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TITLE: Intergenerational income mobility

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Abstract

I outline intergenerational income mobility in Spain using elasticity as a measure of correlation between parents and children's and transition matrices. I use the two-sample two-stage least square estimator to calculate the elasticity coefficients as information of earnings of two different generations is not provided by the INE on one data set. That is, the two data sets used are "Encuesta de Condiciones de Vida" from 2019 to obtain the earnings of children and a set of characteristics from parents, and "Panel de Hogares de la Unión Europea" from 1994 to obtain the same set of characteristics than the ones in in the first data set in order to estimate parent's income. I study the intergenerational mobility of the educational attainment in Spain using elasticity as well and the ordinary least square estimator as information of the level of education of two different generations is provided in a single data set. For both education and income, results from different cohorts will be calculated as a way of detecting different paths between gender or age intervals.

Keywords: intergenerational mobility, income, earnings, educational attainment, transition matrices, two-sample two-stage least square estimator, income distribution.

Contents

1 Introduction

Intergenerational mobility refers to the extent to which individuals' socioeconomic status changes from one generation to the next. In other words, it measures how much differs the position of children in comparison to that of their parents, indicating the degree of movement up or down the social ladder. When at this concept we insert the "economic perception", it is clear that it refers to the capacity of individuals, households or groups to change their economic position across generations in the income distribution.

In recent years, this topic has gathered a significant attention from the public and researchers as it offers insights on the equality of opportunity and occasion on economic prosperity of citizens within a society. The investment a family makes to its children and public policies of a country, mainly through the education system and the labour market, are the main institutions that affect intergenerational mobility as Nicoletti and Ermisch pointed out (2007). Therefore, it is clear that by studying and evaluating these institutions across time and between different countries, researchers might state the causes of divergences.

The objective of this project is to replicate for the year 2019 the analysis carried out by Cervini-Plá in 2012 that presented empirical evidence about the intergenerational mobility of earnings in Spain for the year 2005 using the two-sample two-stage least squares (TS2SLS) estimator. Additionally, we want to present the empirical evidence for the intergenerational mobility of educational attainment, as it is a topic strongly linked to the earnings one, as researchers have stated. Moreover, intergenerational mobility has been historically and generally measured in terms of intergenerational elasticity or, what is the same, a statistical correlation between parents and children's' social standings. Another measure to study intergenerational mobility that has been generally used in this framing are transition matrices, that provide a very visually representation of mobility.

It is important to state that this project does not aim to explain what are the causes that make the level of intergenerational mobility in Spain to be a certain one. Neither to shed lights on the sources of a variation across time of this intergenerational mobility, nor for the income nor for the education.

This project is organized in seven parts. First, in the literature review part I analyze the existing literature about this topic, internationally and for the case of Spain. As follows, I introduce the different methodologies used for the study of the topic, what information they provide and how these procedures are implemented. In the data sources and sample selection problem part I explain the two different databases used in the project, why are those the ones used, what are the variables of our interest and how I modify them in order to deal properly with the two samples. In this section I describe also the variables in the supplemental sample that are used as instrumental variables. Moreover, I explain the characteristics of the main and supplemental individuals of our samples. Afterward, I present the results and findings obtained after being conducted the

different methodologies approaches on our case. The sixth point of the project states for the study of the intergenerational educational mobility as it is one of the main sources of earnings transmission. Therefore, in this section I present the methodology used in the research in this frame, the data sources and sample selection rules, the results obtained and finally some conclusions regarding this outline. To conclude, I provide conclusions about the study of the intergenerational income mobility, its evolution in comparison to the year 2005 and the link with the educational intergenerational mobility nowadays.

2 Literature review

The study of intergenerational mobility for the country of Spain is relatively limited, the study of this topic has been focused mainly in the United States and other countries such as Germany, United Kingdom or Canada. Becker and Tomes (1986) firstly studied intergenerational mobility in the US using the OLS regression and a tradition of the Family Economy. In this background, the parent's utility depends on the children's utility and this intergenerational link involves that parents choose how to distribute their income between consuming or investing in education for their offsprings, which will have long run consequences on children's future income. Dutta, Sefton, & Weale (1999) surveyed education as a matter of public policy. They presented international comparisons of public expenditure on education and discussed the contribution of this expenditure on economic growth. Moreover, they looked at the link between education and earnings in the UK. Continuing on the UK, A. Atkinson (1981) used an intergenerational elasticity coefficient to measure the correlation between parental income and offspring's income. Atkinson found evidence suggesting that individual's income levels during the mid-20th century were strongly correlated with those of their parents, indicating that intergenerational income mobility in Britain was limited. Zimmerman (1992) provided estimation for this same correlation but for the case of the United States using data from the National Longitudinal Survey. In this paper he also corrected the problem of measurement error that early studies presented due to contaminated measures of lifetime economic status, he finally found the intergenerational elasticity in income to be on the order of 0.4. Following in the empirical research, Checchi (1997) estimated transition probability matrixes to measure income mobility through different segments of the earnings distribution, mainly education attainment. He conducted his study for data sets regarding Germany, Italy and United States and he obtained as main result that educational attainment is responsible for almost half of observed immobility. Another important researcher of this topic has been Gary Solon, who proved jointly with Zimmerman the prior estimation problem. Moreover, Solon has contributed with methodological advancements that have enhanced the accuracy and reliability of mobility estimates. Much of Solon's research has focused on intergenerational income mobility in the United States. He has conducted extensive analyses using large-scale longitudinal datasets, such as the Panel Study of Income Dynamics (PSID) to examine mobility patterns and trends over time. It is clear that occupational category is a proxy of the socio-economic status due to it gathers variables such as wages, educational attainment and talent. In addition, occupational data across generations are probably more reliable reported by individuals than income

data. For these reasons, the study of occupational mobility adds economic interest to the study of earnings mobility. Therefore, some interesting empirical works related to this topic are Ermisch and Francesconi (2002) who used data from the British labour market to analyze the occupational mobility between parents and children through the movements along the index of occupational prestige proposed by Goldthorpe and Hope (1974). They found out that the intergenerational elasticity decreases as the parental social status increases. It is also important to mention John Ermisch in the framework of empirical studies for income mobility, in 2007 together with Nicoletti, C. used the two-sample two-stage least squares estimator to analyze intergenerational earnings mobility in Britain for cohorts of sons born between 1950 and 1972. Their main result was that intergenerational mobility decreased significantly among the more recent cohorts, those born during 1961 and 1972, than those prior. Other researchers that have used the TS2SLS to study the intergenerational mobility for other countries are Björklund and Jäntti (1997) for Sweden, Fortin and Lefebvre (1998) for Canada, Lefranc and Trannoy (2005) in France and Mocetti (2007) for Italy. Coming back to the empirical study for occupation mobility, the following authors have resolutely contributed to the investigation; Hellerstein and Morrill (2011), and Long and Ferrie (2013), both studies for the case of the United States.
Finally, in a more recent era we need to point out the research made by Raj Chetty, a professor of economics at Harvard University. He has published several papers analyzing Intergenerational Mobility and Inequality in the United States, for example; “Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States”. The two main outcomes form his research are; “the conditional expectation of children's income given parental income is linear in percentile ranges” (Chetty et al., 2014) and “intergenerational mobility varies substantially between areas within the US” (Chetty et al., 2014).

