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## ABSTRACT

### Spain is Different: Falling Trends of Inequality

In this article we characterize the evolution of inequality in hourly wages, hours of work, labor earnings, household disposable income and household consumption for Spain between 1985 and 2000. We look at both the *Encuesta Continua de Presupuestos Familiares* and the *European Household Community Panel*. Our analysis shows that inequality in individual net labor earnings and household net disposable income has decreased substantially. The decreases in the tertiary education premium and in the unemployment rate have been key ingredients to understand this falling trend. However, the inequality reduction has not been monotonic over the period: while it fell in years of economic expansion, there was an inequality surge in the recession of the early nineties. Public transfers have played a crucial role in smoothing out the inequality arising in the labor market, but instead the Spanish family does not seem to have been an important insurance mechanism. Regarding household consumption, inequality has fallen much less than inequality in household net disposable income, with the decrease mostly concentrated in the second half of the eighties. This suggests that the reduction in income inequality has affected the sources of permanent differences between households only during the second half of the eighties. Our estimates of the earnings process for the period are consistent with this view.

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## 1 Introduction

In recent years macroeconomists have extended their focus from the traditional analysis of long run trends and cycles in aggregate variables to the analysis of long run trends and cycles in distributions.<sup>1</sup> In this article we use household level surveys to characterize the evolution over time of inequality in hourly wages, hours of work, labor earnings, household disposable income and household consumption for Spain. We complement our analysis with a characterization of the evolution of the dispersion of these same variables over the life cycle. As Deaton and Paxson (1994) and Storesletten, Telmer, and Yaron (2004) show, inequality of labor earnings, consumption and hours of work over the life cycle can reveal important information on both the amount of uncertainty in the labor market and the available financial technology to smooth out consumption fluctuations. Finally, we also provide estimates for the stochastic processes driving the shocks in the labor market in order to decompose the evolution of uncertainty into permanent and transitory shocks.

The analysis of trends in inequality for Spain faces the problem of a lack of long-lasting household surveys prior to the mid 80's.<sup>2</sup> For our analysis we will combine two different data sets: the longitudinal household expenditure survey (called *Encuesta Continua de Presupuestos Familiares*), which was run between 1985 to 1996 and the *European Household Panel*, which ranges from 1994 to 2001. Each survey lacks some important data. The consumption survey does not report data on hours worked, while the European panel does not report data on consumption. Neither of them reports data on wealth. This implies that it is not possible to characterize the joint evolution of consumption and hours worked, and that it is not possible to describe the evolution of the wealth distribution.<sup>3</sup>

Our period of study hence ranges from 1985 to 2000. This is a long period of economic expansion in Spain, with the average rate of growth of per capita gdp equal to 3.3 percent. As it is shown in panel (a) of Figure 1, there was only a brief recession in the years 1992 and 1993, with the latter year being the only one with negative growth. In spite of this healthy growth, the unemployment rate was high (see panel (b) in Figure 1). In 1985 the unemployment rate was 21 percent. This was the maximum after the hike started in the mid 70's. Then it declined steadily to 16 percent in 1991. However, the downturn of 1992 and 1993 generated a big surge in unemployment, which skyrocketed to 24 percent in 1994. In the remaining years of our sample period the unemployment rate fell steadily up to 10.5 percent in the year 2000.<sup>4</sup> During our sample period there were two important

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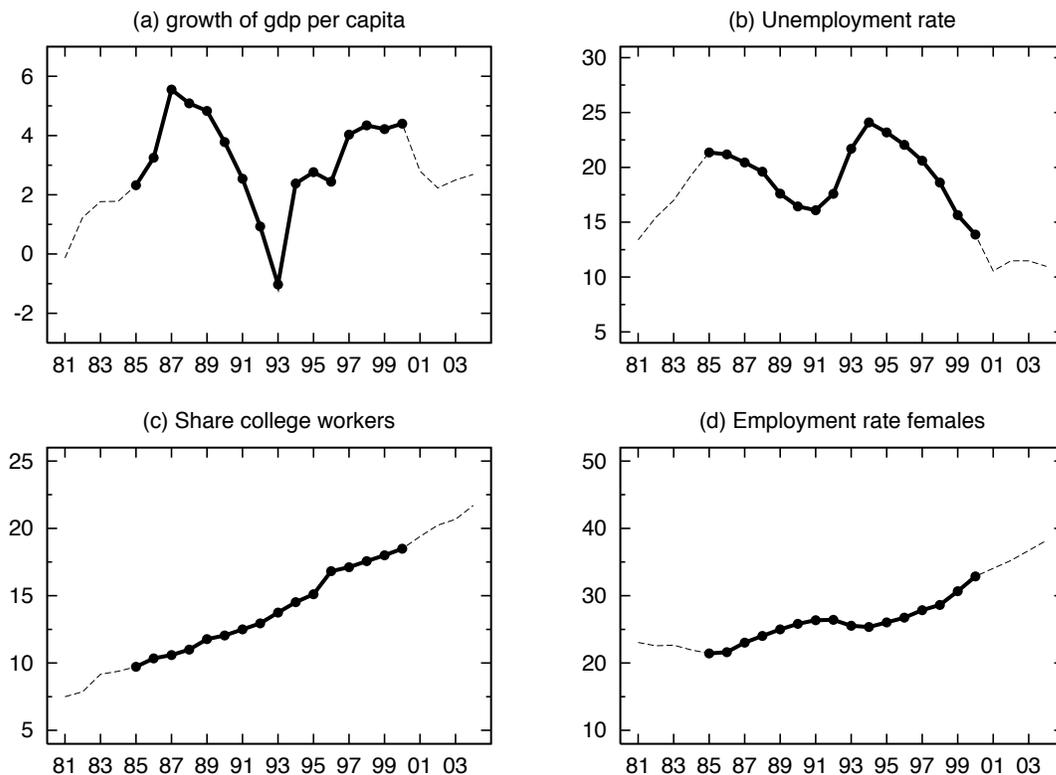
<sup>1</sup>For instance, two recent articles that analyze the trends in income and consumption inequality in the US are Krueger and Perri (2006) and Heathcote, Storesletten, and Violante (2008b).

<sup>2</sup>The longest running household survey is the *Labor Force Survey*, which started in 1976. Unfortunately it does not collect any data on labor earnings or wages.

<sup>3</sup>Regarding the distribution of wealth, the Bank of Spain has recently started the *Encuesta Financiera de las Familias*, a survey of consumer finances modeled after its American counterpart. It is a tri-annual cross-section (with an important panel component) that includes data on household income, labor supply and consumption, as well as very detailed data on assets and liabilities. The waves for 2002 and 2005 are already available. See Bover (2008) for a first descriptive analysis of the wealth distribution in Spain using the *Encuesta Financiera de las Familias*.

<sup>4</sup>An important number of labor market policies reforms were passed over the period of analysis, all of

Figure 1: A brief macro outlook



Note: Data in panels (b), (c) and (d) refer to individuals aged 16 and older. Source: *Instituto Nacional de Estadística*

demographic changes happening in the labor market. First, there was an educational transition. The share of employed workers with a college degree increased from 10 percent in 1985 to 18.5 percent in 2000 (see panel (c) of Figure 1). Second, there was a massive entrance of young females in the labor force. The employment rate of females increased from 21.4 percent in 1985 to 33 percent in 2000 (see panel (d) of Figure 1).

Our analysis of the evolution in cross-sectional inequality shows that during the whole period 1985-2000 inequality in individual labor earnings in Spain has decreased substantially, with the drop in the college premium being the main observable factor behind this fall. In addition, the hefty increase in the incomes at the lower tail of the distribution reveals the crucial role played by the reduction of unemployment along the period. Inequality in household net disposable income has followed the same trend, but with a smaller drop and milder fluctuations. We find that public transfers (among them unemployment benefits and retirement and disability pensions) have played a major role in smoothing out the inequality arising in the labor market. Instead, the Spanish family does not seem to have been an important insurance mechanism: inequality of labor earnings at the household level is larger than at the individual level, and private transfers between

them with the aim of making Spanish labor market more flexible. See Section 2 for details.

households have a very minor impact in inequality reduction. Regarding household consumption, inequality has fallen less than inequality in household net disposable income, with the decrease mostly concentrated in the second half of the eighties.

Looking within sub-periods, we find that the economic expansion between 1985 and 1992, and the recovery from the mid 90's to the end of our sample period, both brought a reduction of inequality partly due to the fall in the tertiary education premium. However, the recession along 1992-1993 witnessed an increase in inequality, mainly driven by an increase in unemployment. The fall of inequality seems to have affected permanent sources of heterogeneity only during the first expansion period: between 1985 and 1992 consumption inequality fell and our estimated process for labor earnings shows a decrease in the dispersion of the permanent component.

When we look at the evolution of inequality over the life cycle we find increases in inequality of individual wages and household earnings, and also a smaller increase in inequality of household net disposable income and consumption. The increases in inequality of household net earnings, household net disposable income and consumption seem to be stronger after the mid 40's. If we take the view that the increase in earnings dispersion over the life cycle comes from the existence of persistent shocks to earnings, then we have to conclude that shocks to labor market earnings become either more volatile or more persistent during the second half of the life-cycle. This would be consistent with the longer duration of unemployment spells for older workers.<sup>5</sup> In addition, these shocks are partly insurable: consumption inequality increases over the life-cycle but less than earnings inequality.

The remaining of the paper is organized as follows. In Section 2 we outline the main institutional changes in Spain for the period 1985 to 2000. In Section 3 we describe the data sets and compare some statistics for the years in which they overlap. Then, in Section 4 we describe the evolution of cross-sectional inequality, from the individual labor market experience to the household disposable income and consumption. The estimates of stochastic processes for hourly wages and household labor earnings are done in Section 5. In Section 6 we describe the evolution of inequality over the life cycle. Finally, Section 7 concludes.

## 2 Institutional changes

The 80's in Spain was a time of institutional and economic transition. In 1977 there were the first democratic elections after more than 35 years of dictatorship. The years between 1977 and 1982 served to set up the new rules of the game, but the economic reforms extended through the whole decade. There was a process of industrial transformation and there was an increase in the openness of the economy with the entrance in the European Community in 1986. Along the period of our analysis there were several important reforms in labor market regulation and personal income taxation. In the next two paragraphs we try to provide a quick overview of such reforms.

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<sup>5</sup>Of course, other interpretations are possible. See Section 6 for further discussion

Concerning the labor market, the high unemployment rate that characterized the Spanish economy induced several legislation changes. First, the 1984 Labor Law Reform relaxed the conditions for firms to hire workers under fixed-term contracts. It is believed that this Law encouraged the creation of new jobs and helped to reduce unemployment for two reasons: it allowed firms to avoid the high severance payment associated to open-ended contracts, and it helped to moderate wage growth as the wage gap between fixed-term contracts and open-ended contracts is substantial. However, it is also believed that it contributed to an increase in the inequality of earnings across workers, the so called “duality” of the labor market: workers in fixed-term contracts experience more unemployment spells than heavily protected workers under open-ended contracts. Second, in 1992 a set of measures were implemented to reduce the unemployment benefits and to toughen the eligibility conditions for it. This reform increased the incentives to search for jobs and possibly helped to reduce unemployment, but it also lowered the incomes of some unemployed workers. Third, in 1994 a new Labor Law Reform was passed. This new reform targeted the wage growth of workers with open-ended contracts. Several changes in the workers-firms collective bargaining were introduced with two objectives. The first one was to strengthen the correlation between workers/firms performance and wage growth, and the second one was to allow for more flexibility in the allocation of working hours along the year. Finally, the 1997 Labor Law Reform introduced a new type of open-ended contract with a lower severance payment aimed at increasing the fraction of open-ended contracts among workers and hence fight the duality of the labor market. To sum up, these policies extended the use of fixed-term contracts, made collective bargaining more flexible and introduced reductions in the firing costs of open-ended contracts. These reforms are believed to have fostered the reduction in the unemployment rate that we observe during the nineties

Regarding taxation, there were three important changes in the personal income tax code during the period of analysis: in 1987, in 1994 and in 1998. In general, these changes consisted of reductions in the top marginal tax rates, reductions in the number of income brackets and the elimination of several types of deductions. One important change in 1987 was that joint taxation for married couples was considered optional instead of compulsory. This was a tax reduction for dual earner couples, and hence a change that pointed to an increase in inequality of after tax household income. However, the final outcome of these reforms in terms of progressivity is unclear.

### 3 Data Sets

As discussed in the introduction, we use two different household surveys to span the period 1985 to 2000. First, the *Encuesta Continua de Presupuestos Familiares* (ECPF). This is the old expenditure survey in Spain, ranging from 1985 to 1996. It is a panel that follows 3,600 households for up to 8 consecutive quarters (two full years). It collects expenditure data for 215 different types of goods, mixing diary data with two different levels of retrospective data. While consumption data is collected at the level of the household, income data in different categories is available for different household members. However,

there is no data for hours nor wealth. This data set allows us to track the evolution of the dispersion in household labor earnings, household disposable income and household consumption (including their covariances), as well as the life-cycle profiles of mean, variance and covariance of these same variables. It is also possible to estimate a process of household labor earnings and decompose the evolution of labor earnings dispersion between returns to observable variables and residual inequality. At the individual level, however, it is of limited interest. Education, which is a key determinant of earnings, is only available for the head, whereas labor market status is only available for both the head and the spouse. Hence, our sample of individual level data will focus on heads only. This survey was stopped in 1996 and its current replacement presents a very important problem for our study: income is aggregated at the household level and comes in very wide brackets for around 80 percent of the households.

The second data set is the *European Community Household Panel* (ECHP). This is a European-wide household panel where households are followed for several years. The survey ranges from 1994 to 2001, but since income variables refer to the year before the survey was conducted, it allows us to document the period 1993 to 2000. It has good data for labor earnings, disposable income and hours of work per household member. Therefore, it allows a good analysis at the individual level as well as at the household level. On the minus side, there is neither data for wealth nor consumption. We can build time series for the dispersion of labor earnings, disposable income, hours and hourly wages both at the household and individual level and life-cycle profiles of mean, variance and covariance of these same variables. Furthermore, we can estimate a process for both labor earnings and hourly wages and decompose the evolution of labor income and hourly wages dispersion between returns to observable variables and residual inequality.

An important characteristic of our data sets is that income data is net of taxes. In particular, the ECPF only provides after tax income whereas in the ECHP data quality is much higher for after tax income than for before tax income. In Appendix B.2 we argue that, based on the ECHP data, changes in the tax system do not seem to be important for the observed changes in inequality. However, this feature of the data represents an important difference with respect to the other studies in this volume, and hence one has to be careful when comparing the inequality figures here with those of other countries.

### 3.1 Sample Selection

Throughout our analysis we will use three different samples.

Sample 1 is a sample of households. In both data sets we take all households with a head between 25 and 60 years of age. We define as head the household member with the highest regular income of the household (over the period in which the household is observed), regardless of age or gender. The reason for making this choice is that this is the criterion followed in the ECPF, a data set that only reports education level for the household head and labor market status for the head and spouse. In order to preserve

comparability between data sets we extend the head definition of the ECPF to the ECHP.<sup>6</sup> We will use sample 1 to analyze how earnings originated in the labor market combine with other sources of income at the household level to obtain the evolution of inequality in total net disposable income and the evolution of inequality in household consumption.

Sample 2 is a sample of household heads active in the labor market. We just take the sample of households and keep the income data for the household head if the labor market status of the head is currently working or unemployed. We will use this sample to analyze inequality in the labor market at the individual level. Of course, one has to be aware that a sample of household heads is different from a sample of individuals: there is a higher fraction of men, average age is higher and there is a lower fraction of college educated workers.<sup>7</sup>

Sample 3 is a sample of individuals aged 25 to 60 who participate in the labor market, supply a positive number of hours and have non-zero labor earnings. We use this sample to analyze inequality in hourly wages and labor supply. Since we do not have data for hours in the ECPF, we construct this sample only for the ECHP.

As final comments regarding sample selection, in our data sets there is no top-coding, so we observe the upper tail of the income distribution with detail. All incomes and consumption are deflated with the Consumer Price Index and reported in 1995 euros. In Appendix A we define the variables used throughout the analysis.

