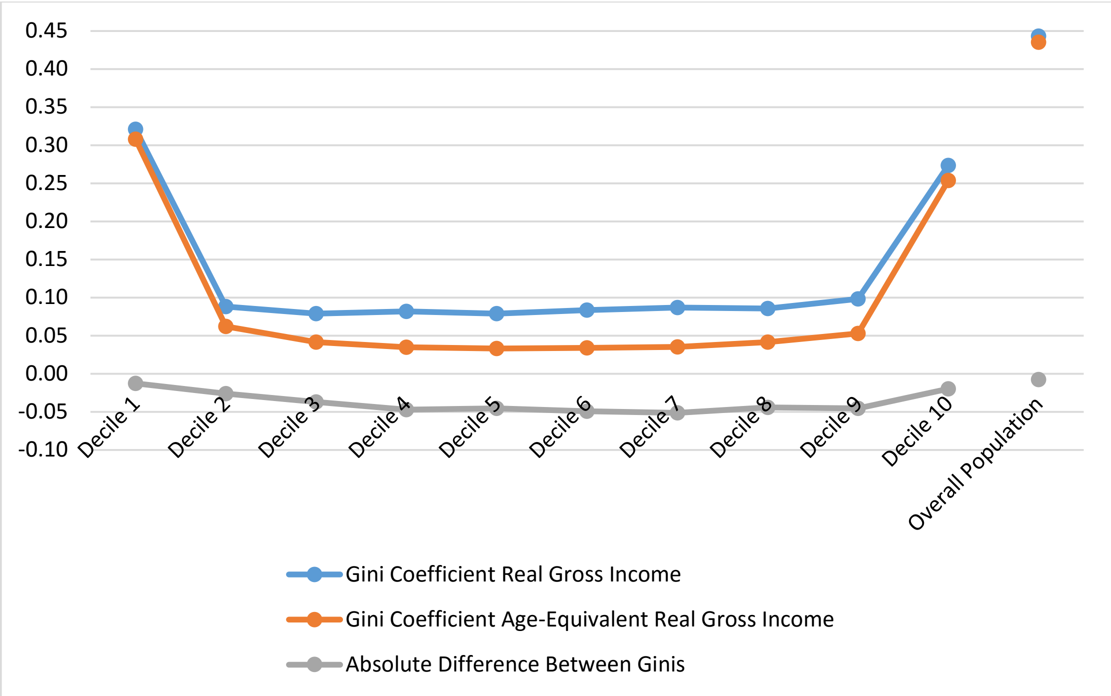
The difference between those Ginis can be understood as an approximation to the fraction of total cross-section income inequality due to age. This portion of annual inequality disappears when the complete life-cycle is analysed or, alternatively, when all incomes are scaled to a single cohort or age group. For that reason, this part of total inequality is often thought of as an intrapersonal one –between periods within a given individual–, sometimes being titled 'non-functional' or 'non-policy-relevant', as acknowledge Millimet et al. (2003).

Absolute difference between Ginis ranges between -0.008 in 2010 and -0.0123 in 2000. This difference narrows from 2000 to 2001, then widens again in 2003 and narrows steadily thereafter. Such behaviour means that, in 2003, 2.77% of total cross-section inequality were due to age and thus irrelevant under a pure lifecycle perspective. This relative proportion, very close to those of 1999 and 2000, sharply decreases thereafter, to reach 1.76% of the total annual inequality in 2010.

The observed pattern in terms of the decreasing proportion of overall income inequality –cross-sectional Gini coefficient– accountable to the lifecycle can be pointing to a relative increase of inequality in permanent incomes, which persists for a given individual across her whole life path.

To have a more detailed picture of the difference between both inequality measures, Figure 4 shows the two Gini coefficients and its absolute difference by deciles. These deciles were constructed using the sum of hypothesized annual incomes across the life cycle from 18 to 85 years of age.

Figure 4. Gini Coefficients for Real Gross Income and Age-Equivalent Real Gross Income, By Lifetime Wealth Decile (2010 Panel Data)



According to the figure above, it is clear that income inequality is far from being equal across deciles. On the contrary, the greatest dispersion in the distribution of incomes is heavily concentrated in the first and in the tenth deciles. Another interesting pattern refers to the divergence exhibited by the age-equivalent income Gini coefficient from the annual observed income one. In absolute terms, this difference is relatively insignificant in the two bottom deciles, as well as in the two top ones. This fact implies that, in the tails of the distribution, where income inequality is much more intense, the portion of inequality due to the life cycle is actually very modest. Conversely, the closer we are to the median (intermediate income decile group), the greater the deviation of the age-equivalent Gini from the conventional cross-sectional one.

In any case, as usual, regardless the decile being under consideration, age-equivalent Ginis are always below the standard ones from annual cross-sections. This is translated in the graph above into a permanently negative difference between Ginis, which implies income inequality being lower when life-cycle or age effects are corrected than when they are ignored. Alternatively, such a difference can be seen as an estimate of the equalizing effect of the life-cycle or the portion of total inequality vanishing as individuals age.