As for the case of Spain, the lack of suitable data has limited the study of intergenerational social mobility. Therefore, the first studies on intergenerational mobility were carried out in the field of sociology. Carabaña (1999), using data from the Socio-Demographic Survey, concludes that the degree of intergenerational occupational mobility in Spain is higher than in Germany and United Kingdom, lesser than the US and similar to France. In the same field, Sánchez-Hugalde (2004) used the Family Budget Survey for the years 1980 and 1990 to study the intergenerational transmission of income and mobility in education. In his work, he finds that across time income mobility increases and goes from an elasticity of 0.64 in 1980 to an elasticity of 0.44 in 1990. He also concluded that in the case of education, the interdependence between the attainment of parents and children is low. However, this work presents a problem of bias due to it only estimates the elasticity for parents and children who live together. Already in the economics domain, Cantó (2000) measured the level of permanent inequality (immobility) in Spain and concluded that income mobility increased in the period from 1985 to 1991 and decreased from 1991 to 1992. Sánchez (2004) analyzed the intergenerational mobility of education and income from the Encuesta de Presupuestos Familiares (EPF) for the years 1980 and 1990. In this study she obtained an income elasticity for Spain of 0.60 on 1980 and an elasticity of 0.44 on 1990, showing a clear increase of income mobility across time. She also stated that that educational intergenerational mobility in Spain is similar than other European countries. More

recently, Cervini-Plá (2014) estimated the elasticity of sons' and daughters' incomes as a measure of intergenerational income mobility, using the Living Condition Survey. She concluded that the mobility of sons and daughters in Spain is "similar to that of France, lower than that of the Nordic countries and Great Britain and greater than that of Italy and the United States". In this work the author also incises on what are the sources of earnings transmission and how do they affect the transmission of earnings across generations.

3 Methodology

The two measures used in this paper are transition matrices and elasticity. In this subsection the methodology of these two measures are explained.

3.1 Intergenerational income elasticity

As it has been explained on the introduction section, the main measure in order to explain intergenerational mobility is earnings elasticity. The equation used to study intergenerational mobility is the following one:

$$W_{it} = \alpha + \beta W_{it-1} + \mu_{it} \qquad (1)$$

where W_{it} is the offspring's log earnings, W_{it-1} is the father's log earnings (the one's of the previous generation), α is the intercept term representing the average of the child's log earnings when β is zero, and μ is the error term. The coefficient β is the intergenerational elasticity of offspring's earnings with respect to their father's earnings, and is our parameter of interest.

Children's earnings are positively related with the ones of their father, therefore, the coefficient β will vary between 0 and 1. A very high value, close to 1, will suppose a less mobile society meaning that the earnings of the previous generation are very related with the ones of the offspring's. On the contrary, a low value of β , close to zero, represents a very mobile society where the children's socioeconomic status is not forcefully influenced by the one their parents.

If in our sample we had information regarding permanent earnings in successive way, that is for the two generations, we would have no problem with directly estimating equation (1) using the ordinary least square estimator. However, we do not have this information in a single data set.

In this project we solve this selection problem by linking two samples and using the two-sample two-stage least square estimator (TS2SLS). The TS2SLS is a statistical method used in econometrics to estimate causal relationships between variables when dealing with endogeneity issues such as omitted variables, measurement errors or simultaneous causality. Therefore, since we do not have information about W_{it-1} in our sample but we do have a set on instrumental variables Z of the parent's earnings we can estimate

equation (1) in two different steps and using two samples. In fact, we consider the main sample which it has data on offspring's log earnings, W_{it} , and a set of characteristic of the parents of this children, Z, that will be used as instrumental variables. Secondly, we have the supplemental sample in which we hold information regarding the earnings of the previous generation, W_{it-1}, and the same set of characteristics that we hold on the main sample, Z.

In the first step of the process, we use the supplemental sample to estimate a log earnings of the parents using as explanatory factors their characteristics, Z, this equation is:

$$W_{t-1} = Z_{t-1}\delta + \nu_i \qquad (2)$$

Therefore, by estimating the previous equation we get the coefficient $\hat{\delta}$ and Z represents the variables observed in the main sample:

$$W_{it-1} = Z_{it-1}\hat{\delta} \qquad (3)$$

In the second step, we estimate the intergeneration mobility equation (1) using the main sample and replacing the father's log earnings by its predictor $Z_{it-1}\hat{\delta}$, thus we estimate equation (1) by using the father's imputed earnings, that is:

$$W_{it} = \alpha + \beta\left(Z_{it-1}\hat{\delta}\right) + \mu_i \qquad (4)$$

The coefficient $\hat{\beta}$ we obtain is the TS2SLS estimate of the intergenerational earnings elasticity.

The properties of the two-sample estimator depend on the variables used as instrumental ones. Thus, it is very important to choose instrumental variables that are strongly correlated with the variable to be estimated, in other words, we need to choose the instruments in order for the R^2 of the regression to be as high as possible. Moreover, it seems very obvious but it is considerable to remark that these variables that we choose and use as instrumental variables must appear on both samples. For example, the variable "Age of the father" might state as a variable strongly correlated to the earnings of the father, however, as this variable does not appear on the main sample cannot be used as an instrumental variable.

3.2 Transition matrices

Firstly, a transition matrix, also known as a stochastic matrix or probability matrix, is a square matrix that is used in the study of Markov chains. Markov chain is a stochastic model that represent sequences of random events where the probability of each event depends only on the state attained on the previous event. That is, the rows and columns of the matrix correspond to the states in the system. Transition matrices can be presented in frequency terms, showing in each element the number of observations in the sample that correspond to the state of the column and to the state of the row.

Moreover, can also be presented in percentage terms, either in row or in column form, showing in each element of the matrix the percentage of observations in each column that corresponds to one row. Or, on the contrary, the percentage of observations in each row that correspond to one column.

As it has been said, one property of transition matrices is its squareness. This means that the number of states presented on the columns of the matrix must be the same as the number of states presented on the rows. However, in our case, as we are dealing with levels of education for two different generations, the precision to catalogue this variable was not the same for the two generations. In order to correct this problem, the number of levels in which the education was classified needs to be the same for the parents and for the offsprings. The precise method for this reclassification is explained on the section below.