### 3.2 Demographics

Our data sets aggregate very well to the the demographic structure of the *Labor Force Survey* (LFS). In particular, they are consistent with the two important trends documented in the Introduction. First, there is an educational transition: the share of household heads with either college education or upper secondary education grows considerably over the sample period. Second, there is a massive increase of secondary earners into the labor market: the employment rate of spouses goes from around 20 percent in the mid 80's to more than 40 percent in the year 2001. This is translated into a big increase in the share of households where both head and spouse are employed.<sup>8</sup>

However, we find one important discrepancy between the two data sets: the share of heads with tertiary education in the overlapping years is 12.6 percent in the ECPF whereas it is 22.2 percent in the ECHP. We think that this discrepancy is due to an over-sampling of highly educated households in the ECHP rather than a problem with the definition of the education categories themselves. There are two reasons for this. First, the share of college graduates in the much larger LFS is very close to the figures in the

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<sup>6</sup>Our definition of household head differs from the more standard use of the highest earning male. This is not critical for our analysis. See Appendix B.1 for a comparison of inequality in labor earnings for different definitions of household head.

<sup>7</sup>See Appendix C for a comparison of demographics between our sample of heads and the Labor Force Survey.

<sup>8</sup>See Table 2 in Appendix C.

ECPF. Second, the income distributions conditional on education in the two data sets are remarkably similar (except for the lowest percentiles).<sup>9</sup>

### 3.3 Income distribution: comparison of data sets

A comparison of the labor earnings distribution across the two data sets for the overlapping years reveals that median earnings are very similar. In particular, using sample 2, the median is slightly larger in the ECPF, but only between 1 and 5 percent, depending on the year. However, the overall dispersion is substantially larger in the ECHP: the standard deviation of the log of income ranges from 0.69 to 0.66 in the ECPF and from 0.92 to 0.85 in the ECHP.<sup>10</sup> As we document in Appendix C.3, the higher dispersion in the ECHP comes mainly from the very low incomes reported in the lower tail of the distribution, and it is preserved across education groups. Since the income distributions are different across the two data sets only at the lowest percentiles, we think that trends in inequality are still comparable.

### 3.4 Average income and consumption: comparison to aggregate data

The ECPF is a survey designed to measure the structure of consumption spending of Spanish households. This effort pays off in terms of a good aggregation of the survey data when compared to aggregate measures of consumption in the Spanish National Accounts (SNA). Pou and Alegre (2002) provide a very detailed comparison between the survey and the SNA. They show that non durable consumption and services of the survey sum up to around 80 percent of the equivalent measure in the SNA.<sup>11</sup> Regarding durable consumption, Pou and Alegre (2002) report a lower level of representativeness: the survey data sums up to between 60 and 80 percent, depending on the years. Coverage for income data is worse. According to Pou and Alegre (2002), total household income net of taxes aggregates up to 60 percent of the SNA. However, there is a lot of heterogeneity depending on the type of income. For instance, they show that labor earnings is around 70 percent of the aggregate figure but instead capital income is only around 15 percent. Finally, during the twelve years of the sample there is no apparent loss of representativeness as the ratios between aggregates from the survey and the aggregates from the SNA fluctuate over the years without any clear trend. Hence, contrary to other countries, the survey sampling does not seem to deteriorate over time. Additionally, the survey measures reasonably well the changes in aggregates.

Regarding the comparison between the aggregates resulting from the ECHP and those reported by the SNA, Delgado and Mercader-Prats (2001) do an accurate study for 1994.

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<sup>9</sup>See Appendix C for details.

<sup>10</sup>The different level of dispersion in income variables between these two data sets has already been reported elsewhere. See for instance Ayala and Sastre (2007).

<sup>11</sup>This coverage rate is remarkable. We have to bear in mind that the SNA collect data of consumption at the national level (this includes non-residents) whereas the ECPF considers only resident households. Consumption of non-residents in the sample period is around 6.5 percent.

They find that the ECHP accounts for 91.4% of the net (after tax) wage and salary earnings registered in the SNA, but only accounts for 49.0% of the gross (before tax) wage and salary earnings. These values go up to 94.8% and 86.0% after imputations. Concerning self-employed income, the ECHP only accounts for around 34% of the SNA figure. Finally, the ECHP accounts for 39.3% of capital income, although the figure grows up to 64.4% after imputations (household receiving capital income are under-represented in the ECHP). There are some factors that can account for these discrepancies. First, the ECHP does not include compensation in kind. Second, the SNA include subjects not covered by the survey (as households living in the autonomous cities of Ceuta and Melilla or non-profit organizations). Third, and possibly more important, the frequency of missing values in the ECHP for the variable gross earnings is much higher than for the variable net earnings (44.33% versus 2.65% of all workers in 1994). This problem is solved by imputing earnings to these households, but it may affect the comparison of the survey with the SNA.

## 4 Cross Section Analysis

We start our analysis of inequality by looking at the evolution of cross-sectional dispersion over time. In Section 4.1 we describe the evolution of inequality in the individual labor market experience, focusing on hourly wages and labor supply. In Section 4.2 we look at inequality in annual labor earnings for household heads. In Section 4.3 we aggregate individuals over the household and look at broader definitions of income. Finally, in Section 4.4 we look at inequality in consumption.

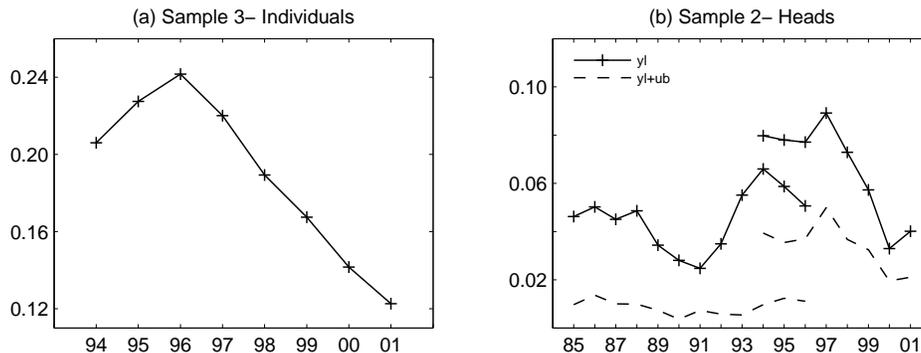
### 4.1 Inequality in hourly wages and labor supply

Our primitive measure of labor market outcome at the individual level is the hourly wage. As there is no available data for hours in the ECPF, we can only build series for the period 1994 to 2001 by use of the ECHP. We will use sample 3 throughout this section.

During our period of study the labor market in Spain was characterized by a very large incidence of unemployment. This is reflected in the fraction of individuals reporting zero monthly labor earnings. As shown in panel (a) of Figure 2, this fraction grows from 20 to 24 percent between 1994 and 1996 and then it decreases to 12 percent.

Figure 3 shows the evolution of the dispersion of individual wages per hour of work as measured by use of several statistics: the variance of the logarithm, the gini index, and the 50th-10th and 90th-50th percentile ratios. Both the variance and the gini index increase between 1994 and 1997 and experience a large decrease afterwards. This fall in inequality from 1998 to 1999 is driven by the fall in inequality at both ends of the wage distribution. As Figure 3 shows, the 50th-10th percentile ratio fluctuates around 1.77 until 1998 and decreases about 0.15 points in 1999. The 90th-50th percentile ratio grew slightly from 1.98 to 2.05 before 1998 and decreases afterwards, slightly less than 0.15 points.

Figure 2: Fraction of individuals with zero labor earnings



Note: In panel (a) we consider monthly earnings of all active individuals in the ECHP. In panel (b) we consider the annual earnings of household heads. The series  $yl$  refers to annual labor earnings; the series  $yl + ub$  refers to the sum of annual labor earnings and unemployment insurance payments.

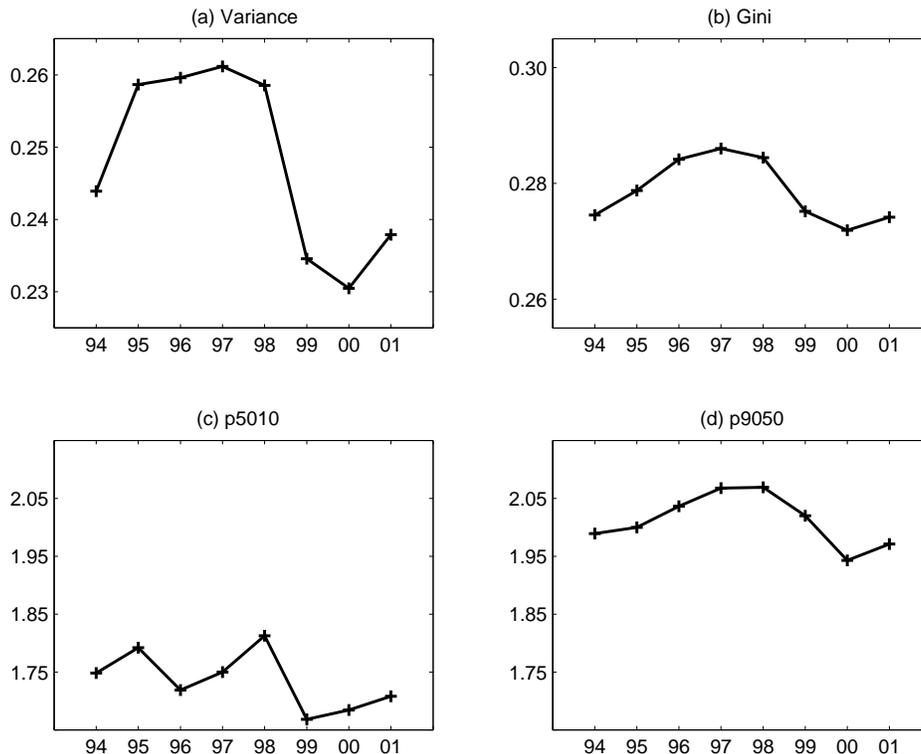
To understand the sources of changes in inequality for hourly wages, in Figure 4 we look at the contribution of changes in the education premium, changes in the gender premium, changes in the experience premium and the evolution of variance of the residual of wages. We measure the education premium as the ratio of the average hourly wage for workers with tertiary education and the average hourly wage for the rest of workers. We define the gender premium as the ratio of the average hourly wage for male workers and the average hourly wage for female workers. For the experience premium we consider the ratio of average wage of workers aged 45-55 over the average wage of workers aged 25-35. The residual of wages is obtained after taking out through a simple regression analysis the effects on wages (in logs) of year dummies, a polynomial in the age of the household head, dummies for family composition and a control for the educational level of husband and wife.<sup>12</sup>

The tertiary education premium is stable until 1996 and then it decreases from about 1.57 to about 1.47 at the end of the decade. The gender premium shows an increasing trend that takes it from around 1.07 to 1.15 over the period.<sup>13</sup> The experience premium increases from about 1.2 in 1994 to around 1.45 in 1996 to remain almost steady afterwards. Finally, we observe that the evolution of the variance of the residual wage is almost constant. The whole picture in Figure 4 indicates that the increase in the experience premium would drive the increase in variance of wages over the mid nineties and the decrease in the tertiary education premium would drive the decrease in variance of wages at the very end

<sup>12</sup>See equation (1) below for more details.

<sup>13</sup>These figures are lower than the 26.3 per cent reported by De la Rica, Dolado, and Llorens (2008) for 1999 using the same data set. The difference is explained by different sample selection. De la Rica, Dolado, and Llorens (2008) exclude individuals with tertiary education, self-employed workers and those working less than 15 hours. Furthermore, their sample includes individuals aged 16 to 65. However, the key difference is the exclusion of tertiary educated workers. The inclusion of this group of workers in their sample would reduce the wage gender gap to 16.9.

Figure 3: Inequality in individual wages



of the nineties.<sup>14</sup>

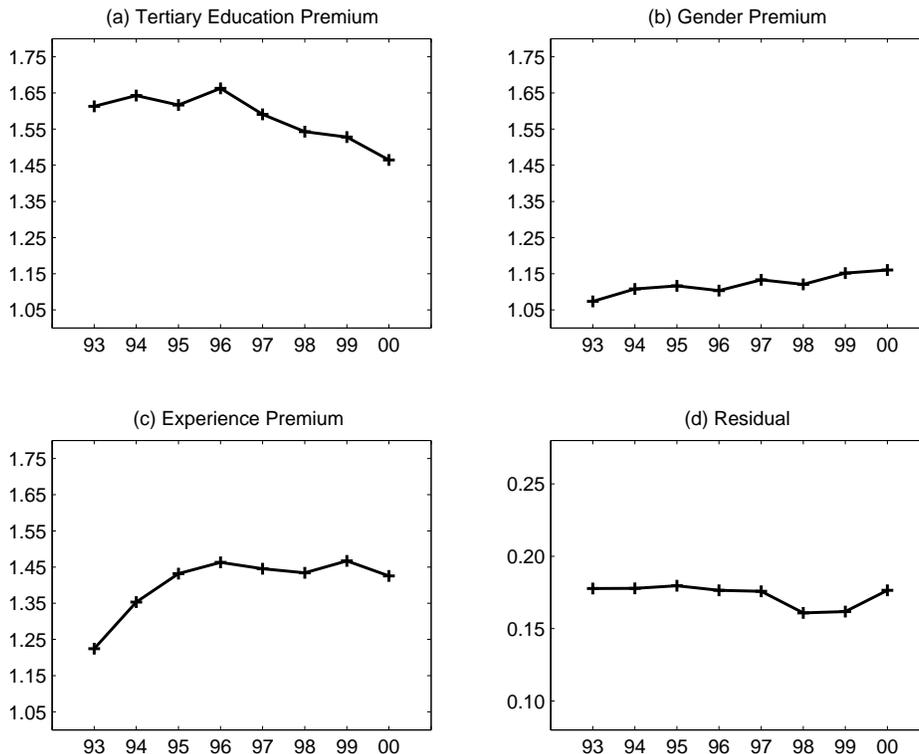
The fall in the tertiary education premium is consistent with the phenomenon of over-education in Spain. Dolado, Felgueroso, and Jimeno (2000), using LFS data, find evidence of a growing proportion of college graduated workers doing unskilled jobs in Spain. A potential explanation for the increase in the experience premium that we are reporting here may be based on the duality between open-ended and fixed-term contracts in Spain. Young workers entering the labor market are typically hired with fixed-term contracts. De la Rica (2004), using the 1995 Wage Structure Survey, shows that the raw wage gap between fixed-term contracts and open-ended contracts in Spain was 0.43, with 0.09 of it unexplained by observable differences among workers (occupation and individual characteristics). There are several possible explanations for a lower wage rate associated to fixed-term contracts. For instance, workers under fixed-term contracts may have less firm-specific human capital because they tend to change jobs very often. Also, union coverage for this type of workers may be lower.

Finally, we complete the picture of the labor market evolution by looking at data of

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<sup>14</sup>In Appendix D we run Mincer regressions to look at the evolution of the premia controlling for demographic changes. The only important difference is that the decrease in the tertiary education premium in terms of Mincer regressions is more moderate than in terms of raw data, implying that the age and sex composition changes of the tertiary educated is important to partially explain the evolution of its trend over the end of the nineties.

Figure 4: Hourly wage premia

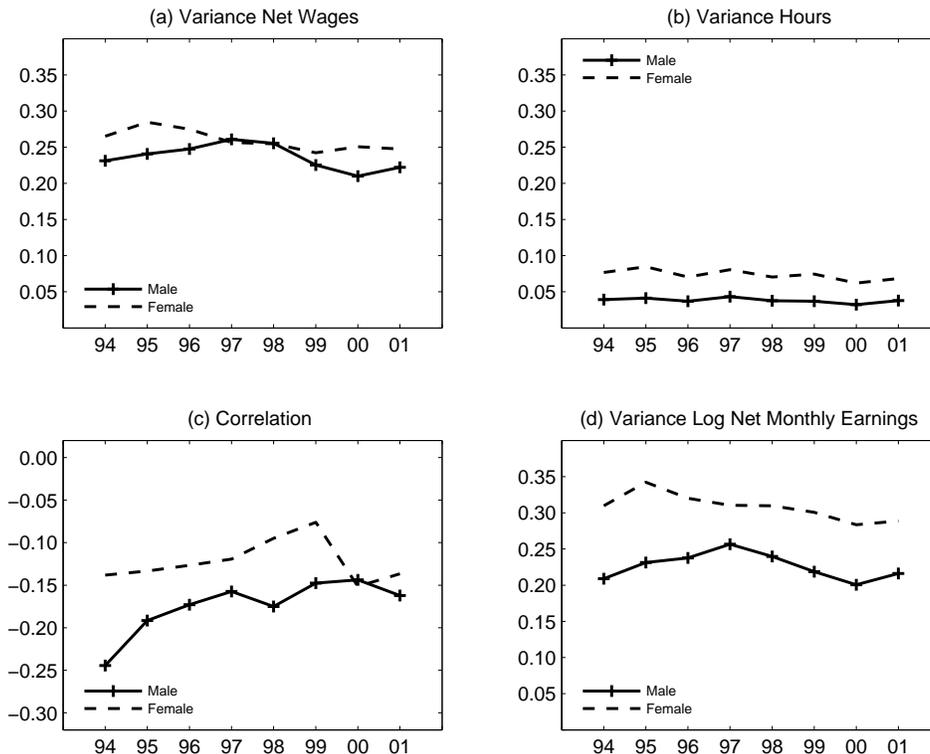


hours. In Figure 5 we report the evolution of the variances of log wages and log hours worked separately for men and women, together with the evolution of the correlation of log wages and log hours and the evolution of the variance of the log of labor earnings.