6. Concluding remarks

Inequality affecting the distribution of income accruing to either individuals or households has a powerful influence on the level of economic well-being they could attain. Nevertheless, inequality measured at any given point in time, normally through annual cross-sectional representative samples from either administrative records or survey datasets, has often been argued to give rise to a misleading picture regarding the distribution of resources. Specifically, annual income inequality is considered to overestimate inequality over longer periods or even lifetime inequality faced by citizens.

In this paper we have made use of the twelve annual samples from the 1999-2010 Spanish Income Tax Panel of Tax Returns in order to assess cross-sectional income inequality in each of these samples and to compare the results with those on a lifecycle-adjusted measure of income, based on the age-equivalent individual-specific income suggested by Millimet et al. (2003). Under the assumption of perfect intra-cohort income immobility and using an age-equivalence scale, this approach allows adjustment of observed incomes so as to rescaling each of them in any given cross-section to a single reference cohort, making them directly comparable as long as age-cohort effect has been removed.

Results confirm that age-equivalent or lifecycle-stage adjusted incomes are more equally distributed than observed annual ones. This circumstance is coherent with the common view about the equalizing or inequality-reducing effect of the lifecycle. Moreover, we also show inequality levels being asymmetric across income deciles, the greatest figures corresponding to most extreme income levels. The absolute and relative portions of overall inequality attributable to the life cycle also vary noticeably by income decile. Finally, we have assessed to what extent our results are different as we use, as an input for the model, annual income data closer to the present.

We believe there is a large field for future research on lifetime income measures using Spanish administrative microdata coming from the personal income tax returns. Meaningful extensions to this paper would include replicating our calculations with different income components, such as labour earnings, business or self-employment income or capital income, rather than using a wider gross income magnitude as has been done here. This would allow assessment of differential behaviour by income source. Another direction for future research involves exploiting the tax-nature of our administrative data and so walking towards an analysis in terms of tax progressivity and the redistributive impact of the Spanish personal income tax in life-cycle terms.

References

Aaberge, R. and Mogstad, M. (2010) "On the Measurement of Long-term Income Inequality and Income Mobility", *IZA Discussion Paper*, no. 4699.

Aaberge, R. and Mogstad, M. (2015). "Inequality in current and lifetime income", *Social Choice and Welfare*, 44 (2): 217-230.

Abeysinghe, T. and Gu, J. (2011). "Lifetime Income and Housing Affordability in Singapore", *Urban Studies*, 48 (9) 1875-1891.

Atkinson, A.B. (1970). "On the Measurement of Inequality", *Journal of Economic Theory*, 2: 244-263.

Bengtsson, N., Holmlund, B. and Waldenström, D. (2012). "Lifetime versus Annual Tax Progressivity: Sweden, 1968–2009", *Discussion Paper Institute for the Study of Labor (IZA)*, no. 6641.

Blundell, R., Graber, M. and Mogstad, M. (2014). "Labor Income Dynamics and the Insurance from Taxes, Transfers and the Family", *Working Paper Institute for Fiscal Studies (IFS)*, no. 01/14.

Blundell, R. and Preston, I. (1998). "Consumption Inequality and Income Uncertainty", *Quarterly Journal of Economics*, 113 (2): 603-640.

Blundell, R., Pistaferri, L. and Preston, I. (2008). "Consumption Inequality and Partial Insurance", *American Economic Review*, 98 (5): 1887-1921.

Blundell, R. (2014). "Income Dynamics and Life-Cycle Inequality: Mechanisms and Controversies", *Economic Journal*, 124: 289-318.

Böhlmark, A. and Lindquist, M. J. (2005). "Life-cycle variations in the association between current and lifetime income: Country, cohort and gender comparisons", *Working Paper Swedish Institute for Social Research (SOFI)*, no. 4/2005, Stockholm University.

Böhlmark, A. and Lindquist, M. J. (2006). "Life-Cycle Variations in the Association between Current and Lifetime Income: Replication and Extension for Sweden", *Journal of Labor Economics*, 24 (4): 879-896.

Brenner, J. (2010). "Life-cycle variations in the association between current and lifetime earnings: Evidence for German natives and guest workers", *Labour Economics*, 17: 392-406.

Browning, M., Deaton, A. and Irish, M. (1985). "A profitable approach to labor supply and commodity demands over the life-cycle", *Econometrica*, 53 (3): 503-543.

Burgos, M. J., Gallego, C., Pérez, C., Pradell, E. and Villanueva, J. (2014). "Panel de Declarantes de IRPF 1999-2010: *Metodología, Estructura y Variables*", *Documentos* de Trabajo del Instituto de Estudios Fiscales, no. 09/2014.

Cameron, L. and Creedy, J. (1994). "Taxation and the Distribution of Lifetime Income", in J. Creedy (ed.), *Taxation, Poverty and Income Distribution*. Aldershot: Edward Elgar. pp. 140–162.

Clemens, J., Emes, J. and Sarlo, C. (2015). *Income Inequality Measurement Sensitivities*, Fraser Institute, July.

Creedy, J. (1992). *Income, Inequality and the Life Cycle*. Aldershot: Edward Elgar.