4 Data Sources and Sample Selection Rules

In the methodology section we explained that two different samples are needed in order to estimate intergenerational income mobility, a main sample and a supplemental one. In this section I will review the data source used, the selection sample and the variables used.

In our case, we used the Survey of Living Conditions (Encuesta de Condiciones de Vida (ECV)) (File P) for the year 2019 as a main sample, that is, the Spanish component of the European Union Statistics on Income and Living Conditions (EU-SILC). We use the one corresponding to this year due to is the more recent one which includes a section involving the intergenerational mobility of poverty, some other years including similar sections were 2011 or 2005. Since 2004, the ECV has annually interviewed a sample of 13,000 households and 35,000 individual people that are representative of the Spanish households. This survey is conducted by the Instituto Nacional de Estadística (INE) and it conducts personal interviews at a one-year interval with adult members of all the households selected. Therefore, from this survey we have information regarding the adult's earnings as well as a set of characteristics (age, gender, education attainment…) of these adults. From this sample we also have some basic information about the parents of these adults when they were between 12 and 14 years old.

As a supplemental sample we use the European Union Household Panel for the year 1994 (EUHP) (Panel de Hogares de la Unión Europea (PHOGUE)) (File adultos). This survey belongs to the to the ever more complete set of harmonized statistical operations for European Union countries. Carried out during the period 1994-2001, the main goal of the EUHP was to make available to the European Commission a statistical observation instrument for the study and follow up of quality of life, labour market conditions and social cohesion. Thus, from this survey we extract information about parent's earnings and the same set of characteristics that are available in the main sample. The characteristics that we chose as instrumental variables are educational attainment, labour situation and the category of occupation (following the ISCO-08 code).

Although, as we have mentioned, the characteristics of the fathers used as instrumental variables are found in both samples, we need the classification of these variables to be homogeneous across surveys. Thus, for the variable “level of studies of the father” the reclassification of its levels has been the following one:

Table 1: reclassification for the sample **ECV 2019** (variable PT110) (in this case, no need of reclassification)**.**

Low level
Intermedium level
High level

Table 2: reclassification for the sample **PHOGUE 1994** (variable PT022)**.**

Illiterate and with no studies	Low level
Primary studies	
Fist level of secondary studies	
Occupational training of first degree	Intermedium level
Occupational training of second degree	
Second level secondary studies	
Short-term University studies (higher education)	High level
Long-term University studies (Doctorate and Master's studies)	

For the variable “labour or employment situation”, the reclassification has been the following one:

Table 3: reclassification for the sample **ECV 2019** (variable PT130)**.**

Full-time salaried	Salaried
Part-time salaried	
Self-employed (including family help)	Self-employed
Unemployed	Unemployed
Retired or early retired	Retiree
Permanently unable to work	Housework
Dedicated to housework, caring of children or of other people	
Other class of economic inactivity (student)	Another inactive economical class

Table 4: reclassification for the sample **PHOGUE 1994** (variable PE001A)**.**

Salaried	Salaried
Remunerated apprentice	
Worker in training	
Self-employed	Self-employed
Family help	
Unemployed	Unemployed
Retired	Retiree

Dedicated to housework, caring of children or of other people	Housework
Performing military service or substitute social benefit	
Other class of economic inactivity	Another inactive economical class
Student or scholar	

Finally, as both samples follow the ISCO classification, no need of recodification of the variables of "occupation of the father and of the children" has been needed, in the two cases the levels of the variables are the next one:

Table 5: reclassification for the samples **ECV 2019 and PHOGUE 1994** (variables PT150 and PE006C, respectively)**.**

1	Legislators, senior officials and managers
2	Professionals
3	Technicians and associate professionals
4	Clerks
5	Services and sales workers
6	Skilled Agricultural/Forestry/Fishery workers
7	Craft and related trade workers
8	Plant and machine operators, and Assemblers
9	Elementary occupations
0	Armed forces occupations

Our supplemental sample will be composed by fathers between 35 and 55 years old at 1994, that are on a working basis (full time or partial time) and that, as a consequence, they present positive earnings. Therefore, as a set of conditions is required in order for these fathers to take part of our definitive supplemental sample, there are some levels of the previous three variables that do not take part of our model (ex. retirees or unemployed people). Furthermore, two main reasons explain why women are not taken as part of the supplemental sample. The first is that in 1994 women on society were not as integrated on the labour market as men and therefore, full-time women workers were probably more common in only some types of households (highly educated households or very poor households). The second is due to reasons of simplicity of the study.

Therefore, our main sample is composed by individuals, either the head of the household or their partner, that were born between 1969 and 1989, self-employed or in paid employment, who report positive earnings and in are in a full-time or partial-time basis. Thus, in 2019, these adults were between 30 and 50 years old and were 12 or 14 years old between 1983 and 2003. This is the reason why we use the European Union Household Panel for the year 1994 as the supplemental sample to estimate father's earnings.

We suppose that when children were between 12 and 14 years old, their fathers were between 35 and 55 years old. Thus, when we estimate the fathers' earnings regression, we select males between those ages. After the exclusions, we have a total of 7,406 pairs,

and in this sample, we have employed fathers and children that reported positive earnings.

The earnings variable we use for the case of the fathers and for the case of the children are net income from working activities during the previous year. For the case of the fathers, we have needed to convert the pesetas into euros and then to apply inflation to treat both earnings with the same basis.

Tables 6 and 7 present the main descriptive statistics of our main final sample of sons and daughters, separately for those who are between 30 and 40 years old and for those who are between 40 and 50.

Table 6: Descriptive statistics: sons in the main sample after exclusions.

	Sons 30-40	**Sons 40-50**
Observations	1,598	2,396
Annual earnings	16,092.07	19,854.81
Log of annual earnings	9.68	9.89
Education		
Low level	36.92%	35.77%
Intermedium level	25.28%	24.75%
High level	37.80%	39.48%
Occupation		
Legislators, senior officials and managers	3.09%	3.97%
Professionals	13.95%	13.51%
Technicians and associate professionals	13.26%	13.97%
Clerks	5.87%	6.40%
Services and sales workers	15.03%	13.22%
Skilled Agricultural/Forestry/Fishery workers	1.52%	2.38%
Craft and related trade workers	19.13%	20%
Plant and machine operators, and Assemblers	14.52%	14.90%
Elementary occupations	13.64%	11.63%

Table 7: Descriptive statistics: daughters in the main sample after exclusions.