As mentioned above, the variance of wages for all workers is increasing between 1994 and 1997 and decreasing afterwards. Panel (a) in Figure 5 shows that inequality in male wages follows the same pattern, whereas inequality in female wages already starts falling in 1995. Panel (b) in Figure 5 shows that there is very little action with hours. We find that the variance in hours is small and much higher for females than for males, which is explained by the higher incidence of part-time employment among females. Regarding the correlations between wages and hours, panel (c) in Figure 5 shows that it is increasing all over the period for males, whereas for females it increases much less and only until 1998 to decline a little afterwards. In addition, we observe that these correlations are negative. Finally in panel (d) in Figure 5 we report the variance of log monthly earnings, which is just the sum of the variances of wages and hours plus the covariance term. We observe that, both for males and females, the pattern of inequality is almost identical to the one for hourly wages. Inequality in labor earnings for males grows more between 1994 and 1997 than inequality in hourly wages because of the increase in the correlation between hours and ages.

The negative correlation between wages and hours may arise as the result of individ-

Figure 5: Individuals inequality in labor supply



uals using work hours as a self-insurance mechanism against shocks to hourly wages.<sup>15</sup> If individuals cannot use financial markets or other private arrangements to smooth consumption, they may need to work long hours when hourly wages are low.<sup>16</sup> The fact that the correlation for males has been increasing over time can be interpreted from two different angles. First, it may be a pure composition effect: there has been an increase in college workers and college workers earn more and work more hours. Second, it may be a fall in the use of labor as a self-insurance mechanism. This means that, either insurance possibilities (through financial markets or family) have improved, or rather that the relative importance of transitory shocks has increased. Indeed, the estimation of a wage process for hourly wages in Section 5 shows an increase in the importance of the transitory shocks during this period. Regarding the difference between men and women in the correlation of hours and wages, we interpret the lower correlation for females as the result of female labor supply being used as an insurance mechanism against heads earnings shocks.<sup>17</sup>

As a final remark, we should be cautious in interpreting the evolution of the variance of wages and the evolution of the correlation of hours and wages. Part of the changes may arise due to composition effects. The decrease in the unemployment rate, and the long

<sup>15</sup>Of course, part of this comes from the division biased created by measurement error in hours.

<sup>16</sup>See Low (2005), Pijoan-Mas (2006) and Heathcote, Storesletten, and Violante (2008a).

<sup>17</sup>See Attanasio, Low, and Sánchez-Marcos (2005)

run demographic changes in the labor market that has brought more women and more educated individuals into the labor market, are likely to play a role.<sup>18</sup>

**To sum up.** Between 1994 and 1997 inequality in hourly wages increased, with the increase being mostly related to the increase in the experience premium. Then, in 1998 wage inequality started to decline, with the fall being mostly related to the tertiary education premium. In contrast to the US, UK and Canada, unobservable variables do not explain the dynamics of wages. Finally, inequality among wages of women did not follow this same pattern because it started to fall before, in 1996.

## 4.2 Inequality in labor earnings

In order to characterize the evolution of inequality of incomes in the labor market for the whole period, we analyze the evolution of the dispersion of annual labor earnings in our sample of household heads.<sup>19</sup>

Panel (b) in Figure 2 plots the fraction of zeros for annual labor earning and annual labor earnings plus unemployment benefits.<sup>20</sup> For the whole period of study, the trend in the ECPF follows very well the trend in the unemployment rate measured in the LFS. The trend in the ECHP instead has the peak shifted to 1996.<sup>21</sup>

In Figure 6 we plot the evolution of different statistics of inequality in labor earnings and inequality in labor earnings plus unemployment benefit. There is a substantial discrepancy in the level of inequality between the ECHP and the ECPF for the four years in which the data sets overlap. In particular, inequality measured in the ECHP is substantially higher than inequality measured in the ECPF.<sup>22</sup>

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<sup>18</sup>Note that according to the ECHP, the male employment rate (among the age range 25-60) has increased from 74.6 per cent in 1994 to 83.7 per cent in 2001, mainly due to the reduction in the unemployment rate. In the same period the female employment rate has increased from 35.9 per cent to 49.0 per cent, at least partially driven by the increase in female labor market participation over the last decades.

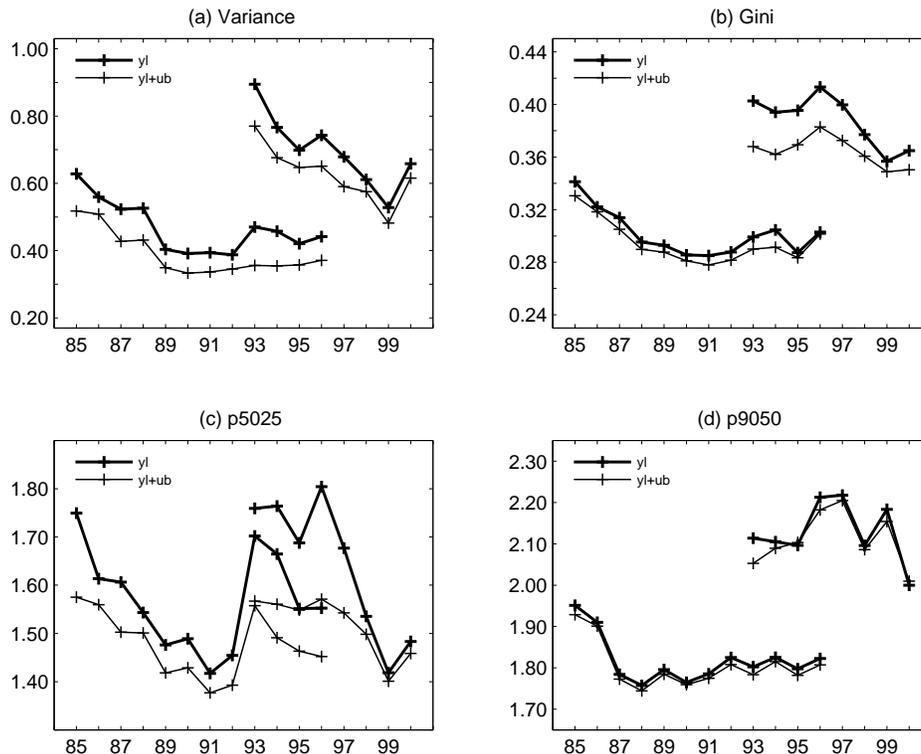
<sup>19</sup>Recall that the reason to focus on household heads is twofold. First, information on education in the ECPF is collected only for the heads. The education of the head is important because it is arguably one of the most important determinants of labor earnings. Second, labor market status is only collected for heads and spouses. This means that, for the other members of the household, it is impossible to know whether zero labor earnings is the result of the unemployment experience in the labor market, or instead it just reflects non-participation.

<sup>20</sup>The incidence of zero labor earnings in this sample is substantially lower than in the sample of individuals used in the previous section. There are two reasons for this. First, the income data in the sample of heads refers to the year, so it takes much longer unemployment spells to report zero labor earnings. Second, the demographic composition of the sample of heads is different from the demographic composition of the sample of individuals: there are more men, they are older and they are less educated (the first two contribute to have a lower fraction of zeros in the head sample, but not the third).

<sup>21</sup>The levels in the two data sets are slightly different: for instance, in the overlapping years the fraction of zeros in annual earnings is between 6% and 7% in the ECPF and between 8% and 9% in the ECHP.

<sup>22</sup>This is not only due to the higher incidence of zeros reported in panel (b) of Figure 2 because, by construction, the variance of logs omits the zeros and the difference in inequality is also present.

Figure 6: Inequality in head of household earnings

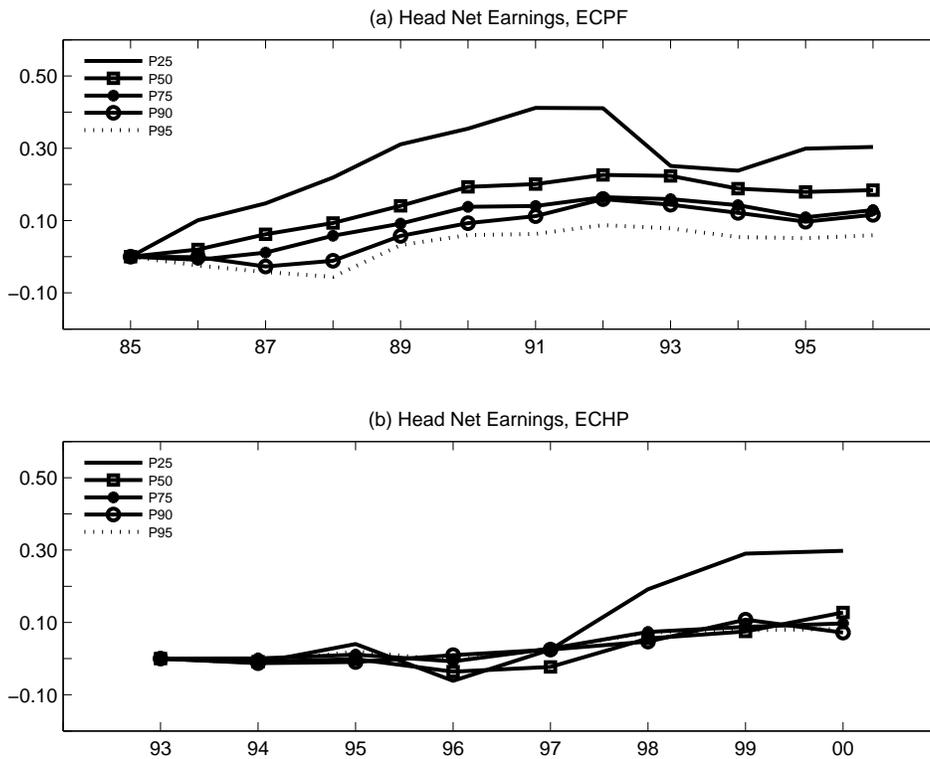


Note: the series  $yl$  refers to annual labor earnings; the series  $yl + ub$  refers to the sum of annual labor earnings and unemployment insurance payments.

Regarding the evolution of inequality for the whole period, we observe a clear pattern of falling inequality. In particular, the ECPF shows a steady decline in the variance and gini of labor earnings during the expansion of the 80's, which is stopped and slightly reverted in the early 90's. Then, between 1994 and 1996 the variance of logs seems to decline a little whereas the gini index fluctuates a bit but its trend remains stable. For the same period 1994 to 1996 the ECHP also shows a decline in the variance of logs (albeit sharper than in the ECPF) and a trendless fluctuation in the gini index. Then, from 1996 onwards inequality falls steadily.<sup>23</sup>

<sup>23</sup>The pattern of falling inequality in the labor market had already been documented elsewhere. Abadie (1997) uses the *Encuesta de Presupuestos Familiares* (EPF) of 1980 and 1990 to compare the cross-sectional distribution of annual earnings of household heads. He finds a fall in overall inequality and a fall in the returns to college. The sampling and questions in the EPF are very similar to the ones in the ECPF. The main difference is that the EPF is a cross-section taken every 10 years, with a larger sample size. Incidentally, the definition of household head in both surveys is the same. Hidalgo (2008) combines data from the EPF and the ECPF to look at the evolution of annual earnings of heads of single-earner households. He also finds that both inequality and returns to college fall from 1980 to 1990. However, he documents a slight increase in inequality and returns to college in 2000. There are two main factors that can explain this difference. The first one is that Hidalgo (2008) looks at a sample of households with only one earner, which, as Table 2 in Appendix C shows, is a sample with a rapidly changing composition. The second factor is that the data of Hidalgo (2008) for 2000 come from a new version of the ECPF, while our data for the second half of the 90's come from the ECHP. The new version of the ECPF has

Figure 7: Percentiles of head earnings



The decrease in the variances of earnings during the second half of the eighties that we document in the ECPF is driven by a decrease in inequality in both tails of the distribution. In particular, both the 90th-50th percentile ratio and the 50th-25th ratio decline during the period.<sup>24</sup> Instead, the increase in inequality that happens in 1993 seems to be present only in the lower tail: the 90th-50th percentile ratio hardly changes whereas both the 50th-25th percentile ratio and the fraction of individuals with zero earnings increase substantially. Looking at the ECHP we observe that the reduction of inequality between 1993 and 2000 is also mostly related to the lower tail of the earnings distribution. Indeed, the 90th-50th ratio falls very little between 1994 and 2000 whereas

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a number of problems that makes it very difficult to compare to the old one. The ECPF was stopped in 1996. In 1998 a new survey was started to replace it. However, this new survey reports income data in very wide brackets for a fraction of 4/5 of all households. Besides, the income data is reported for the whole household. This makes the comparison of inequality with the old ECPF very problematic. In contrast with these results, Arellano, Bentolila, and Bover (2002) find an increase in the college premium between 1980 and 1987 when looking at a data base of Social Security Administration records. This data set is very interesting because it collects administrative data for the 5 percent of the universe of Spanish workers at a monthly frequency. However, it has a severe problem with top-coding: for college workers even the earnings at the median are unobservable.

<sup>24</sup>We deviate here from the standard practice of reporting the 50th-10th percentile ratio to characterize the lower tail of the wage distribution. This is because due to the incidence of unemployment the labor earnings of the 10th percentile are zero or close to zero for some years.

both the 50th-25th ratio and the incidence of zero earnings fall sharply from 1996 onwards.

A more detailed picture of the evolution of labor earnings at different points of the distribution is provided in Figure 7. In panel (a) we report the evolution of head earnings in the ECPF, for different percentiles of the distribution, as the log difference with respect to its value in 1985. We observe that the median income increased 22 percent between 1985 and 1992 (around 2.9 percent per year). During this same period, the income of the 25th percentile increased 41 percent (around 5 percent per year) whereas the incomes at the 90th and 95th percentile fell until 1987 and then they increased for total increases of 16 and 10 percent respectively until 1992 (around 2.1 and 1.6 percent per year). Instead, from 1993 onwards, income at the median and at percentiles above the median stayed more or less stable (they decreased slightly) whereas the income earned at the 25th percentile declined sharply until 1994, around 8 percent in just two years, and recovered slightly afterwards. In Panel (b) of Figure 7 we see how in the ECHP income at all percentiles is stable until 1996 and then income at the 25th percentile grows 30 percent between 1996 and 2000 whereas median income grows less and incomes at the top percentiles grow around 10 percent during the same period.

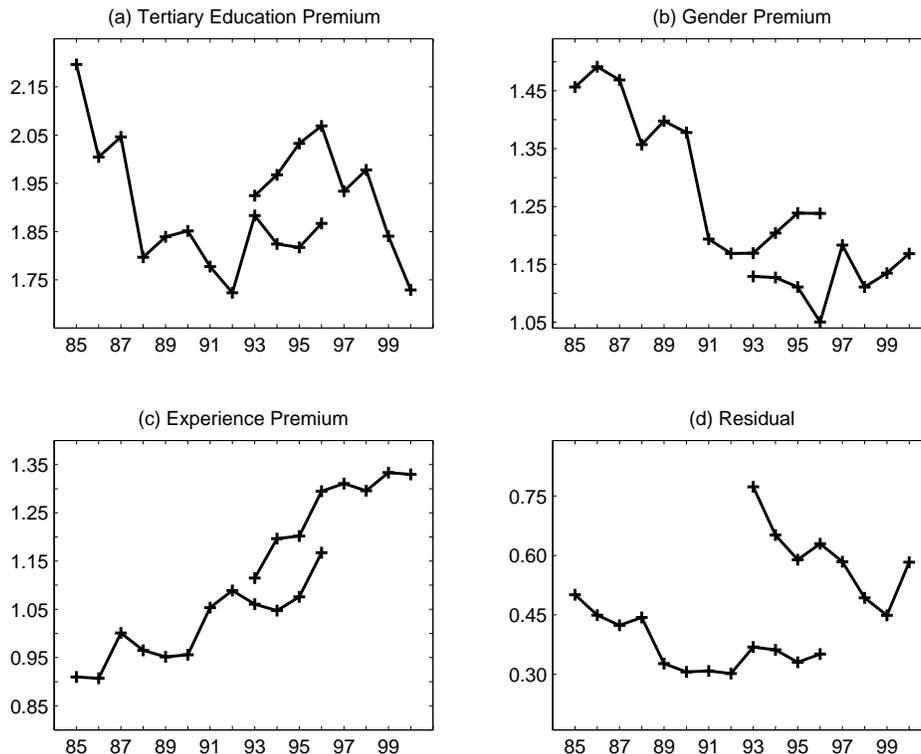
Finally, even among those individuals that report positive labor earnings, income variation within a year may be largely driven by variation in the number of months in unemployment. For this reason, in 6 we also show the evolution of inequality of head earnings plus unemployment benefits. We find that adding unemployment benefits lowers the level of inequality, mostly as measured by the 50th-25th percentile ratio, but it does not change the trends. In addition, changes in inequality are much more moderate at the lower tail of the distribution.