Creedy, J. (1997). "Lifetime Inequality and Tax Progressivity with Alternative Income Concepts", *Review of Income and Wealth*, 43: 283-295.

Creedy, J. (1999). "Lifetime versus Annual Income Distribution", in J. Silber (ed.), *Handbook on Income Inequality Measurement*. Boston, MA: Kluwer Academic Publishing.

Creedy, J., Halvorsen, E. and Thoresen, T.O. (2013). "Inequality Comparisons in a Multi-Period Framework: The Role of Alternative Welfare Metrics", *Review of Income and Wealth*, 59 (2): 235-249.

Deaton, A. (1991). "Saving and Liquidity Constraints", *Econometrica*, 59 (5): 1221-1248.

Deaton, A. and Paxson, C. (1993). "Saving, Growth and Aging in Taiwan", *Working Paper National Bureau of Economic Research (NBER)*, no. 4330.

Deaton, A. and Paxson, C. (1994) Intertemporal Choice and Inequality, Journal of Political Economy, vol. 102, no. 3, pp. 437-467, The University of Chicago.

Deaton, A. and Paxson, C. (1995). "Saving, Inequality and Aging: an East Asian Perspective", *Asia-Pacific Economic Review*, 1 (1): 7-19.

Fields, G.S. (2010). "Does Income Mobility Equalize Longer-term Incomes? New Measures of an Old Concept", *Journal of Economic Inequality*, 8: 409-427.

Haider, S. and Solon, G. (2006), "Life-Cycle Variation in the Association between Current and Lifetime Earnings", *American Economic Review*, 96 (4): 1308-1320.

Harding, A. (1994). "Lifetime vs. Annual Income Distribution in Australia", in J. Creedy (ed.), *Taxation, Poverty and Income Distribution*, Aldershot: Edward Elgar. pp. 104-139.

Instituto Nacional de Estadística (2013). *Encuesta de Condiciones de Vida Metodología*, Madrid: INE.

Jenkins, S. (1987). "Snapshots versus Movies 'Lifecycle Biases' and the Estimation of Intergenerational Earnings Inheritance", *European Economic Review*, 31: 1149-1158.

Lambert, P.J. (2001). *The Distribution and Redistribution of Inc*ome (3rd ed.). Manchester: Manchester University Press.

Levell, P., Roantree, B. and Shaw, J. (2015). “Redistribution from a Lifetime Perspective”, *Working Paper Institute for Fiscal Studies (IFS)*, no. W15/27.

Levell, P., Roantree, B. and Shaw, J. (2016). “Mobility and the lifetime distributional impact of tax and transfer reforms”, *Working Paper Institute for Fiscal Studies (IFS)*, no. W16/17.

Levell, P. and Shaw, J. (2015). “Constructing Full Adult Life-cycles from Short Panels, *Working Paper Institute for Fiscal Studies (IFS)*, no. W15/01.

Lillard, L. A. (1977). “Inequality: Earnings vs. Human Wealth”, American Economic Review, 67 (2): 42-53.

Millimet, D., Podder, N., Slotje, D. and Zandvakili, S. (2003). “Bounding Lifetime Income Using a Cross Section of Data”, *Review of Income and Wealth*, 49 (2): 205-219.

Moss, M. (1978). “Income Distribution Issues viewed in a Lifetime Income Perspective”, *Review of Income and Wealth*, 24 (2): 119-136.

Murray, J. (1964). “Potential Income from Assets: Findings of the 1963 Survey of the Aged”, *Social Security Bulletin*, December: 3-11.

Nordhaus, W.D. (1973). “The Effects of Inflation on the Distribution of Economic Welfare”, *Journal of Money, Credit and Banking*, 5: 465-508.

Onrubia, J., Picos, F. and Pérez, C. (2011). *Panel de Declarantes de IRPF 1999-2007: Diseño, Metodología y Guía de Utilización*. Madrid: Instituto de Estudios Fiscales,

Pijoan-Mas, J. and Sánchez-Marcos, V. (2010). “Spain is different: Falling trends of inequality”, *Review of Economic Dynamics*, 13: 154-178.

Pou, L. and Alegre, J. (2002). “La Encuesta Continua de Presupuestos Familiares: Descripción, Representatividad y Propuestas de Metodología para la Explotación de la Información de los Ingresos y el Gasto”, *Documentos de Trabajo de FUNCAS*, no. 172/2002.

Roantree, B. and Shaw, J. (2014). “The Case for Taking a Life-Cycle Perspective: Inequality, Redistribution, and Tax and Benefit Reforms”, *IFS Report R92*. London: Institute for Fiscal Studies.

Salas, R. and Rabadán, I. (1998). “Lifetime and Vertical Intertemporal Inequality, Income Smoothing, and Redistribution: A Social Welfare Approach”, *Review of Income and Wealth*, 44 (1): 63-79.

Shorrocks, A.F. (1978). “Income Inequality and Income Mobility”, *Journal of Economic Theory*, 19: 376-393.

Slemrod, J. (1992). “Taxation and inequality: a time-exposure perspective”, in J. Poterba (ed.), *Tax Policy and the Economy*. Boston, MA: The MIT Press.