	Daughters 30-40	**Daughters 40-50**
Observations	1,522	2,236
Annual earnings	13,020.42	15,540.76
Log of annual earnings	9.47	9.65
Education		
Low level	21.16%	24.51%
Intermedium level	21.29%	22.18%
High level	57.56%	53.31%
Occupation		
Legislators, senior officials and managers	1.73%	3.01%
Professionals	25.45%	20.69%
Technicians and associate professionals	13.42%	12.19%
Clerks	17.28%	22.85%
Services and sales workers	23.72%	20.33%
Skilled Agricultural/Forestry/Fishery workers	0.80%	0.58%
Craft and related trade workers	2.39%	2.56%
Plant and machine operators, and Assemblers	2.19%	3.10%
Elementary occupations	13.02%	14.66%

5 Results

The results section is divided into two parts. First, I will show the values obtained for the empirical results for intergenerational mobility estimation correcting for the sample selection problems and compare them with the values obtained by Cervini-Plá for the year 2005. On the other hand, I will present the results using transition matrices and also contrast them with the ones for the year 2005.

5.1 Intergenerational earnings elasticity

As it has previously been explained on the methodology section, we use a two-sample two-stage estimation, whose first step consists in the estimation of the fathers' earnings using the supplemental sample. These coefficients are then used to assign the fathers' earnings in the main sample, since we have the same characteristics in both samples (main and supplemental). Therefore, in the second step, using the coefficients of the supplemental sample and the characteristics of the main sample we estimate the earnings for each father in the main sample.

Table 8 reports the second step, the coefficients of the intergenerational regression between annuals children's earnings differentiated by gender (for sons and daughters) and by age intervals (for those who are between 30 and 40 years old and those who are between 40 and 50 in 2019), and the fathers' imputed earnings. Moreover, the table also shows the standard deviation below every coefficient, the number of observations for each cohort and the R-squared.

Table 8: Intergenerational income elasticity results distinguishing by gender and by age intervals.

	Sons 30-40	**Sons 40-50**	**Daughters 30-40**	**Daughters 40-50**
Father's earnings	0.266 (0.082)	0.559 (0.062)	0.553 (0.081)	0.614 (0.068)
Obs.	1,598	2,396	1,522	2,236
R^2	0.006	0.031	0.029	0.033

The elasticity for sons and daughters who were aged between 30 and 40 years old in 2019 was 0.26 and 0.55, respectively. We observe that the difference in elasticities between genders, in this case, is statically significant being more than double for daughters than for sons. This difference means that for the daughters who were aged between 30 and 40 years old in 2019, the level of income of their fathers (when those were between 35 and 55 years old), explained more than the double of their current income of what it explained for the sons of their same age.

If we compare these values with ones obtained by Cervini-Plá for 2005 presented in Table A.1, we see that for the case of sons this value has decreased from 0.380 to 0.266 meaning a less persistence of fathers' income. On the contrary, for the case of daughters the value has increased from 0.369 to 0.553 implying that there was less earnings

mobility in the year 2019 than in 2005 for daughters who were aged between 30 and 40 years old at those years.

If we move to the cohorts of sons and daughters who were aged between 40 and 50 years old in 2019, we obtain elasticity values of 0.559 and 0.614, respectively. In this situation we notice that the difference between genders is meaningless, but continuing being higher the elasticity for daughters. We balance these values with the ones of 2005 and we observe that in the two cases the values have increased going from 0.427 to 0.559 for sons and rising from 0.498 to 0.614 for daughters. These variations imply that in Spain the income mobility has decreased from 2005 to 2019 meaning a more persistence of fathers' income either for sons and daughters who were aged between 40 and 50 years old in 2019.

Table 9 reports the same values as table 8 does but showing it in different cohorts. In this case elasticities are presented in total terms for the case of sons and daughters (including all ages) and by age intervals of between 30 and 40 years old and 40 and 50 years old (in both cases, including sons and daughters). In this perspective we observe that the elasticity of daughters is much higher than the one of sons, 0.587 and 0.396 respectively. We also notice that the elasticity for the age interval between 30 and 40 years old is shorter than the one between 40 and 50 years old.

Table 9: Intergenerational income elasticity results in total terms distinguishing by gender and by age intervals.

	Sons	**Daughters**	**30-40**	**40-50**
Father's earnings	0.396 (0.051)	0.587 (0.054)	0.405 (0.058)	0.570 (0.047)
Obs.	3,830	3,576	3,120	4,632
R^2	0.015	0.031	0.015	0.030

5.2 Transition matrices

As it has been explained on the methodology section, another way to characterize intergenerational mobility is using mobility matrices. The idea is to characterize the conditional probabilities of transition between ordered groups. Table 10 gives the fraction of children, sons and daughters included, in each earnings quantile given the earnings quantile of their fathers. In other words, each cell in Table 10 can be interpreted as the probability of the children being in quantile i^{th}, conditional on his or her father being in quantile j^{th}.

Table 10: transition matrix of earnings between fathers and children.

		Quantil of child				
		1	**2**	**3**	**4**	**5**
Quantil of father	**1**	25.30%	21.92%	20.23%	17.93%	14.61%
	2	20.25%	22.23%	21.38%	19.77%	16.37%
	3	21.15%	20.99%	21.37%	20.38%	16.11%
	4	17.40%	15.90%	20.49%	21.34%	24.87%
	5	14.04%	16.13%	15.98%	21.53%	32.33%

As intuitively our mind would think, the matrix shows a strong persistence on the two bottom and upper extremes in which the quantile of earnings of the father coincides with the one of the children. That is, about 25% of children remain in the bottom quantile of the earnings distribution if their father remains to that quantile. Not only this, but we also observe high quantile values on those cells that are near this bottom extreme, for example around 22% of children whose fathers belong to the lowest quantile remain in the second lowest quantile. On the opposite extreme, about 32.33% of children of the richest fathers remain in that same quantile. In this case we also observe a high persistence on the values of the cells around this extreme point as, for example, almost a 25% of children who their father belong to the second richest quantile are capable to move up until the richest quantile.

Moreover, it is also remarkable to mention the high diagonal values that the matrix presents, not getting lower than 21% for any case, indicating an elevated persistence of earnings throughout the distribution.

Table A.2 shows the values that Cervini-Plá obtained in 2005 for this same matrix that we have constructed and therefore, it is meaningful to compare them and see how has evolved. We easily see that in 2005 the matrix presented, in general, a very similar values that ours presents with high persistence on the bottom and upper extremes and at those cells around those two points. However, it is significant to mention that the 2019's matrix presents slightly more social mobile values. For instance, for the children whose father belonged to the poorest quantile in 2005, a 30.08% remained at that same quantile and a 24.40% located at the second lowest one. If we compare these two values with the ones obtained for 2019, we see that have lowered into a 25.30% and a 21.92%, respectively, showing a slightly increase in income distribution.

Tables 11 and 12 display the transition matrices of earnings between fathers and, respectively, sons and daughters who were between 30 and 40 years old in 2019. In the same way, tables 13 and 14 show the same matrices but for those sons and daughters who were between 40 and 50 years old in 2019. Presenting the results in these cohorts makes it simple for us to note the similarities and differences between gender and ages intervals.

Table 11: transition matrix of earnings between fathers and sons aged between 30 and 40 years old.