Next, we look at possible causes for the observed evolution of earnings inequality. In Figure 8 we report the tertiary education premium, the gender premium, the experience premium and residual inequality. We observe that the quality of the match between the two data sets in 1993, the first overlapping year, is very high for the three premia and that the disparity in inequality between data sets in this year seems to be mainly due to residual wage inequality. In the subsequent overlapping years, 1994, 1995 and 1996, the tertiary education premium and the gender premium start to spread apart. Regarding the evolution of the premia in labor earnings of the head over the whole sample period, the most remarkable feature is the large drop in the tertiary education premium, which was around 115 percent in 1985 and 75 percent in 2000. The gender premium also falls substantially between 1985 and 2000, from 45 percent to 15 percent. Together with these drops, we find an important increase in the experience premium, from -10 percent in 1985 to around 30 percent in 2000. Finally, the variance of the residual of head earnings is decreasing.<sup>25</sup>

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<sup>25</sup>In Appendix D we also run Mincer regressions to look at the premia. The overall picture does not change much. However, the estimates reflect that unemployment differences across education groups partially account for the tertiary education premium. Also, changes in age and sex composition of the tertiary education group may have played a role in the decrease in the tertiary education premium. Finally, the dynamics of the experience premium are consistent with the unemployment rate being higher for young workers.

Figure 8: Labor earnings premia



The simultaneous increase in the experience premium and fall in the tertiary education premium seem to be in contradiction: education and experience are two different measures of skill, if returns to skill have increased over the period one would expect both premia to increase. However, following Katz and Murphy (1992), the changes in relative supplies of different types of workers together with a skill-biased demand shift may explain this. Figure 22 in Appendix C shows that the share of workers of different age groups in the workforce has not changed during the sample period. Hence, the increase in the experience premium must reflect a demand shift for this type of skill. Instead, Figure 22 shows a substantial increase in the supply of tertiary educated workers; this means that we may still have a college-biased demand shift that has not been large enough to offset the increase in supply. An alternative explanation is that there has been no skill-biased demand shift in Spain. If we measure experience not as age but as the sum of actual hours of work, the massive entrance of female workers into the labor force would imply a fall of experience despite the fact that the average age of the workforce has not change much. Then, the increase in the experience premium and the fall in the education premium would be just driven by supply factors. The first explanation would make Spain singular because the increase in the experience premium would be demand-driven instead of supply-driven, as it has been argued to be the case in the US and France by Wasmer (2001) and Jeong, Kim, and Manovskii (2008). The second explanation would make Spain special because of the absence of skill-biased demand shifts.

**To sum up.** The evolution of inequality in labor earnings between 1985 and 2000 in Spain is rather unique. While countries such as the US, the UK, Italy or Germany experienced increases of inequality of different sizes, the experience of Spain was a clear fall in inequality. In addition, it is also distinctive the fall in the tertiary education premium over the whole period. We find that part of this fall shall be attributed to the reduction in unemployment, which was affecting low skilled workers more than college educated ones. The fall in inequality was present in both tails of the distribution during the expansion years 1985-1992. However, the recession of 1993 implied a sharp increase in inequality mostly concentrated in the lower tail of the distribution. At least part of this was due to the large surge of unemployment. As the recession waned and the unemployment rate fell, inequality decreased again but only in the lower tail of the distribution. The reduction of inequality between 1985 and 1992 was partly generated by the reduction in the gender premium and the reduction in the tertiary education premium. In contrast, the experience premium increased over this same period.

### 4.3 Inequality in income at the household level

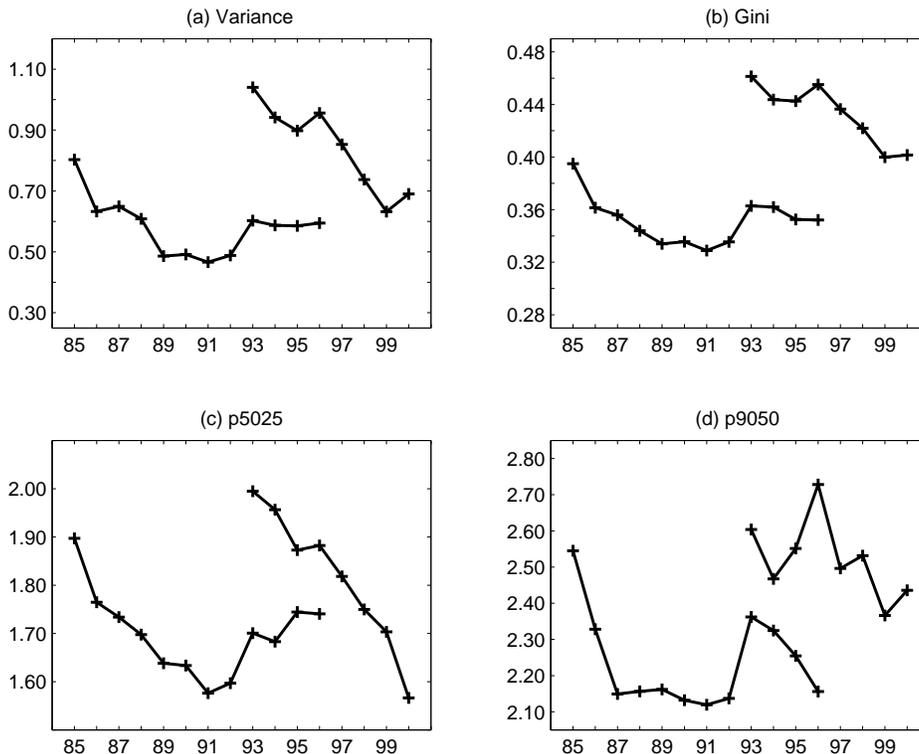
To describe the evolution of inequality at the household level, we start by aggregating labor earnings for all members of the household. We look at different versions of this variable. First, the raw data. Second, to account for differences in household size, we normalize household labor earnings by the OECD scale equivalences. And third, we decompose the variance of the equivalized data into different parts. For this decomposition we regress equivalized household labor earnings  $y_{i,t}$  against time dummies  $D_t$ , a vector of education dummies  $D_{i,t}^e$ , a vector of family composition dummies  $D_{i,t}^f$  and an age polynomial  $f_t(A_{i,t})$ ,

$$\ln y_{i,t} = D_t + \beta_t^e D_{i,t}^e + \beta_t^f D_{i,t}^f + f_t(A_{i,t}) + \varepsilon_{i,t}^y \quad (1)$$

Then, we look at the variance of the residual,  $var_t[\varepsilon_{i,t}^y]$ , the variance of the contribution of education,  $var_t[\beta_t^e D_{i,t}^e]$ , the variance of the contribution of family type,  $var_t[\beta_t^f D_{i,t}^f]$ , and the variance of the contribution of age,  $var_t[f_t(A_{i,t})]$ .

Figure 9 plots the evolution of different inequality statistics for equivalized household labor earnings. Both the variance of logs and the gini index display very similar patterns and mimic the trend of inequality in the earnings of the head. However, there is a noticeable difference in the level of inequality, which is higher in household earnings than in head earnings. As with the labor earnings of heads, the 50th-10th percentile ratio moves along with the variance and gini, which tells that changes at the lower tail are important. However, contrary to individual level data, the 90th-50th percentile ratio also moves along the gini and the variance of logs. In particular, the increase in inequality between 1992 and 1993 was not apparent in the upper tail of the earnings of heads but it is very sharp in the upper tail of labor earnings at the household level. One potential explanation is that only families at the very top of the distribution were not suffering the unemployment crisis, whereas families at the median may have had one of the family earners suffering unemployment for a while.

Figure 9: Inequality in equivalized household labor earnings

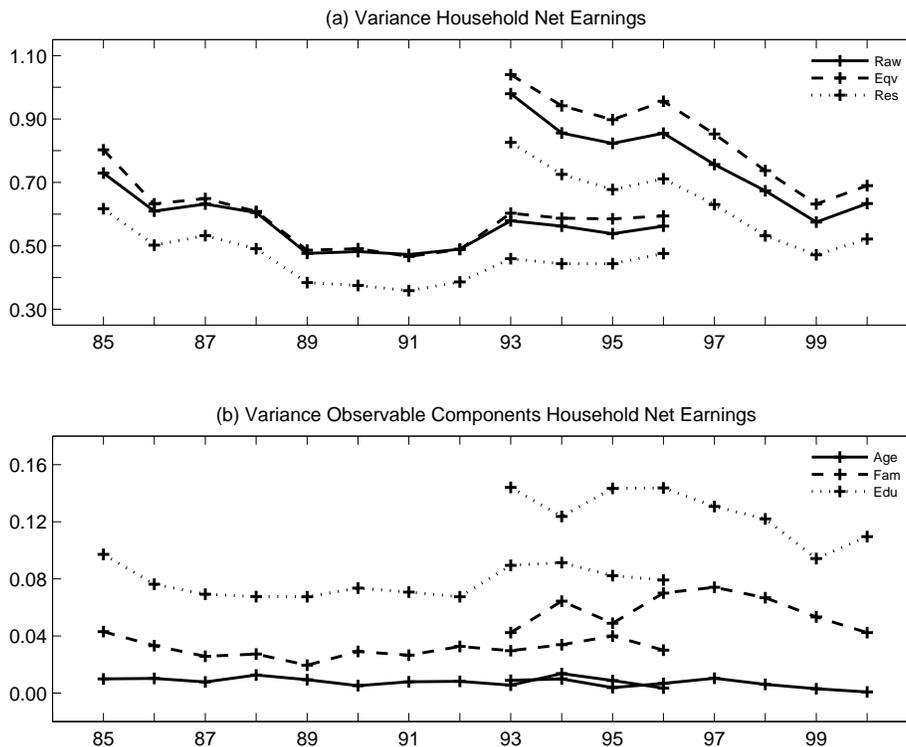


In panel (a) of Figure 10 we plot together the evolution of the variance of log raw earnings and the variance of log equivalized earnings (the series analyzed in Figure 9) for the two data sets. We find that the pattern described by the equivalized series is very similar to the pattern of the raw series, with the level of inequality measured with the raw earnings being slightly lower. Figure 10 also let us analyze the results of the decomposition of variance done with the regression described in equation (1). We observe that the variance of the residual component accounts for around 76 to 80 percent of total variance. Of the observable components, education of the head is the most important and it accounts for around 11 to 16 percent of total variance. Both the residual component and the education component track the pattern of inequality described by the equivalized series. Family composition and age are much less important, with their contributions to total variance fluctuating around 5 and 2 percent respectively.<sup>26</sup>

The decrease in the variance of the education component of earnings is consistent with the decrease in the tertiary education premium reported in Figure 8. However, the stability of the contribution of age to explain the variance of household earnings contrasts with the large increase in the experience premium that we reported above. The main reason for this discrepancy is that labor supply and labor earnings of spouses (and other

<sup>26</sup>Despite the difference in overall inequality between the two data sets, it is remarkable that the variance decomposition of equivalized earnings preserves the same proportion for each component across data sets.

Figure 10: Earnings inequality and its decomposition



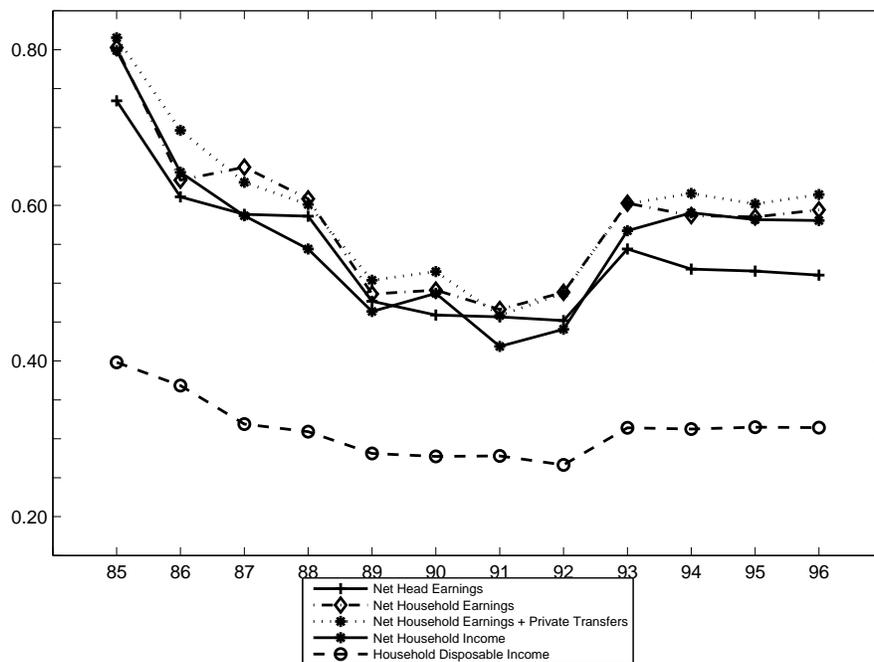
members of the household) may have increased more among households with young heads, which would compensate the larger labor earnings of older workers. This is a reasonable explanation because the increase in female participation has affected particularly the younger cohorts.<sup>27</sup>

Next, we examine how inequality in labor market earnings and inequality in other sources of income add up to inequality in household disposable income. We focus on a series of intermediate income variables: head net earnings, household net earnings, household net earnings plus private transfers, household net income (adding capital income), and finally, household net disposable income (adding public transfers, mainly unemployment benefits and disability and retirement pensions). Figures 11 and 12 plot the evolution of inequality (variance of the logs) for these series in the ECPF and the ECHP, respectively. In the next paragraphs we describe the effects of each income source in household inequality.

First, the level of inequality in household earnings is slightly higher than the level of inequality in head earnings for most of the periods. In the ECPF both series move together until 1993, when the gap starts increasing. In the ECHP the variance of earnings of the

<sup>27</sup>Other explanations may rely on the different categorization of age in the two different exercises. Although inequality between age groups 25-35 and 45-55 has increased, inequality within those age groups may have fallen. Indeed, we actually find a fall in inequality for workers within the age range 45-55 in the ECPF and a fall in inequality within age group 25-35 in the ECHP.

Figure 11: From individual earnings to household disposable income, ECPF



household is also above inequality in head earnings in the period 1993 to 1996. However, between 1998 and 2000 the inequality in the earnings of the heads and the inequality in the earnings of the household become identical. The relatively higher inequality of household earnings with respect to head earnings suggests that the earnings of the other household members become larger for households where the earnings of the head are already large. This may be due to the existence of some assortative mating which generates a positive correlation between the education of head and wife. This is specially important for Spain as the labor market participation for females is strongly related to education.<sup>28</sup>

Second, private transfers seem to be relatively unimportant: the series of household earnings with private transfers is extremely similar to the series of household earnings.

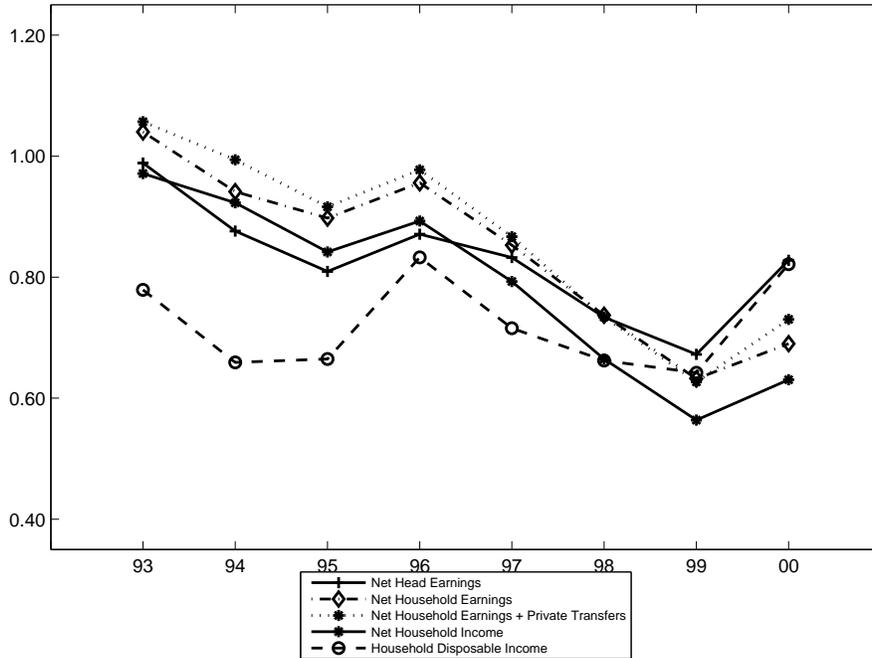
Third, the addition of financial income to build the series of household net income hardly changes anything in the ECPF: the level of inequality is slightly smaller and the trends are identical. The picture is not too different for the ECHP: the addition of financial income decreases household inequality only slightly.<sup>29</sup>

Fourth, public transfers are very important, at least until 1997. Adding them to household net income decreases the level of inequality about one third. In addition, the

<sup>28</sup>The convergence of household and head labor earnings inequality after 1998 may reflect the fact that the increase in female employment during the second half of the 90's has been more dramatic for women with secondary education.