		Quantil of son (30-40)				
		1	**2**	**3**	**4**	**5**
Quantil of father	**1**	20.63%	22.06%	21.20%	23.21%	12.89%
	2	19.30%	20.93%	23.49%	23.49%	12.79%
	3	20.75%	15.85%	26.04%	23.02%	14.34%
	4	17.01%	16.18%	26.97%	21.99%	17.84%
	5	15.65%	15.02%	18.53%	23.32%	27.48%

Table 12: transition matrix of earnings between fathers and daughters aged between 30 and 40 years old.

		Quantil of daughter (30-40)				
		1	**2**	**3**	**4**	**5**
Quantil of father	**1**	33.85%	25.78%	19.88%	11.49%	9.01%
	2	29.09%	30%	17.27%	14.32%	9.32%
	3	30.93%	28.81%	15.68%	16.95%	7.63%
	4	25.82%	26.29%	18.78%	15.96%	13.15%
	5	18.65%	22.83%	19.61%	23.78%	15.11%

In table 12 we note a strong persistence of earnings on the poorest quantiles of the distribution in comparison to the ones on table 11. That is, almost 34% of daughters whose father belongs to the poorest quantile remain on the same one, as for sons this value states "only" for about 21%. This trend is confirmed as we focus on other quantiles, for example, the 11.49% of daughters whose father belongs to the lowest quantile are capable to reallocate to the second richest one (4^{th} quantile). This situation for sons is completely different as the value increases up to the 23.21%, more than double of daughters. When we center the attention to the richest quantiles of the matrices, we observe that the situation changes completely. About the 15% of daughters whose father is on the richest quantile are able to continue on the same quantile. In the case of sons this value rises up to the 27.48%, meaning that on the richest quantiles the earnings mobility between generations is higher for daughters than for sons that are between 30 and 40 years old. However, as we have seen, in the poorest quantiles the mobility is bigger for sons than for daughters.

Table 13: transition matrix of earnings between fathers and sons aged between 40 and 50 years old.

		Quantil of son (40-50)				
		1	**2**	**3**	**4**	**5**
Quantil of father	**1**	18.52%	18.52%	20.99%	20.99%	20.99%
	2	13.45%	13.73%	24.55%	23.72%	24.55%
	3	11.03%	15.17%	22.76%	26.21%	24.83%
	4	8.99%	8.27%	16.91%	26.62%	39.21%
	5	9.11%	8.61%	13.92%	19.75%	48.61%

Table 14: transition matrix of earnings between fathers and daughters aged between 40 and 50 years old.

		Quantil of daughter (40-50)				
		1	**2**	**3**	**4**	**5**
Quantil of father	**1**	29.72%	23.43%	19.09%	16.14%	11.61%
	2	22.20%	27%	19.01%	16.45%	15.34%
	3	25.47%	26.65%	19.81%	15.33%	12.74%
	4	19.12%	17.13%	17.93%	21.12%	24.70%
	5	13.11%	18.50%	13.35%	20.84%	34.19%

In tables 13 and 14 we note certain tendencies very similar that the ones we have seen in tables 11 and 12. That is, more mobility of earnings between generations in poorest quantiles for sons than for daughters and in the richest ones, a higher mobility for

daughters than for sons. Indeed, some tendencies are even deeper for the individuals who were aged between 40 and 50 years old in 2019 than for the previous age interval. In particular, about 48.61% of sons whose father belongs to the highest quantile remain in the same one. We observe that in comparison to the first age interval cohort, this number has increased by more than 20 points as it “only” states for about 27.48% for those sons who were aged between 30 and 40 years old in 2019. However, we must state that as the mobility in the richest quantiles for daughters continues being higher than for sons in the age interval 40-50, in comparison to the age interval 30-40 the mobility for daughters is lower. That is, about 34% of daughters who were aged between 40 and 50 years old in 2019 and their father belongs to the highest quantile remain in the same one. On the other hand, for those who were aged between 30 and 40 years old, only the 15.11% were capable to maintain the quantile of their father.

6 Education as a source of earnings transmission

When discussing about socioeconomic status mobility on a society, it is important to discuss what are the sources of earnings transmission, that is, through what channels are earnings transmitted? As Nicoletti and Ermisch (2007) stated, one of the main institutions that affect intergenerational mobility is the education system. Indeed, public policies affect this aspect and therefore intergenerational mobility.

The main purpose of this section of the project is to present empirical evidence about the intergenerational educational mobility in Spain.

Intergenerational educational mobility refers to the movement or changes in educational attainment or accomplishment within different generations in an economy, country, region or family. In other words, it measures the extent to which individuals' level of education differs from that of their parents or previous generations. So, as education affects directly the social or income mobility in an economy across generations, a high degree of education mobility will mean that the level of schooling of children is less determined by their progenitors and, therefore, that society owns a greater equality of opportunity. On the contrary, if on that economy a low degree of education mobility persists, the level of education of children will be directly determined by the one of their parents leading to a society with lower equality of opportunities.

Intergenerational mobility is usually measured in terms of intergenerational elasticity or linear correlation between parent’s and offspring’s attainment of education. The higher this correlation, the less social mobility the society offers. Another way of studying intergenerational educational mobility is by using transition matrices between fathers and children.

6.1 Methodology

The methodology used in this subsection of the project is the same one used in the study of the income mobility. Thus, intergenerational elasticity and transition matrices are the

tools employed. In the case of transition matrices, the features of the method do not vary with the income study. However, in the case of the intergenerational elasticity, the methodology is different as in the case of income and thus, the explanation can be found in the following section.

6.1.1 Intergenerational educational elasticity

As explained above, one of the standard measures of intergenerational mobility is educational elasticity. More precisely, we consider the following intergenerational mobility formula:

$$E_{it} = \alpha + \beta E_{it-1} + u_{it} \qquad (5)$$

where E_{it} is the offspring's educational level, E_{it-1} is the father's educational level (the previous generations), α is the intercept term representing the level of education that the offspring's get if their parents have no studies and u_{it} represents the random error of the equation. The coefficient β is the intergenerational elasticity of offspring's education with respect to their father's education, and is our parameter of interest.

Children's educational level are positively related to their father's level, therefore, the coefficient β varies between 0 and 1. A high value of β implies a high persistence of the educational status of the previous generation into the offsprings, implying a less mobile society. On the contrary, a low value of β, close to zero, represents a very mobile society where the children's educational attainment is not strongly influenced by the position of the parents.

As in our sample we have information regarding the education attainment for successive generations, we have no problem with directly estimating equation (5) using the ordinary least square estimator.

6.2 Data sources and sample selection rules

In order to study what is of our interest for the country of Spain, we use the sample Survey of Living Conditions (Encuesta de Condiciones de Vida (ECV)) for the year 2019, that is, the Spanish component of the European Union Statistics on Income and Living Conditions (EU-SILC). We use this sample for the year 2019 due to it is the more recent year in which the Survey includes a section involving the intergenerational mobility of poverty, some other years including similar sections were 2011 or 2005.