<sup>29</sup>The evolution of inequality in household disposable income described in Figures 11 and 12 is consistent with previous findings. Oliver, Ramos, and Raymond-Bara (2001), using the ECPF, also document the fall in inequality until 1992, the increase in 1993 and the stability until 1996. Ayala and Sastre (2007), using the ECHP, also document the fall of inequality in household earnings between 1993 and 2000 and the stable pattern for inequality in household disposable income over the same period.

Figure 12: From individual earnings to household disposable income, ECHP



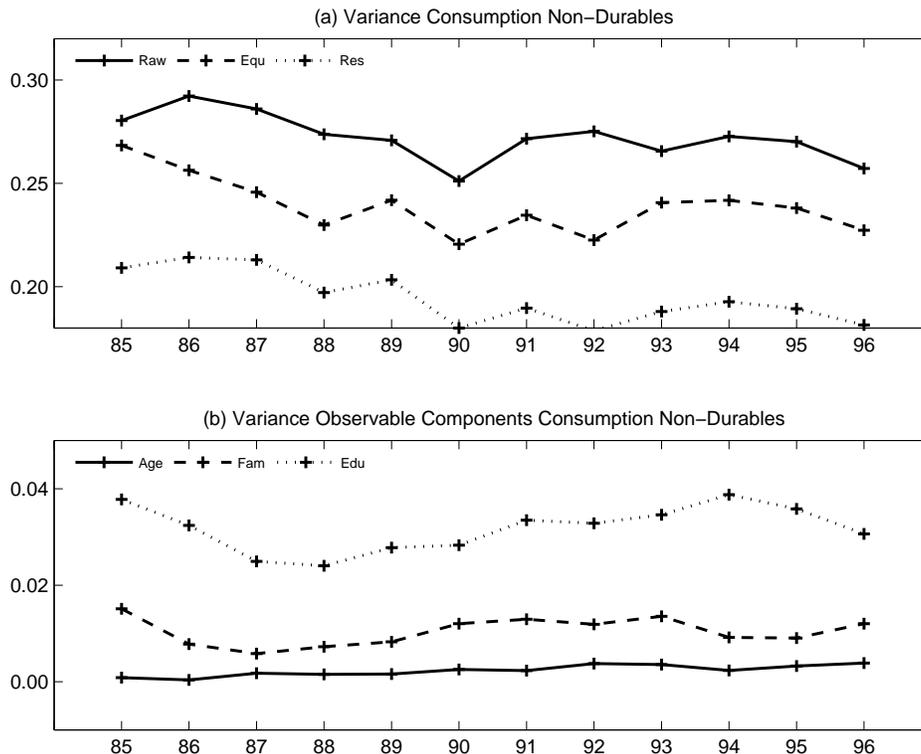
changes in inequality over time of net disposable income are milder than those of net income.<sup>30</sup> Finally, from 1998 onwards the level of inequality of net household income is not very different from the level of inequality of net disposable income.

As a final remark, one potential explanation for the observed decrease in income inequality may be given by the changes in the personal income tax code that we mentioned in section 2. Recall that all income data in both surveys are after taxes. For the ECHP we can assess the role of changes in the personal income tax codes because this data set reports both before and after tax income measures. In Appendix B.2 we look at these two income definitions in detail. We find that the evolution of inequality in individual labor earnings is almost identical for both series. Therefore, we conclude that the changes in the tax system cannot be a major explanation for the fall in inequality between Spanish households, at least between 1993 and 2000.

**To sum up.** The evolution of inequality in labor earnings at the household level and inequality of disposable income at the household level are not too different from the evolution of inequality in the earnings of heads. The most remarkable difference is that the increase in inequality of earnings at the household level in the recession of the early 90's did affect the upper tail: household earnings at the top percentiles increased with respect to household earnings at the median. This did not happen at the individual level. It is noteworthy that the family does not seem to have been a good insurance mechanism in Spain: inequality in labor earnings at the household level is not smaller than inequality

<sup>30</sup>There is a small exception in 1996 when, according to the ECHP, the peak of inequality in household disposable income is substantially more abrupt than the one for household income. This does not happen in the ECPF for the same year

Figure 13: Consumption inequality and its decomposition



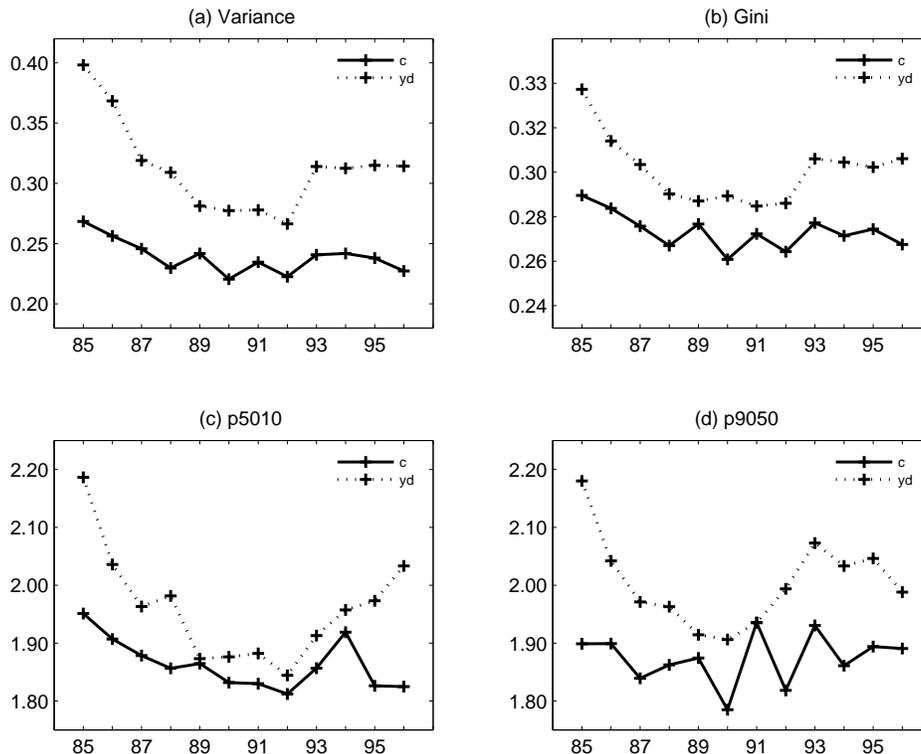
of labor earnings of heads. In addition, private transfers, which may largely come from other households related by blood, play a very minor role. Instead, government transfers are the most important income source in terms of reducing inequality between households, at least until the mid nineties.

#### 4.4 Inequality in consumption

We follow the evolution of inequality in non-durable consumption from 1984 to 1996 by use of the ECPF. In panel (a) of Figure 13 we report the variance of raw consumption, equalized consumption and residual consumption. In panel (b) of Figure 13 we report the variance explained by age, family composition and education.<sup>31</sup> We see a very small fall of around 2 percentage points in inequality of raw consumption. This fall is not uniform. Indeed, the variance of log consumption falls around 3 percentage points between 1985 and 1990. Then, there is a slight increase of consumption inequality until 1992 and finally it remains stable afterwards. The variance of equalized consumption follows a similar pattern with similar magnitudes in the changes. However, inequality in equalized consumption does not grow between 1990 and 1992, it increases in 1993 and remains stable afterwards.

<sup>31</sup>This decomposition is the same as in the analysis of household labor earnings.

Figure 14: From disposable income to consumption



The decomposition of the variance shows that residual variance is the most important component, accounting for around 80 percent of total variance. Among the observable components, education accounts for around 13 percent, family composition accounts for around 5 percent and age accounts for less than 1 percent. These figures are very similar to the ones found in the decomposition of the variance of equivalized disposable income. The evolution of inequality in equivalized consumption is largely driven by the residual component. Instead, the consumption variance due to observable components evolves somewhat differently.

In order to compare the fall in consumption inequality to the fall in household disposable income, in Figure 14 we plot together the measures of inequality for household disposable income and household equivalized consumption. The dispersion of income is larger than dispersion of consumption for all inequality measures. This means that changes in asset position are used to smooth out income fluctuations, so at least part of the heterogeneity in income is not permanent. Regarding the trends, the fall of inequality in income during the expansion years of the eighties and early nineties is substantially larger than the fall of inequality in consumption. This suggests that changes in inequality are largely driven by changes in the dispersion of the transitory component of labor earnings. We will discuss this issue further in Section 5.

Finally, concerning the recession of the early nineties, we find an increase of inequality in income that is also larger than the increase in consumption inequality. It is interesting to look at the lower tail of the distribution during the recession. The 50th-10th percentile

ratio of consumption increases as much as the one of disposable income. This suggests that at the low end of the distribution the income fall in the recession was very difficult to insure. We might think that this is because the unemployment shock was perceived as having permanent effects in life-time income or rather because households faced borrowing constrains. The second explanation may be more plausible because in 1995 the 50th-10th ratio of consumption falls again whereas the one for income keeps increasing.

**To sum up.** Consumption inequality fell between 1985 and 1996, but much less than household income inequality. All the reduction in consumption inequality is concentrated in the expansion years between 1985 and 1990. In 1991 and 1992, income inequality fell but consumption inequality did not. Then, consumption inequality increases with the recession in 1993 but it does not fall again as the economy recovers. This suggests that, while the economic expansion in the second half of the 80's managed to reduce somewhat permanent sources of inequality among households, the expansion of the second half of the 90's failed to do so.

## 5 Estimation of Stochastic Wage and Earnings Process

In the previous sections we have seen that residual or within skill inequality is a big component of total dispersion in hourly wages and household labor earnings. In this section we estimate a stochastic process for the residual component for both variables. The estimates of these processes may be useful to understand and interpret the trends in earnings and consumption inequality that we have described in previous sections. In addition, a stochastic process for individual hourly wages may be useful as an input for macroeconomic models that explicitly model the decision of hours worked at the individual level. The stochastic process for household labor earnings may be useful as an ingredient for models that abstract from the labor supply decision and take the household as its decision unit.

We assume the following stylized statistical model

$$\ln y_{it} = x'_{it}\psi_t + \alpha_{it} + \varepsilon_{it} \quad (2)$$

where  $y_{it}$  is a measure of income,  $x_{it}$  represents a vector of controls including year, age, family composition and education dummies,  $\psi_t$  represents a vector of time varying coefficients,  $\varepsilon_{it}$  represents the transitory component of the income innovations and  $\alpha_{it}$  represents the permanent component of the income innovations,

$$\alpha_{it} = \alpha_{it-1} + \eta_{it} \quad (3)$$

We assume that  $\eta_{it}$  and  $\varepsilon_{it}$  are *i.i.d.* across agents; that  $E(\varepsilon_{it}) = E(\eta_{it}) = 0$ ,  $E(\varepsilon_{it}^2) = \sigma_{\varepsilon t}^2$  and  $E(\eta_{it}^2) = \sigma_{\eta t}^2$ , and  $E(\varepsilon_{it}, \eta_{it}) = 0$  for all  $t$ ; that  $E(\varepsilon_{is}, \eta_{it}) = 0$  and  $E(\varepsilon_{is}, \varepsilon_{it}) = E(\eta_{is}, \eta_{it}) = 0$  for all  $s \neq t$ . So we allow both the variance of the transitory component and the variance of the permanent shock to be time-varying.

Let's define,

$$g_{it} = (\ln y_{it} - x'_{it}\psi_t) - (\ln y_{it-1} - x'_{it-1}\psi_{t-1}) \quad (4)$$

Then we compute the autocovariances of  $g_{it}$  in our sample and use them to estimate  $\sigma_{\eta t}^2$  and  $\sigma_{\varepsilon t}^2$  by GMM.<sup>32</sup>

## 5.1 The ECHP

We use our sample of heads (sample 2) to estimate the stochastic processes for hourly wages and individual earnings in the ECHP. The proposed stochastic process is adequate at the annual frequency because typically, if one takes the growth rate of the income residual, the autocovariances of second order and above are not statistically different from zero.<sup>33</sup> We evaluate whether our data from the ECHP conforms to this statistical model. In Table 1 we provide the unconditional autocovariances by year up to order seven (the maximum that is possible to estimate with our data) and their standard errors.<sup>34</sup> We do so for both head’s wage and household earnings. We find that the covariances of order  $j = 0$  and  $j = 1$  are clearly statistically different from zero. Autocovariances at the second order and beyond are not statistically different from zero, with the exception of the autocovariances at the second order for the household earning and the fourth order for the head’s wage.

Table 1: Autocovariances of the unexplained growth

Order	Head wage		Household Earnings	
0	0.0773	(0.0015)	0.4769	(0.0123)
1	-0.0311	(0.0011)	-0.1645	(0.0088)
2	-0.0007	(0.0010)	-0.0192	(0.0070)
3	0.0006	(0.0012)	-0.0005	(0.0080)
4	-0.0024	(0.0013)	0.0014	(0.0082)
5	0.0019	(0.0017)	-0.0100	(0.0112)
6	-0.0017	(0.0024)	0.0150	(0.0175)

Standard errors are reported in parenthesis.

Next, we estimate the processes for wages of the head and for labor labor earnings of the household, and we plot them in Figure 15. Recall that wages are computed using monthly earnings whereas household earnings are computed using annual variables. Regarding the process for the head’s wage, we find that both the variance of the transitory and permanent shocks are small in size and steady until 1996, with the variance of the

<sup>32</sup>The variance of the permanent component in the first sample period,  $\sigma_{\eta 0}^2$ , is not identified. In addition, the variance of the transitory component in the first sample period,  $\sigma_{\varepsilon 0}^2$ , and the variance of the permanent component in the second sample period,  $\sigma_{\eta 1}^2$ , are not separately identified. The same happens with the variances of the permanent and transitory component of the last sample period,  $\sigma_{\varepsilon T}^2$  and  $\sigma_{\eta T}^2$ . We follow the standard practice of assuming  $\sigma_{\varepsilon 0}^2 = \sigma_{\varepsilon 1}^2$  and  $\sigma_{\varepsilon T}^2 = \sigma_{\varepsilon T-1}^2$  in order to yield identification.

<sup>33</sup>Abowd and Card (1989) and more recently Meghir and Pistaferri (2004) find instead that, for annual earnings, the second autocovariance is also different from zero with PSID data. However, as these articles show, it is easy to accommodate the process above by just allowing an MA(1) term in the transitory component.

<sup>34</sup>We follow the standard methods described in Abowd and Card (1989).

transitory shock being larger. However, the variance of the transitory component shows an increasing trend starting in 1996, whereas the variance of the permanent shock becomes more volatile but still without a clear trend. Concerning the process for household earnings, the variance of the transitory and the permanent components are of similar size.<sup>35</sup> Both present a smooth decreasing trend over the period, which is slightly more pronounced for the permanent component. In the case of the permanent component the decrease is concentrated between 1993 and 1996, what could be driven by the reduction in unemployment that happened after 1993. If this is the case, it seems that the reduction in unemployment affected the permanent component of earnings as well as its transitory component, in particular during the first years of recovery. This suggests that there are human capital losses associated to unemployment spells and that the focus of public policies should not be only in terms of unemployment insurance but also in terms of human capital formation of the unemployed. However, as a word of caution, the fall in the dispersion of shocks to household earnings does not appear with the ECPF data (see next sub-section) and the fall in the permanent component of earnings between 1993 and 1996 is inconsistent with the stable consumption inequality over the same period.

## 5.2 The ECPF

With the ECPF we cannot estimate a process for hourly wages. We estimate instead a process for labor earnings of the head with sample 2 as well as processes for labor earnings of the household and disposable income for the household with sample 1. We need to estimate these processes at a quarterly frequency. The ECPF follows households up to 8 quarters. If we aggregated our quarterly data at the annual level, we would lose most of our panel dimension since we would end up with at most two yearly observations per household. With quarterly data we can build 7 observations of residual wage growth  $g_{it}$  per individual. It is not clear that the proposed income process suits well quarterly level data since at this frequency the growth of income residuals tends to be autocorrelated at higher lags than  $j = 1$ . We however proceed with this specification and refer the reader to Albarran, Carrasco, and Martinez-Granado (2007) for a more complete estimation using a different sample of the ECPF.<sup>36</sup>

Figure 16 plots the results. Regarding the levels, for the three variables the dispersion of the transitory component is larger than the dispersion of the innovations in the permanent component. This is particularly acute for household disposable income. Regarding the trends over the period, the three variables display a similar pattern. The variance of

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<sup>35</sup>The dispersion of the shocks to household earnings is much larger than the one of the shocks to wages. This is because the dispersion in the labor earnings definition at the annual level is much larger than the dispersion in labor earnings at the monthly definition. See Appendix B.2 for details.

<sup>36</sup>Albarran, Carrasco, and Martinez-Granado (2007) report that residual income growth is autocorrelated until the 5th lag. We also estimate the autocovariances of  $g_{it}$  and their standard errors for every year. Our estimates (not reported here) show that autocovariances of order 0 and 1 are strongly significant for every year, while the rest of autocovariances are non-significant for some years and significant for some others. However, when they are significant, their point estimate is one order of magnitude smaller than the one for the autocovariance for  $j = 1$ .

Figure 15: Estimated coefficient of the stochastic wage and income process, ECHP

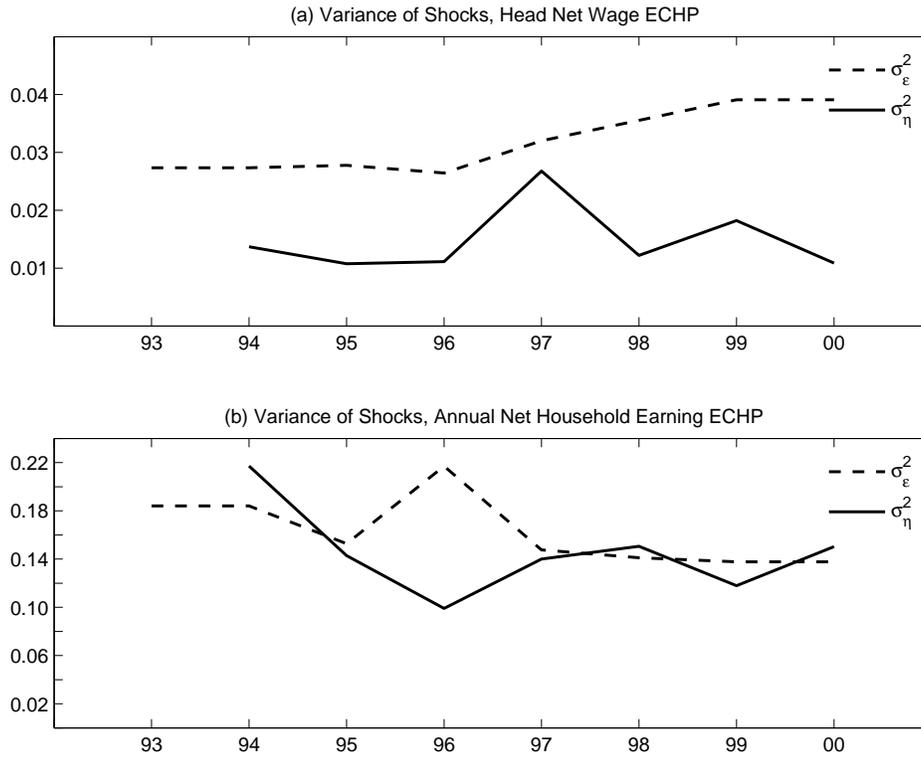
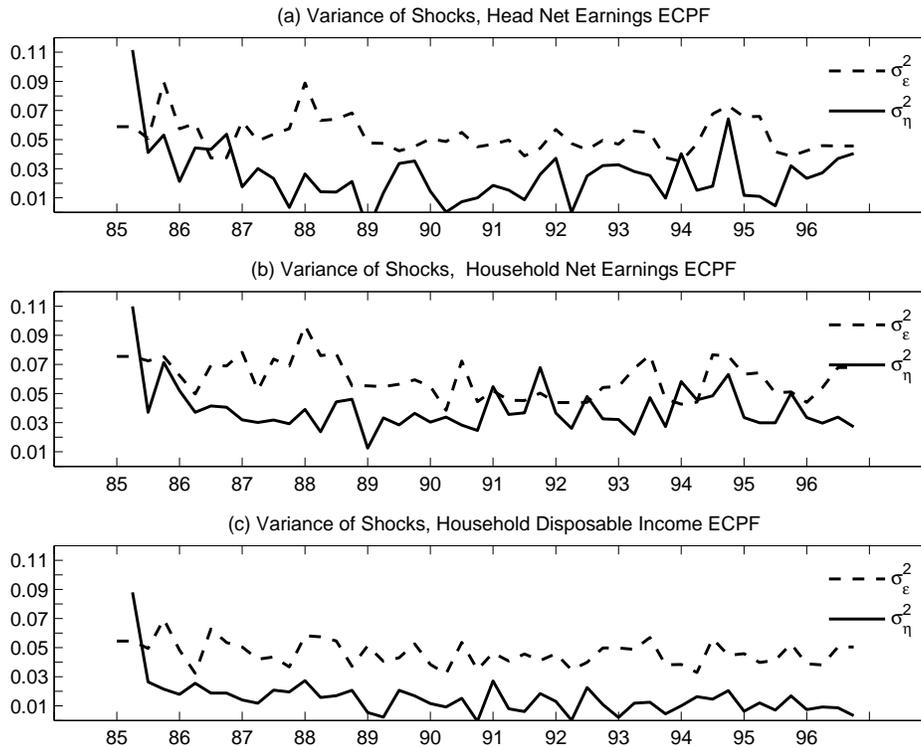


Figure 16: Estimated coefficient of the stochastic income process, ECPF



innovations of the permanent component falls sharply during the economic expansion of the second half of the 80's, but this decrease stops in the first quarter of 89. Then, it remains stable, for household earnings and disposable income and it increases slightly for head earnings. The variance of the transitory component does not change much.<sup>37</sup>

These results are consistent with some of our findings in previous sections. In particular, consumption inequality only falls between 1985 and 1990 and our estimates show that the permanent component of earnings falls only during this same period. However, the sharp decrease in the permanent component of earnings or income seems a little bit inconsistent with the mild fall of inequality in consumption. There are different ways to think about this. First, maybe the parsimonious description of the income process is too simple and we would need to model the transitory shock with a longer lag structure.<sup>38</sup> Second, we may think that the permanent transitory decomposition identified with income data alone is not good enough. A solution would be to use the moments of consumption growth as Blundell and Preston (1998) to help identify permanent and transitory shocks.<sup>39</sup>

## 6 Life-Cycle Profiles

In order to characterize how the dispersion of different variables changes as households age, we have to face the standard problem of disentangling age effects, cohort effects and year effects. We follow in this respect Heathcote, Storesletten, and Violante (2005) who ignore alternatively cohort effects and year effects and then analyze the age profiles of our statistics of interest under both cases. Let's define  $M(a, y)$  as our statistic of interest computed for individuals of given age  $a$  in a given year  $y$ . We can analogously define  $M(a, k)$  as the same statistic computed for individuals of age  $a$  and cohort  $k$ . For our analysis we will consider of age  $a$  all individuals whose age is in the interval  $[a - 2, a + 2]$ . For the cohorts we will consider five-year intervals for the year of birth. Then, to obtain the age profiles controlling for year effects we regress  $M(a, y)$  against a full set of year

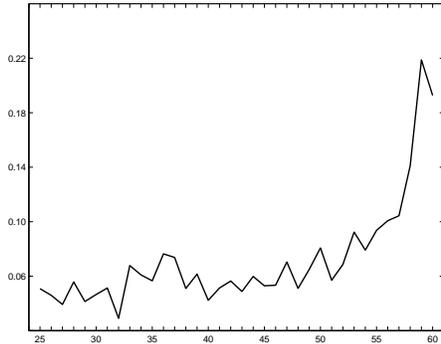
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<sup>37</sup>As indicated before, the identification of the large variance of the permanent component in the second quarter of 1985 relies on imposing the assumption that the variance of the transitory component in the first and second quarters of 1985 are identical. If we did not make this assumption, our first identified variance of the permanent component would be for the third quarter of 1985. In that case, we would still observe a fall of variance of the permanent component during the second half of the eighties, but of much smaller size.

<sup>38</sup>Indeed, Albarran, Carrasco, and Martinez-Granado (2007), also using the ECPF, do allow for a longer lag structure in the transitory shock and use consumption data to separate the persistent and transitory components. However, they find an increase in the permanent component of income over the sample period.

<sup>39</sup>An alternative explanation may be that Spanish households cannot insure transitory shocks very well. Notice that for household disposable income, the permanent component represents a small part of overall uncertainty. If transitory shocks are difficult to insure, then part of the overall dispersion in consumption inequality also comes from transitory shocks and hence the decrease in the permanent component of earnings shocks decreases little the dispersion of consumption. However, preliminary results in Casado (2009) suggest that Spanish households do insure very well against transitory shocks (whereas only 1/4 of permanent shocks do not get transmitted to consumption). This is similar to what Blundell, Pistaferri, and Preston (2008) find for the US.

Figure 17: Fraction of head participants who report zero earnings, ECHP



dummies and age dummies or a polynomial on age. To obtain the age profiles controlling for cohort effects we regress  $M(a, k)$  against a full set of cohort dummies and age dummies. In this section we focus only on the results ignoring cohort effects. In Appendix E we also provide the results ignoring year effects, which have very similar implications. For the life cycle analysis we do not mix our data sets. In Section 6.1 we use sample 2 of the ECHP to describe the evolution over the life-cycle of the dispersion in hourly wages, the dispersion in hours, the correlation between these two variables and the dispersion in monthly earnings. In Section 6.2 we use samples 1 and 2 of the ECPF to describe the evolution over the life-cycle of the dispersion of different household level income and consumption variables as well as individual labor earnings.

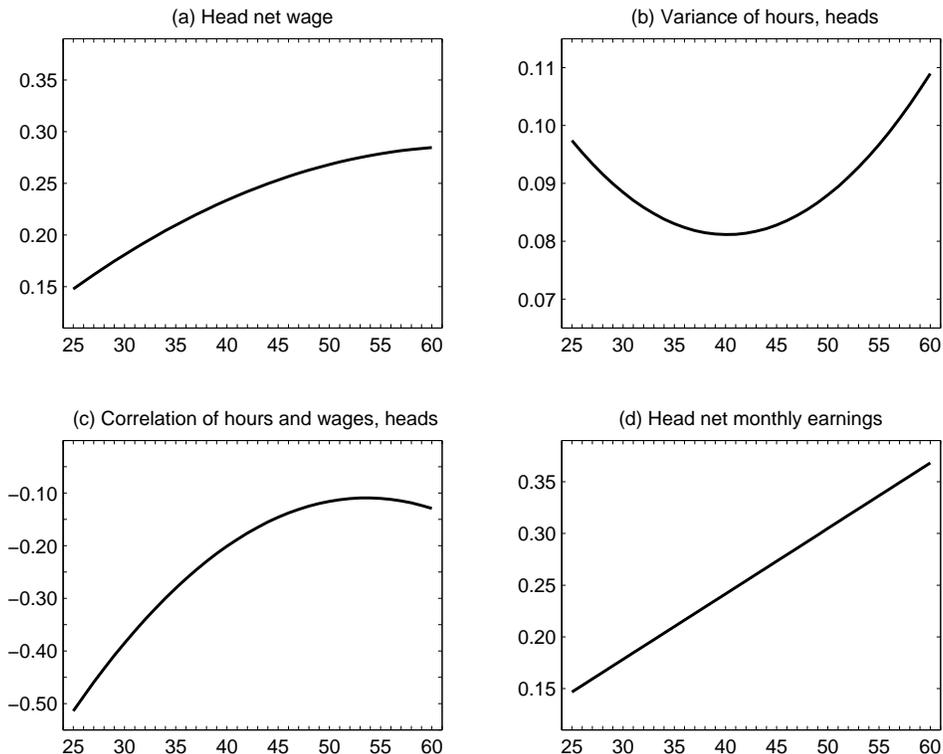
### 6.1 Inequality in hourly wages and labor supply

In this sub-section we use sample 2 of the ECHP to report the life-cycle profiles for the dispersion in hourly wages, hours of work, labor earnings and the correlation between wages and hours. To be consistent with our definition of hourly wages, our definition of labor earnings is going to be the monthly measure. Note that the large incidence of unemployment and its different impact at different ages (see Figure 17) make us think that selection may play a role in the observed profiles for wages, hours and earnings. In particular, from age 55 onwards there is a large increase in the fraction of heads who report zero earnings that is very notorious at age 58. This may be related to the fact that workers who get unemployed at age 58 or older may not have incentives to work again as the public unemployment insurance system (that provides an unemployment benefit up to two years) pays their corresponding contribution to the pension system to qualify for early retirement at age 60.<sup>40</sup>

Regarding the life-cycle profile of the variance of the head's wage, panel (a) in Figure 18 shows that it increases around 14 percentage points between ages 25 and 60, with

<sup>40</sup>In fact, using data from the LFS 1993-2000, we also find that male unemployment rate increases at the end of the life-cycle, in particular it goes from 9% at 45 to 14% at 59, decreasing then to around 10% at age 60 as some people get retired.

Figure 18: Inequality over the life-cycle controlling year effects, ECHP



the overall profile being slightly concave. Two interpretations may be given to such profile. First, labor market shocks have less than unitary persistence. Alternatively, we may think that the selection process that increases the fraction of heads reporting zero earnings from age 50 shapes the profile, that would show linear growth otherwise. This should be the case if heads at the tails of the distribution are those who exit the labor market earlier. Then the profile would be consistent with a unit root for the persistent shock once selection is taken into account. In panel (b) Figure 18 we see that the age profile for hours is U-shaped, which means that the heterogeneity in hours for young heads decreases as they age, but then in the mid 40's dispersion starts to increase. Note that since our definition of hours is usual weekly hours this is completely unrelated to unemployment, except perhaps for the selection of which individuals are included in the sample. The correlation of hours and wages, which is reported in panel (c) of Figure 18, is negative, as in section 4.1, even once we condition on age. This is important because it shows that the negative correlation between wages and hours found in the cross-section is not an artifact of the life-cycle: in principle, if old workers (who have higher wages on average) work less hours than young workers a negative correlation could appear. The correlation increases sharply with age, at least until age 50 and falls a little after that. In contrast, the age profile of the correlation between hours and wages in countries such as UK is U-shaped. This is consistent with the interpretation that Spanish workers use labor supply as an insurance mechanism. In presence of borrowing constraints, the only way for a young worker to smooth consumption when facing bad shocks is by working

longer hours. As workers age, they accumulate assets and make lesser use of hours of work as a tool for smoothing consumption and hence hours track wages more closely. A potential explanation for the fall in the correlation for older workers can be found in the social security system. Pension benefits are a function of the contributions over the 8 years prior to retirement.<sup>41</sup> Individuals with low wages at the end of the life-cycle may find it profitable to work harder in order to qualify for a higher pension upon retirement. Finally, in panel (d) of Figure 18 we see that the variance of monthly earnings of the head increases linearly with age, around 20 percentage points until age 60. Before age 50, the profile is steeper than the one for wages as a result of the increasing correlation of wages and hours along the life-cycle (and in spite of the slight decrease in the variances of hours). Furthermore, the constant growth rate of the monthly earnings profile after age 50 contrasts with the decreasing growth rate of the wage profile and the decreasing correlation profile, and it seems to be driven by the increase in the variance of hours.