Since 2004, the ECV has annually interviewed a sample of 13,000 households and 35,000 individual people that are representative of the Spanish households. This survey is conducted by the Instituto Nacional de Estadística (INE) and it conducts personal interviews at a one-year interval with adult members of all the households selected. Therefore, from this survey we have information about the adult's attainment on education as well as some basic characteristics (age, gender, net income…) of these adults. Moreover, we also have information about the educational attainment of the progenitors, separately for the father and for the mother, of these adults.

In order for our study to be more consistent, we need to recode some variables. That is, we keep only the individuals whose age is between 30 and 50 years, both included. Moreover, we hold only those observations that present positive earnings and that are self-employed or in paid employment in a full-time way. Therefore, we are left with a set of individuals, either male or female, that were born between 1969 and 1989. After doing this recodification, we achieve a data set of 6,506 observations that present a set of homogeneous characteristics. As it is logical, each one of these individuals presents also information regarding their parent's educational attainment.

In order to be able to treat together the variables "education of the survey respondent" (education children) (variable PE040) and "education of the father and of mother" (variables PT110 and PT120, respectively), we need these variables to catalogue the level of education in the same way. From the sample data that we are using (ECV from 2019), the variable "education children" is catalogued in 10 different levels and, on the contrary, the variables "educations of the father and of the mother" are catalogued in only 3 levels. Therefore, the following reclassification has been needed in order for the variable "education of the children" to classify education in only three levels.

Table 15: reclassification for the sample **ECV 2019.**

Previous classification		**Posterior classification**	
Less than primary education	78	Low level	1,854
Primary education	270		
First stage of secondary education	1,506		
Second stage of secondary education	1,220	Medium level	1,531
Second stage of secondary education. For people from 16 to 34 years old.	153		
Second stage of secondary education. Professional orientation: without direct access to superior education	2		
Second stage of secondary education. Professional orientation: with direct access to superior education	145		
Non-superior post-secondary education.	7		
Non-superior post-secondary education. For people from 16 to 34 years old	4		
Superior education	3,121	High level	3,121
Total	6,506	**Total**	6,506

After recoding the levels of this variable, the frequency table of this variable distinguished by gender is the following one:

Table 16: frequency table of education (by gender).

	Gender		**Total**
Children's education	**Male**	**Female**	
Low level	1,300	554	1,854
Medium level	961	570	1,531
High level	1,473	1,648	3,121

Total	3,734	2,772	6,506

So, by doing this we achieve that the variable "education of the children" ranks the attainment on education in the same way as the Spanish survey does it for the progenitors. Thus, we can already use transition matrix, that require to be squared, as a tool to evaluate intergenerational educational mobility.

6.3 Results

In this subsection I introduce the results obtained in the study of intergenerational mobility in the frame of education. The subsection is divided into the two different methodology approaches used for the study; first transition matrices and then in terms of elasticity.

6.3.1 Transition matrices

As explained on the methodology section, a useful tool to study intergenerational mobility, and then educational one, are transition matrices. In the following tables each cell shows two different pieces of information, the bottom one can be interpreted as the probability of a son or daughter being at the quantile i^{th} conditional on his or her father being at the quartile j^{th}. The upper one shows the same information but in frequency terms out of the total sample.

Table 17 shows the transition matrix of education attainment between all children, either son or daughter and for all ages included, and of their father. As it is shown, the number of observations employed for this matrix (5,948) is lower than the total observations taken in the sample (6,506). This takes place due to some individuals do not report any information regarding their father's education and only present it for their mothers. Therefore, those individuals are part of the sample of the study but are not taken into account on the construction of this particular matrix.

Table 17: transition matrix of education between fathers and children.

	Children's education			**Total**
Father's education	**Low level**	**Medium level**	**High level**	
Low level	1,550 35.20%	1,071 24.35%	1,781 40.45%	4,403 100%
Medium level	64 8.57%	187 25.03%	496 66.40%	747 100%
High level	45 5.64%	112 14.04%	641 80.33%	798 100%
Total	1,659 27.89%	1,371 23.05%	2,918 49.06%	5,948 100%

Firstly, we notice that on average the education level of the generation of the father is lower than the one of their offspring's. We can state this due to from the 5,948 pairs of observations, for 4,403 individuals the educational attainment of their father was low,

this supposes a 74%. On the contrary, only 1,659 of these individuals present a low level of education, this simply supposes a 27.89%. Actually, this more educated children's generation explains the high social mobility that we found for those children whose father have a low or medium education level. That is, a 40.45% of children whose father displays a low level are able to make a move up until the highest standing. In the same way, a 66.40% of those whose father had a medium level finish up in the highest standing as well. The situation is the opposite if we focus on the extreme of the maximum education attainment. At this point we see that the mobility is minimal as the 80.33% of children whose father accounts for a high level of education end up on the same level.

Table A.3 presents the transition matrix of education between fathers and children that Cervini-Plá obtained for the year 2005. That table ranks in four the different levels of education attainment of the two generations instead of three levels that we rank. Nevertheless this dissimilarity, we see that some currents are the same for both years as, for example, the high persistence across generations for those children whose father stay on the highest quantile; a 73.90% in 2005. Furthermore, for 2005 and 2019 the mobility is higher for those children whose father stays on the lowest quantile and it even has improved across time as, in 2019, 40.45% are capable to move up to the highest one, for only 23.42% to do it in 2005. For the case of the medium quantiles, we see that even in 2005 the mobility was pretty elevated it has increased more as it moved from a 35.75% and 52.13% in 2005 to a 66.40% in 2019 of children are able to relocate themselves up to the highest quantile. To sum up, the matrices of the two years show us that the educational mobility has slightly improved over time. However, the dissimilarity of the number of levels used to rank education for the two years prevent us from knowing exactly what has been this variation.

Tables 18 and 19 display the transition matrices of education between fathers and sons and daughters, respectively, who were aged between 30 and 40 years old in 2019. In the same way, tables 20 and 21 show the same matrices but for those sons and daughters who were between 40 and 50 years old in 2019. Decomposing the transition matrix of table 17 in the following four matrices makes it easier in the process of comparing situations between genders and age intervals.

Table 18: transition matrix of education between fathers and sons aged between 30 and 40 years old.

Son's education (30-40)	**Father's education**			**Total**
	Low level	**Medium level**	**High level**	
Low level	431 43.71%	257 26.06%	298 30.22%	986 100%
Medium level	31 15.66%	66 33.33%	101 51.01%	198 100%
High level	22 10.95%	34 16.92%	145 72.14%	201 100%
Total	484 34.95%	357 25.78%	544 39.28%	1,385 100%

Table 19: transition matrix of education between fathers and daughters aged between 30 and 40 years old.

Daughter's education (30-40)	Father's education			Total
	Low level	Medium level	High level	
Low level	172 23.43%	172 23.43%	390 53.13%	734 100%
Medium level	11 6.32%	27 15.52%	136 78.16%	174 100%
High level	3 1.92%	14 8.97%	139 89.10%	156 100%
Total	186 17.48%	213 20.02%	655 62.50%	1,064 100%

In table 18 we note a strong persistence on lowest extreme of the main diagonal, about 44% of sons whose father attains a low level of education attain the same one. However, the situation is completely different for daughters, only the 23.43% of those daughters whose father has the lowest level remain in that same level of education. For this reason, we can state that for the case of education for those children who were aged between 30 and 40 years old in 2019, the mobility across generations in the lowest level was higher for daughters than for sons. If we focus on the highest quantile of the matrices, we observe that this status is not the same. Certainly, almost the 90% of daughters whose father is on the upper quantile stay on the same level of education attainment, but for the case of sons this value is "only" about 70%. That is, on the highest quantiles of the education matrices between fathers and, daughters and sons, the mobility across generations is greater for sons than for daughters.

Table 20: transition matrix of education between fathers and sons aged between 40 and 50 years old.

Son's education (40-50)	Father's education			Total
	Low level	Medium level	High level	
Low level	698 40.84%	427 24.99%	584 34.17%	1,709 100%
Medium level	14 6.42%	72 33.03%	132 60.55%	218 100%
High level	15 6.12%	45 18.37%	185 75.51%	245 100%
Total	727 33.47%	544 25.05%	901 41.48%	2,172 100%

Table 21: transition matrix of education between fathers and daughters aged between 40 and 50 years old.

Daughter's education (40-50)	Father's education			Total
	Low level	Medium level	High level	
Low level	315 26.27%	270 22.52%	614 51.21%	336 100%
Medium level	13 7.07%	26 14.13%	145 78.80%	322 100%

High level	8 3.43%	36 11.16%	199 85.41%	958 100%
Total	1,199 20.79%	184 19.93%	233 59.28%	1,616 100%

In tables 20 and 21 we note some characteristics of the matrices similar to the ones of tables 18 and 19. Indeed, we also notice an inferior mobility for sons on the lowest quantile of the educational matrices than for daughters due to the 40.84% of sons persist on the lowest quantile alike as their fathers, and it is the 26.27% of daughters. Nevertheless, we need to mention that this divergence on the educational mobility between genders is not as persistent as for the previous age interval. Furthermore, for children who were between 40 and 50 years old in 2019, the educational mobility in the highest quantile was superior for daughters than for sons. We note this due to about 85.41% of daughters were capable to maintain the same educational attainment than their fathers, on the case of sons the 75.51% were capable to do it. This is the same situation as we have observed on the age interval cohort between 30 and 40 years old. Despite this, as we have seen for the lowest quantile of the matrices, this difference in educational mobility between genders is not as intense as for the first age interval studied.

6.3.2 Intergenerational educational elasticity

In this subsection of the project, the empirical results for intergenerational mobility estimation for the education attainment are presented.

The following table shows the coefficients of the intergenerational regression between children's attainment on education (sons and daughters) and the father's one, separated for those children who are between 30 and 40 years old and those who are between 40 and 50 years old. As well, the standard error is displayed below every coefficient and the number of observations and the R-squared are also shown for every case.

Table 22: Intergenerational educational elasticity results distinguishing by gender and by age intervals (father's report).

	Sons 30-40	**Sons 40-50**	**Daughters 30-40**	**Daughters 40-50**
Father's education	0.390 (0.029)	0.414 (0.036)	0.309 (0.030)	0.308 (0.026)
Obs.	1,385	2,172	1,064	1,616
R^2	0.1105	0.1031	0.0868	0.0772

We easily notice that the coefficients that explain the education persistence between generations for sons are higher than those for daughters, in both age intervals. Another way of seeing the difference between the two gender is by observing the R-squared, that are also larger for sons. That is, the educational level of fathers definitely explains a larger part of the educational attainment of his sons than of his daughters.

The next table presents the results for the case of the mother's educational level in the same format as the one of the fathers.

Table 23: Intergenerational educational elasticity results distinguishing by gender and by age intervals (mother's report).

	Sons 30-40	**Sons 40-50**	**Daughters 30-40**	**Daughters 40-50**
Mother's education	0.414 (0.031)	0.408 (0.033)	0.300 (0.031)	0.320 (0.032)
Obs.	1,486	2,274	1,131	1,689
R^2	0.1072	0.0611	0.0742	0.0546

When we analyze these results, we find features that converge with the ones of the father's education. That is, when we estimate the coefficients, we also identify that for sons are larger than for daughters. In fact, for the four different sample groups, the coefficients take very similar values of ones of the case of the father's education (i.e. the differences are not statistically significant). Therefore, we can state that the educational attainment of mother's explains the same part of the educational level for the four sample groups specified in the same way as the one of the father's does.

In tables 24 and 25 the same coefficients of elasticity are reported but, in these cases, are shown in total terms differentiating between genders and also for the total sample. Moreover, in table 25 instead of picking up fathers as the previous generation we choose mothers, in this way we can evaluate the existence of any dissimilarity between genders from the perspective of the previous generation.

Certainly, the values we get from the two matrices are almost identical and without any statistical difference. Therefore, from those we can state that the correlation on the educational attainment with their parents, either mother or father, is higher for sons than for daughters. This stronger correlation of sons might be due to several social, economic or cultural factors. For example, the difference in expectations parents might have to males and females, being sons more encouraged or expected to follow their fathers educational and careers paths more closely, while daughters might face different career expectations.

Table 24: Intergenerational educational elasticity results in total terms distinguishing by gender (father's report).

	Total sample	**Sons**	**Daughters**
Father's education	0.374 (0.014)	0.407 (0.020)	0.312 (0.020)
Obs.	5,948	3,405	2,543
R^2	0.0979	0.1077	0.0834

Table 25: Intergenerational educational elasticity results in total terms distinguishing by gender (mother's report).

	Total sample	**Sons**	**Daughters**
Mother's education	0.373 (0.016)	0.404 (0.023)	0.310 (0.023)
Obs.	6,270	3,595	2,675
R^2	0.0728	0.0776	0.0625

6.4 Conclusions for intergenerational educational mobility

Different statements can be concluded from the results obtained on the study of the intergenerational educational mobility.

Firstly, from transition matrices we can say that children's generation is highly more educated than the one of parents. For this reason, we observe a high educational mobility on the lower quantiles of the matrix that presents the education level between fathers and children, and a low mobility on the higher quantile of the matrix. Moreover, in comparison to the year 2005, the trends that the matrix stated presents are generally similar to the one presented by Cervini-Plá. However, in 2019 we observe a higher persistence on the highest quantile and more mobility on the bottom quantile, these slightly differences might be given due to in 2005 individuals were not as educated as in 2019 might be.