## 6.2 Inequality in income and consumption

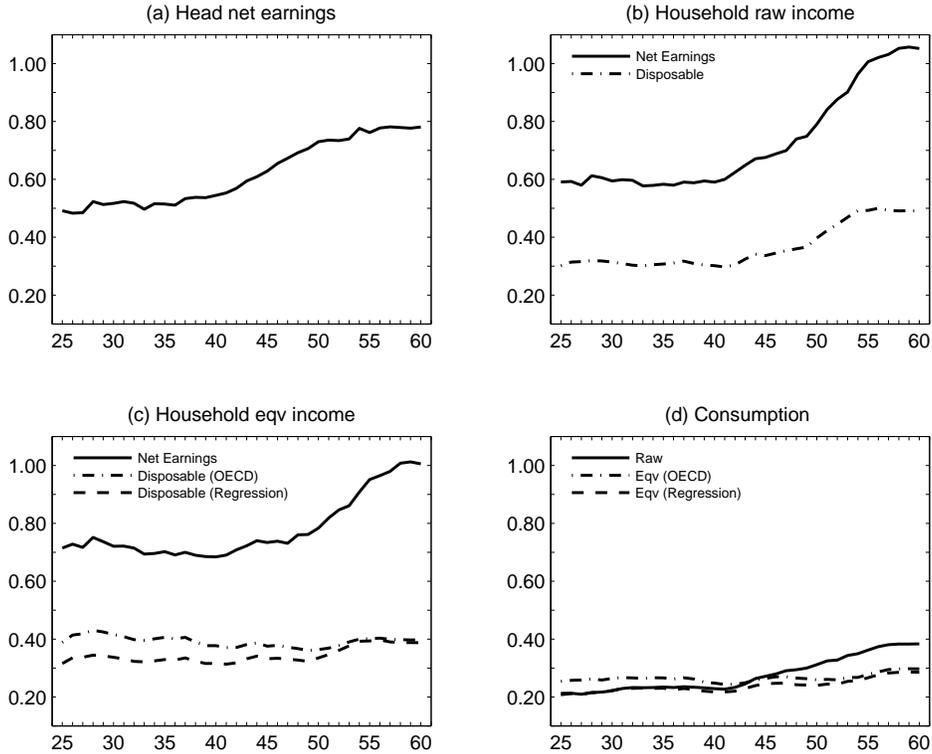
In this section we use our samples of heads and households from the ECPF to characterize, between 1985 and 1996, the evolution of inequality in individual labor earnings, household labor earnings, household disposable income and household consumption. In panel (a) of Figure 19 we plot the age profile for labor earnings of the head. We find that dispersion increases monotonically over the life cycle, with the total increase around 30 percentage points. In panel (b) we plot dispersion in household labor earnings and in household total disposable income. Dispersion in household labor earnings behaves very similarly to dispersion in labor earnings of the head, with a larger increase of around 40 percentage points that seems to happen in the latter part of the life cycle. Dispersion in disposable income, however, is much lower and grows less, around 20 percentage points. This suggests that financial and public incomes serve to smooth out both permanent and transitory components of dispersion in the labor market.

In panel (c) we report again dispersion in household labor earnings and disposable income, but for the variables equivalized by the OECD scale. Dispersion in equivalized household labor earnings grows around 10 percentage points less than dispersion in raw earnings. Dispersion in the equivalized measure of household disposable income remains basically constant over the life cycle. The smaller growth of inequality in equivalized household earnings is mainly due to the fact that, for young households, the level of inequality of equivalized household earnings is larger than the level of inequality of raw earnings. This may be partly explained by the negative correlation between female labor supply and the number of children. The absence of growth of inequality in equivalized household disposable income may be understood by noting that, for old households, the level of inequality of equivalized disposable income is lower than its raw counterpart. This may be related to the fact that at advanced ages there is a positive correlation between household size and the number of household members contributing to the household bud-

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<sup>41</sup>In 2002 this changed to 15, but individuals in our data set that are at the end of the life-cycle are not affected by this reform.

Figure 19: Inequality over the life-cycle controlling year effects, ECPF



get: household members other than the main couple tend to be their retired parents who receive a retirement pension.

Finally, in panel (d) we plot the evolution of inequality in consumption and equivalized consumption. Dispersion in consumption grows little until age 42 and then it increases markedly for an overall increase of around 17 percentage points. Instead, when we equivalize consumption with the OECD scale, the growth of inequality is smaller, around 4 percentage points. Additionally, we consider an alternative definition of equivalized consumption by regressing out the number of adults and children.<sup>42</sup> We report this age profile in panel (d) of Figure 19. This alternative measure of equivalized consumption increases 8 percentage points, with most of the increase happening in the second part of the life-cycle.<sup>43</sup> Therefore, regarding consumption we have different patterns depending on how

<sup>42</sup>OECD equivalences of scale are an arbitrary way to capture increasing returns in consumption at the household level due to the fact that some consumption goods are public at the household level. Different consumption bundles in different countries may be subject to the increasing returns at different rates. Moreover, the standard OECD scale may be a good approximation for households of small size but it may be bad for households of larger size. In our sample there is a lot of heterogeneity in household size, with some households being comprised of several adults (in Spain, young adults live with their parents for many years and when the young adults leave home it is the old grandparents who go in). For this reason we consider an alternative way of controlling for household size in consumption. We regress our measure of log raw consumption against linear and quadratic terms in the number of adults and the number of kids. Then, we define equivalized consumption as the residual of this regression.

<sup>43</sup>For comparison, we also define a second measure of equivalized household disposable income by

we control for household size: a growth of 17 percentage points for raw consumption, a growth of 8 percentage points for consumption equivalized by our regression and a 4 percentage increase for consumption equivalized by the OECD scale.

How can we interpret these graphs in terms of the structure of income uncertainty? All the definitions of labor earnings coincide in showing increasing dispersion over the life-cycle. Following MaCurdy (1982) we can interpret this as evidence in favor of the existence of persistent shocks to labor earnings. As discussed by Storesletten, Telmer, and Yaron (2004), the properties of the stochastic process are revealed by the curvature of the age profile: when it is concave it means less than unitary persistence, whereas when it is linear it suggests the existence of a unit root. Our profiles are convex. There are two ways of rationalizing this. First, it can be that innovations are heteroskedastic, with variance increasing after age 42 or so. Second, it can be that the persistence of shocks is very weak until age 42 and it becomes stronger afterwards. This second interpretation would be consistent with the view that long-term unemployment in Spain was specially severe for older workers.<sup>44</sup> Under the view that labor earnings shocks are important, the profiles of consumption reveal information on their insurability. We observe that inequality in consumption grows over the life-cycle, but it does so at a lower rate than inequality in earnings. Following Deaton and Paxson (1994), we can interpret this as evidence of imperfect insurance of the shocks.

There is however an alternative interpretation for the increasing variance of labor earnings. Lillard and Willis (1979) first suggested that the increase of earnings inequality over the life cycle may be due to permanent differences in the rate of growth of earnings. Of course, if these differences are perfectly known to individuals and there are no strong credit constraints, then consumption inequality should not change with age. However, Guvenen (2007) argues that people may not know their own rate of growth of earnings. Then, if people learn about it as income realizations unfold, the age-profiles of consumption will be increasing and convex.

## 7 Conclusions

In this article we explore the evolution of inequality in Spain along several dimensions for the period 1985-2000. The clearest finding is that inequality in individual labor earnings in Spain has decreased substantially, with the decrease in the college premium being the main observable factor behind this fall. In addition, the substantial decrease in unemployment

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taking the equivalence of scale obtained through regression in consumption and applying it to household disposable income. We report inequality of this second equivalized measure of household disposable income in panel (c) of Figure 19.

<sup>44</sup>A potential third explanation would be sample selection. Among young workers, only those who receive good shocks leave their parents home and become household heads, whereas those who receive bad shocks stay with their parents and do not enter a sample of heads. However, if this argument was true, one would expect the increase in variance to start around age 30 or so, when most males are already household heads independently of their labor market history. In addition, the convex profile also arises in samples of individuals, like sample 3 in the ECHP (not reported here).

from around 24 percentage in 1985 to 13 percentage in 2000 drives a hefty increase in the incomes at the lower tail of the distribution. Part of the fall in the tertiary education premium is due to this reduction in unemployment, which affected differently different education groups. Inequality in household disposable income has followed the same trend, but with a smaller drop and milder fluctuations. Two things are worth mentioning with respect to household disposable income. First we find that all along the period public transfers play a crucial role in smoothing out the inequality arising in the labor market. Second the Spanish family does not seem to have been an important insurance mechanism. Inequality of labor earnings at the household level is larger than at the individual level, and private transfers between households have a very minor impact in inequality reduction. Finally, concerning household consumption, inequality has fallen less than inequality in household disposable income, with the decrease mostly concentrated in the second half of the eighties, when, according to our estimates, the decrease in income inequality seems to be driven by permanent sources.

Focusing on the different stages of the business cycle, we find that the economic expansions between 1985 and 1992 and then the one that ranges from the mid 90's to the end of our sample period in the year 2000, brought a clear reduction of inequality between households. Inequality in labor earnings of workers fell and so did inequality in disposable income at the household level, albeit to a lesser degree. The fall in inequality in labor market earnings can be related to two observable changes: the decrease in the incidence of unemployment and the fall in the college premium, with the difference in the average annual earnings of workers with a college degree and the rest of workers shrank 40 percentage points during the period. The simultaneous increase in the experience premium attenuated the effect on inequality. Then, the recession of 1992 and 1993 witnessed increases in inequality for all variables, mainly as a result of the increase in unemployment.

Finally, when we look at the evolution of inequality over the life cycle we find an increase in inequality of annual household net earnings, which is stronger after the mid 40's, and also a much smaller increase in inequality of household disposable income. Raw consumption inequality increases quite dramatically from age 40, although equivalized consumption shows a much flatter pattern. We provide two alternative interpretations for the increase in earnings and consumption dispersion over the life cycle. First, shocks to earnings become either more volatile or more persistent during the second half of the life-cycle. Second, the existence of pre-determined differences in the rate of growth of earnings that workers do not know and learn about them as new income shocks unfold. Finally, heterogeneity in household size at the end of the life-cycle seems to play an important role in explaining the increase in raw consumption inequality.

After collecting all these facts, several questions remain open. First, the fall in the tertiary education premium is at odds with the experience in other countries. Does this mean that no skill-biased technical change took place in Spain? The increase in the experience premium at a time in which the age composition of the labor force did not change too much suggests the existence of some skill-biased demand shift happening in Spain. The simultaneous increase in the supply of college workers may have compensated this demand shift and hence the returns to college education have fallen. However, it

would be interesting to explore this issue in more detail and learn about the size of the demand shift for skilled workers and check whether other explanations may also be valid. For instance, despite the fact that the age composition of the labor force has not changed much, the massive entrance of female workers suggest a fall of a more accurate measure of experience because females work fewer hours. With a fall in the supply of experience is not clear that we can interpret the increase in the experience premium as coming from an increase in the relative demand for skilled workers.

Second, the larger inequality in household labor earnings than in individual labor earnings suggests that the Spanish family is not a good insurance mechanism against labor market uncertainty. Why is so? Is this just because of assortative mating and higher participation rates of more educated women? Or are labor earnings shocks correlated among spouses? Finding out about this is a key ingredient to understand how uncertainty in the labor market affects welfare.

Finally, the fall in the variance of permanent shocks in the second half of the 80's is consistent with the observed fall in the variance of consumption during the same period. However, the fall in consumption inequality seems far too small compared to the fall in the variance of permanent shocks. Further research is needed to reconcile these findings.

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## A Appendix: variable definitions

Income variables come net of taxes and social security contributions. All income and consumption variables are deflated with the Consumer Price Index and reported in 1995 euros.

### A.1 The ECPF

The following list refer to the variables used in both sample 1 and sample 2. For sample 1, household income variables refer to the sum of the corresponding variable over all household members.

- Net labor earnings: earnings from dependent work plus two thirds of earnings from personally-owned business
- Net labor earnings plus private transfers: we add private transfers to the previous series
- Net income: we add capital income, which includes one third of the earnings coming from personally-owned businesses
- Total net disposable income: we add public transfers such as unemployment benefits and retirement and disability pensions
- Consumption: we use expenditure in non-durable consumption goods and services. In particular, there are more than 300 different items that can be grouped in nine categories:
  1. Food, beverages and tobacco
  2. Clothing and shoes
  3. House utilities, such as heating, electricity and water
  4. Goods and services for the house, such as cleaning products
  5. Medical expenditures
  6. Transport
  7. Entertainment and culture
  8. Other goods and services, such as hotels and restaurants
  9. Other expenditures

## A.2 The ECHP

Sample 1 (households):

- Net labor earnings: household's total net income from work (wage and salary earnings plus self-employment income) in year prior to the survey (hi110).
- Net labor earnings plus private transfers: we add private transfers (hi123) to household's labor earnings.
- Net income: we add net household capital income (hi121) and net property/rent income (hi122) to household labor earnings plus private transfers.
- Net disposable income: we add public transfers (hi130: unemployment benefits, disability, retirement pensions and other public transfers) to household's net income.

Samples 2 and 3 (heads and individuals)

- Annual labor earnings: individuals's total net income from work (wage and salary earnings plus self-employment income) in year prior to the survey (hi110).
- Monthly labor earnings: total net monthly wage and salary earnings in current year (pi21m). Note that monthly earnings refer only to labor earnings obtained as an employee, which excludes any income from self-employment.<sup>45</sup>
- Hours worked: total number of hours worked per week in main an additional jobs (pe005).
- Wage: monthly labor earnings divided by weekly hours multiplied by 4.3 (pi21m divided by pe005 times 4.3).

Note that to construct hourly wages in samples 2 and 3 we do not use annual labor earnings in the previous year but monthly earnings in the month before the interview takes place. The reason for this is that the ECHP only reports information for hours as the usual weekly hours in the previous month. This choice ensures a much less noisy measure of hourly wages and avoids creating a too large division bias for the correlation of hours and wages. However, it is not without problems. First, the time scope of the income definition used to construct annual earnings in samples 1 and 2 is different from the one used to construct hourly wages (monthly earnings). And second, the monthly earnings refer only to labor earnings obtained as an employee, which excludes any income from self-employment. See Appendix B.2 for a comparison between inequality of annual earnings and monthly earnings.

Education in the ECHP is the highest level of general or higher education completed (pt022). There are 3 categories for this variable that use the The International Standard

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<sup>45</sup>See Appendix B.2 for a comparison between inequality of annual earnings and monthly earnings.

Classification of Education (ISCED) designed by UNESCO: 1: those with education level of ISCED 5-7, 2: those with education level of ISCED 3 and, finally, 3: those with education level ISCED 0-2. So first level closely corresponds to the college graduate in the US categorization, although those with ISCED 5 are not college graduated. The second level corresponds to the high school graduates in the US categorization and the third level to dropouts.

## **B Appendix: Robustness**

In this appendix we provide some comparisons of inequality when we change the household head definition or when we consider alternative definitions of earnings.

### **B.1 Definition of household head**

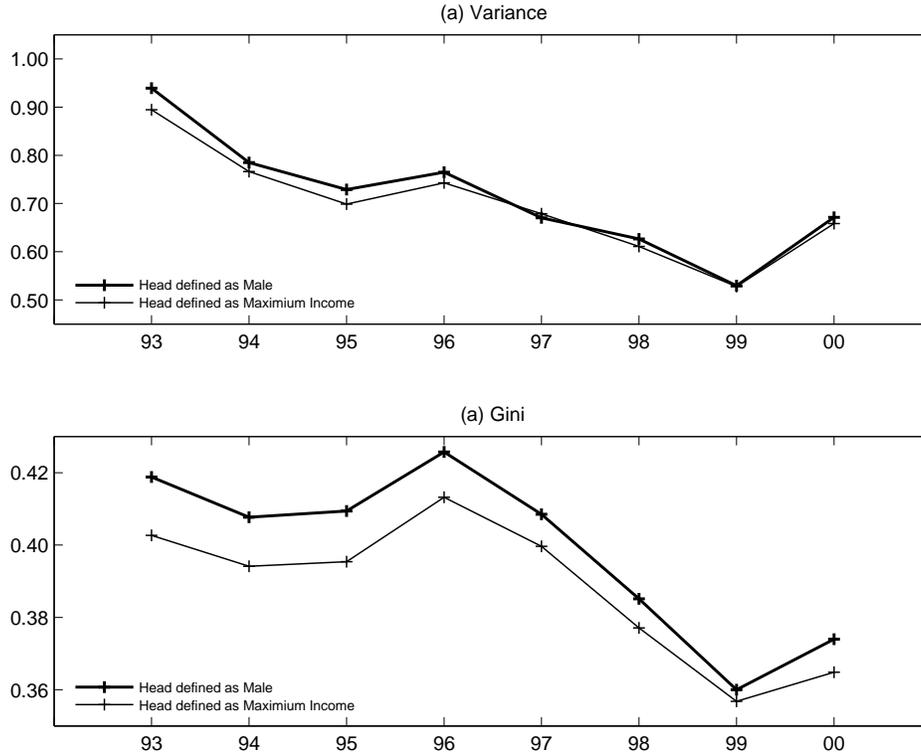
Throughout our analysis, in households with more than one adult we have defined the head as the adult with the highest regular income. This is a slightly different definition from the more common one, which takes as the head the oldest male in the household. Our definition allows us to use the education information for the whole period of study and we argue that it does not have strong implications regarding the pattern of inequality. To see this, in panel (a) of Figure 20 we show that both the level and trend in the variance of log earnings of the household head are similar with the two alternative definitions of the head. In panel (b) of Figure 20 we observe that the same is true for the Gini index.