In addition, focusing on the matrices that present results differentiating between genders and age intervals some conclusions can be obtained. As a matter of fact, for the interval of individuals who were aged between 30 and 40 years old in 2019, a higher mobility of education is presented for daughters than for sons, on the lowest quantile of the matrices. However, on the highest quantile of the matrices, the mobility is higher for sons than for daughters. Therefore, women aim at ending up on higher levels of education independently on what is the level of her father, in comparison to men. This circumstance might be due to with lower levels of education, the labour opportunities that women might come up are lower-paid in comparison to those opportunities that men, with same level, might get.

For those children who were aged between 40 and 50 years old in 2019 the situation in the lowest and highest quantiles of the matrices are the same as the ones presented for the first age interval. Nevertheless, the differences on mobilities between genders on both extremes of the matrices are not as intense as in the age interval 30-40. That is, for those younger individuals (aged between 30 and 40 years in 2019) the differences in mobilities on the two extremes are higher than for the older individuals (aged between 40 and 50 years in 2019). So that, the tendency is women aspiring every time more to the highest levels of education, whatever the level of their fathers is, while men do not need to follow this path as their mobility across time does not significantly vary.

Secondly, from the coefficients estimated showing the intergenerational elasticity several conclusions can be expounded. In the two age intervals studied we observe a higher elasticity for sons than for daughters with their fathers. This higher coefficient of sons explains us that a higher persistence of the educational status of the previous generation into the sons than into daughters. This outcome might confirm the conclusions obtained from the transition matrices; that is, as the educational level of the parents' generation is in general lower, daughters aim at getting a higher education than the one their parents got and that is why the correlation for daughters is lower than of sons. Therefore, the educational intergenerational mobility in the transition matrices for the lower quantiles is higher for daughters than for sons. Moreover, when these coefficients are computed taking mother's education as the previous generation, we get

a very similar results for both genders and both age intervals. Thus, the correlation of children's education, for the four cohorts studied, is equally linked to the one of their fathers than to the one of their mothers.

7 Final remarks

Earlier, I presented an estimation of the indexes of elasticity for the earnings intergenerational mobility for the two gender and two different age intervals. For the same cohorts I displayed transition matrices characterizing the conditional probabilities of transition between generations by quantile regressions. Furthermore, researchers have stated a strong influence of education into intergenerational mobility and therefore, the results exhibiting mobility for schooling are also presented.

In the earnings frame, we find an elasticity of 0.266 for sons between 30 and 40 years of age, an elasticity of 0.559 for sons between 40 and 50 years of age. In the case of daughters, we obtain elasticities of 0.553 and 0.614, respectively. If we compare these results with the ones for the year 2005, we see that in general elasticities have increased, meaning that in 2019 the persistence of wages across generations was higher than in 2005. This enlargement might be due to in the 2005 study, earnings of individuals from 1980, born between 1923 and 1943, are taken as supplemental sample and therefore, the generally low academic training of those individuals explained the shorter earnings they presented in comparison with those earned by his children, born between 1955 and 1975, that commonly attained higher levels of education. Another possible explanation of the persistence of the levels of earnings across generations in the study for 2019 might be the big economic crisis that Spain, as many other countries, suffered in 2007 and lasted until 2014 with important consequences. Therefore, linked to this stagnancy of the economy the earnings of individuals were not able to growth neither. On the other hand, during the period 1980 and 2005 no big economic crisis occurred and therefore, the economy of the country managed to maintain a constant increase that was turn into serious differences on earnings of individuals between years.

Moreover, from transition matrices we remark a strong persistence on both upper and lower extremes and high values on the main diagonal. In comparison to 2005, it is observed that the matrix for the year 2019 shows a slightly increase in income distribution across quantiles however, the differences on values are very small. In addition, as commented on the results section, big differences between genders on both extremes of the main diagonal are noticed, as well when we compare between age intervals.

Finally, when looking for the relationship between the income and education mobility across generations some statements can be made; that is, big contradictions on mobilities on those two frames between genders appear. Certainly, in education mobility, on the lowest quantiles of the transition matrices there is higher mobility for daughters than for sons, and in the higher quantiles the mobility is superior for sons than for daughters. However, in the earnings study, on the lowest quantiles of the matrices there is a higher mobility for sons than for daughters and on the highest quantiles the

mobility is higher for daughters than for sons. These findings state that as daughters aim at getting a higher level of education than sons, in comparison to the ones of their fathers. Daughters may end up getting lower earnings more easily than sons, in comparison of their father's level of earnings.

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Appendix

Table A.1: *intergenerational elasticity correcting for the sample selection problems for 2005.*

	Sons 30-40	**Sons 40-50**	**Daughters 30-40**	**Daughters 40-50**
Father's earnings	0.380 (0.042)	0.427 (0.041)	0.369 (0.074)	0.498 (0.062)

Obs.	1334	1322	875	821
R^2	0.061	0.08	0.072	0.10

Note. From "Exploring the Sources of Earnings Transmission in Spain", by Cervini-Plá M. (2013). *Hacienda Pública Española, 204(1), p.54,* https://ddd.uab.cat/record/272516. CC 2013 by Maria Cervini-Plá.

Table A.2*: transition matrix of earnings between fathers and children for 2005.*

		Quantil of child				
		1	**2**	**3**	**4**	**5**
Quantil of father	**1**	30.08%	24.40%	19.12%	15.74%	10.66%
	2	23.93%	22.34%	23.54%	15.69%	14.50%
	3	16.98%	19.17%	20.26%	22.64%	20.95%
	4	16.20%	18.29%	21.67%	23.26%	20.58%
	5	13.23%	16.20%	15.66%	22.41%	32.49%

Note. From "Exploring the Sources of Earnings Transmission in Spain", by Cervini-Plá M. (2013). *Hacienda Pública Española, 204(1), p.56,* https://ddd.uab.cat/record/272516. CC License 2013 by Maria Cervini-Plá.

Table A.3: *transition matrix of education between fathers and children for 2005.*

Father's education	**Children's education**			
	None or primary school	Lower secondary	Upper secondary	University degree
None or primary school	23.73%	28.52%	24.34%	23.42%
Lower secondary	4.44%	25.23%	34.58%	35.75%
Upper secondary	3.37%	9.21%	35.28%	52.13%
University degree	0.57%	4.82%	20.71%	73.90%

Note. From "Exploring the Sources of Earnings Transmission in Spain", by Cervini-Plá M. (2013). *Hacienda Pública Española, 204(1), p.56,* https://ddd.uab.cat/record/272516. CC License 2013 by Maria Cervini-Plá.