### **B.2 Different earnings definitions in the ECHP**

The main income measures in the ECHP are annual and net of taxes and refer to the year previous to the interview. However, the ECHP also reports labor earnings in the month previous to the interview and for this measure there is a version before taxes as well as a version after taxes. In our analysis, we have used the annual net income measures for samples 1 and 2 and the net monthly earnings to compute wages in samples 2 and 3. In this Appendix we go through a comparison of these alternative variables.

In panel (a) of Figure 21 we plot the variance of logs of annual earnings after taxes and monthly earnings after taxes. As shown, inequality of annual earnings is much higher than inequality of monthly earnings, although the gap closes along time. There are several reasons for this. First, the variable for monthly earnings does not include earnings from self-employment. As self-employment income shows a much higher inequality than income for employees this difference should create more inequality for the series of annual earnings. Second, unemployment spells shorter than a year and longer than a month reduce annual earnings but not monthly earnings. This creates more inequality in the variable of annual earnings. Consistently, the inequality difference between the two series narrows in the years in which unemployment falls and widens in the years in which unemployment increases.

Figure 20: Head male versus Head Max



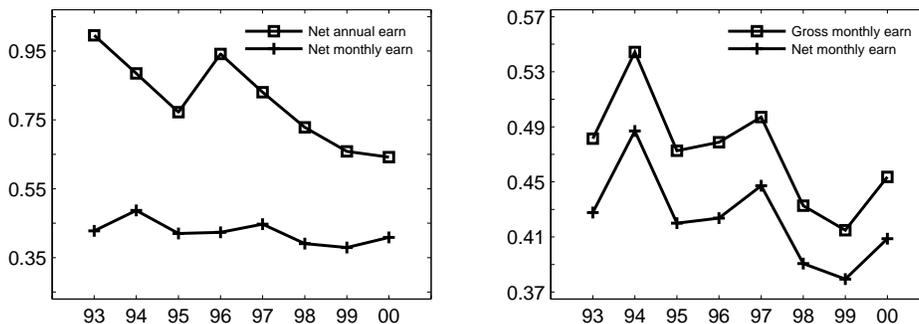
In panel (b) of Figure 21, we compare the variances of logs for after tax and before tax versions of the monthly household earnings variable. As expected, inequality in the after tax series is substantially smaller. However, the two series co-move perfectly, indicating that changes in the tax code during the period had a negligible effect in labor earnings inequality.

As a final remark, the data before taxes contains a large amount of missing observations, which is one of the reasons why we have excluded them from the main analysis (the other reason being to preserve comparability between data sets).

## C Appendix: demographics

Our data sets aggregate very well to the the demographic structure of the LFS. However, we find one important discrepancy between the two data sets in the share of heads with tertiary education. In this Appendix we argue that this discrepancy is due to an over-sampling of highly educated households in the ECHP rather than a problem with the definition of the education categories themselves.

Figure 21: Gross vs net monthly hhold earnings



### C.1 Demographics: comparison of data sets

In Table 2 we report some descriptive statistics for the sample of households in the two data sets. As shown in the first 6 rows, the average of demographic variables such as age, marital status or household size in the overlapping years is remarkably similar. There is just a slight discrepancy in the fraction of household heads that are male: around 85 percent in the ECPF and around 82 percent in the ECHP.

The next 3 lines in Table 2 show data on education. We find here an important discrepancy between the two data sets. The share of heads with tertiary education in the overlapping years is 12.6 percent in the ECPF whereas it is 22.2 percent in the ECHP.<sup>46</sup> As we argue in the next two sub-sections, we think that this discrepancy is due to an over-sampling of highly educated households in the ECHP rather than a problem with the definition of the education categories themselves. The bottom part of Table 2 shows data on employment. The two data sets are quite consistent. The employment rates of heads and spouses are almost identical, and so is the fraction of households with both members employed. When we break down the employment rate of the heads by education group, we see that the employment rates are also very similar across data sets. The only remarkable difference is the employment rate of heads with upper secondary education, which is 5 percentage points higher in the ECPF than in the ECHP.

### C.2 Demographics: comparison to aggregate data

In order to analyze the representativeness of our samples, we start by comparing the proportion of different demographic groups in the labor force with the equivalent figures obtained from the Labor Force Survey (LFS). In panel (a) of Figure 22 we plot the fraction of individuals with tertiary education. The figure in the LFS grows steadily from 10 to 20 percent. Our sample of household heads (sample 2) in the ECPF follows the trend very well, with a slightly lower level. Instead, the proportion of heads with tertiary education in the ECHP is substantially larger than in the LFS. Furthermore, the sample

<sup>46</sup>This difference is not due to the slightly different gender composition of heads in the two samples because the difference is preserved when we look only at household heads who are males.

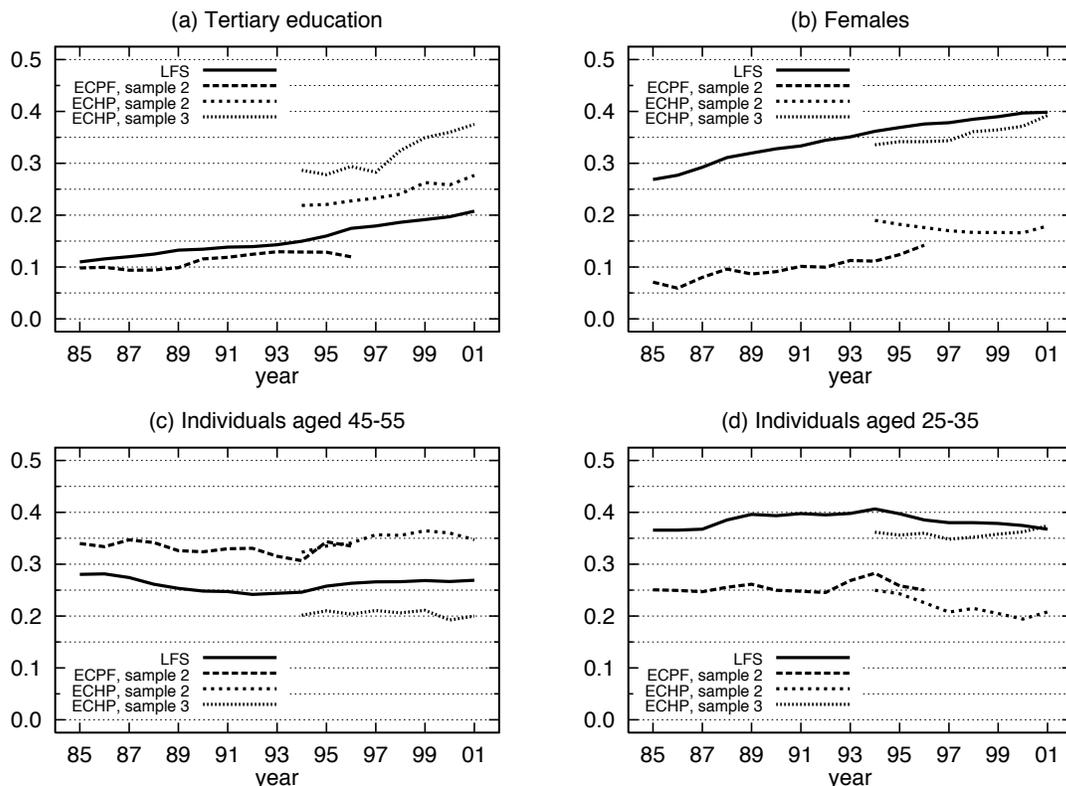
Table 2: Sample Descriptive Statistics

	ECPF				ECHP		
	85-87	88-90	91-93	94-96	94-96	97-99	00-01
Demographics							
Fraction of Male Heads (%)	90.1	88.4	87.1	84.9	81.7	83.2	82.8
Age of Head	44.2	44.2	44.1	44.0	43.7	44.0	44.4
Fraction of Married Head (%)	87.6	86.2	85.0	83.9	83.5	84.1	82.0
Age of Spouse	41.2	41.3	41.3	41.4	41.4	42.1	42.8
Number of Adults	2.7	2.7	2.7	2.7	2.7	2.8	2.8
Number of Children aged $\leq 16$	1.3	1.2	1.1	1.0	0.9	0.9	0.9
Education Head							
Tertiary Education (%)	9.1	9.8	11.9	12.6	22.2	24.5	26.7
Upper Secondary Education (%)	9.2	11.7	15.2	17.5	14.9	16.8	17.1
Other (%)	81.7	78.5	73.0	69.9	62.9	58.7	56.1
Labor supply							
Fraction of Head Employed (%)							
All	81.0	84.7	83.1	81.3	80.4	84.9	86.9
Tertiary Education	95.2	96.3	94.7	94.0	93.1	95.6	94.2
Upper Secondary Education	94.0	93.8	91.9	90.4	85.0	89.1	92.4
Other	78.4	81.4	79.2	76.3	74.7	79.3	81.7
Fraction of Spouse Employed (%)	21.7	26.8	29.2	33.5	31.3	35.3	40.0
Fraction of both Employed (%)	18.3	23.9	25.5	28.6	23.6	27.8	31.2
Number of Observations	9,987	9,597	9,194	9,050	12,095	9,429	5,504

Note. The statistics are computed on our samples of households (sample 1), see Section 3.1.

of individuals (sample 3) in the ECHP shows a larger proportion of people with tertiary education than found both in the sample of heads of this same data set and in the LFS. We conclude that the sample of heads is relatively less educated than the Spanish population (possibly due to the difference in age, see below) and that the ECHP over-samples highly educated individuals (sample 3 in the ECHP should be representative of the population and hence close to the LFS). Regarding the proportion of females, panel (b) shows that our samples of heads under represent the actual number of females in the Spanish labor force. Instead, the sample of individuals in the ECHP aggregates very well to the actual number of females. Finally, regarding age, we find that the samples of heads are relatively older than the Spanish labor force (see panels c and d).

Figure 22: Participants by type of person



### C.3 Income distribution: comparison of data sets

In Table 3 we use sample 2 to compare several statistics of the distribution of household head’s annual labor earnings for the years in which our data sets overlap. Because the ECHP collects income data for the year before the interview, the overlap for income variables is for the period 1993-1996. Looking at the unconditional distribution, we see that for every year the median labor earnings is similar across data sets, being slightly larger in the ECPF (between 1 and 5 percent larger, depending on the year). However, the dispersion is substantially larger in the ECHP: the standard deviation of the log of income ranges from 0.69 to 0.66 in the ECPF and from 0.92 to 0.85 in the ECHP. When comparing the income at the tails of the distribution we observe that the higher dispersion in the ECHP comes mainly from the very low incomes reported in the lower tail. This difference in income inequality is preserved across education groups: for our three education groups we have that the median incomes and the incomes at the 90th percentiles are very similar across data sets, with the big difference being in the incomes reported at the lower tail of the distribution.<sup>47</sup>

The difference in inequality between the data sets is a concern, as it is the higher proportion of heads with tertiary education in the ECHP. We think that these two problems

<sup>47</sup>The low incomes at the lower tail of the ECHP seem to be associated to earnings of self-employed workers.

are unrelated and that the differences in education arise from differences in the sampling design of the surveys rather than from misclassification of educational groups. We have two reasons for this. First, the median income and the incomes at the 90th percentiles within education groups are very similar across data sets. The higher inequality in the ECHP comes from very low incomes at the lower tail for all three educational groups. And second, the differences across data sets in the coefficients of labor earnings regressions against observable variables are relatively small.<sup>48</sup> Therefore, although there are differences in inequality levels across data sets, we think that the trends are comparable.

Table 3: Annual labor earnings of head

year	ECPF					ECHP				
	Obs	p10	p50	p90	sd	Obs	p10	p50	p90	sd
All										
1993	2,006	2487	10,165	18,320	0.69	3,987	320	9,708	19,965	0.92
1994	2,063	2080	9,811	17,910	0.68	3,514	626	9,578	19,658	0.86
1995	1,994	2580	9,723	17,479	0.65	3,345	1,081	9,615	19,532	0.81
1996	2,026	2600	9,774	17,813	0.66	3,034	402	9,252	19,830	0.85
Tertiary Education										
1993	246	8,263	16,436	27,206	0.48	907	6,340	15,718	27,739	0.71
1994	254	7,294	16,447	26,246	0.54	801	6,536	15,297	26,857	0.65
1995	246	7,769	16,238	25,875	0.53	794	6,478	15,578	27,766	0.63
1996	248	7,464	16,946	27,679	0.55	737	5,807	15,187	27,155	0.64
Secondary Education										
1993	385	4,958	12,208	20,029	0.50	583	1,849	11,325	20,870	0.76
1994	378	4,342	12,085	20,075	0.53	554	1,813	10,655	20,659	0.81
1995	333	5,669	11,769	19,347	0.42	556	1,803	10,464	20,133	0.70
1996	404	4,836	11,820	18,582	0.57	520	1,685	10,075	20,226	0.83
Less than Secondary Education										
1993	1,375	1,746	8,527	14,322	0.68	2,497	106	8,060	14,529	0.94
1994	1,431	1,272	8,418	14,017	0.66	2,159	110	7,948	14,274	0.85
1995	1,415	1,885	8,596	13,830	0.64	1,995	125	7,957	14,424	0.82
1996	1,374	1,963	8,603	14,185	0.64	1,777	0	7,743	13,869	0.84

Note. All earnings in 1995 euros. The statistics are computed on our samples of household heads (sample 2), see Section 3.1. We have four overlapping years because the income data in the ECHP refers to the previous year. **Obs** refers to the number of observations; **p10**, **p50** and **p90** refer to income at the 10th, 50th and 90th percentiles; **sd** refers to the standard deviation of the log.

<sup>48</sup>Against this argument there is the small difference in employment rate for households with secondary education. Given that in the ECPF the fraction of heads with tertiary education is lower than in the ECHP, one could argue that some heads in the ECPF that report secondary education are misclassified heads with tertiary education. If that was the case, the employment rate of heads with secondary education in the ECPF should be higher than in the ECHP as the employment rate of misclassified heads with tertiary education is higher. This is actually the case. Recall, however, that the difference is not too big and that the comparison with the LFS shows that it is the ECHP and not the ECPF the one that seems misaligned.

## D Mincer regressions

During our sample period there is an important increase in the fraction of college educated workers and female workers (see Figure 1). To check whether the premia reported in Figures 4 and 8 arise because of these changes in the composition of the labor force we report an alternative measure of each of the premia that controls for differences in the other observable variables. As Eckstein and Nagypal (2004), we run year by year Mincer regressions of either logged hourly wages or annual earnings against a dummy for tertiary education, a dummy for gender and four age group dummies (25-35, 36-45, 46-55, 56-60).<sup>49</sup>

### D.1 Hourly wages

In Figure 23 we plot the Mincer coefficients for the regression of hourly wages with sample 3 of the ECHP. The estimates show that the gross premia reflect pretty well the behavior of the more suitable estimates of premia that the Mincer regressions provide. Indeed, in the same Figure 23 we report the raw premia in log wages for comparison. The only important difference is that the decrease in the tertiary education premium in terms of Mincer regressions is more moderate than in terms of raw data, implying that the age and sex composition changes of the tertiary educated is important to partially explain the evolution of its trend over the end of the nineties.

### D.2 Labor earnings

In Figure 24 we plot the Mincer coefficients for the regressions of annual labor earnings of the heads by use of sample 2 of our two data sets. We also report the premia of the logged labor earnings for comparison. Recall that the premia in Figure 8 are computed including individuals with zero labor earnings whereas the premia of the logs in Figure 24, by construction, drop the zeros (as it also happens with the coefficients of the Mincer regressions).

Regarding the tertiary education premium, we find four important differences in Figure 24. First, the premium in logs is substantially smaller than the premium in levels. Second, the fall in the premium in logs is half as big as the fall in the premium in levels: over the whole sample period the premium in levels falls from 115 percent to 75 percent, whereas the premium of the logs moves from 80 percent to 60 percent. Third, during the recession years in the early nineties the tertiary education premium in levels increased whereas the one in logs stayed stable. These three facts suggest that the unemployment risk is lower for highly educated workers, that the fall in unemployment rate over the whole period benefited more the highly educated, and that the destruction of employment in the recession of the early nineties was specially severe for non college workers. The fourth important difference is that the decrease in the tertiary education premium between 1996

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<sup>49</sup>For the experience premium we plot the difference between the coefficients of the 46-55 and the 25-35 age dummies.

Figure 23: Mincer coefficients: hourly wages

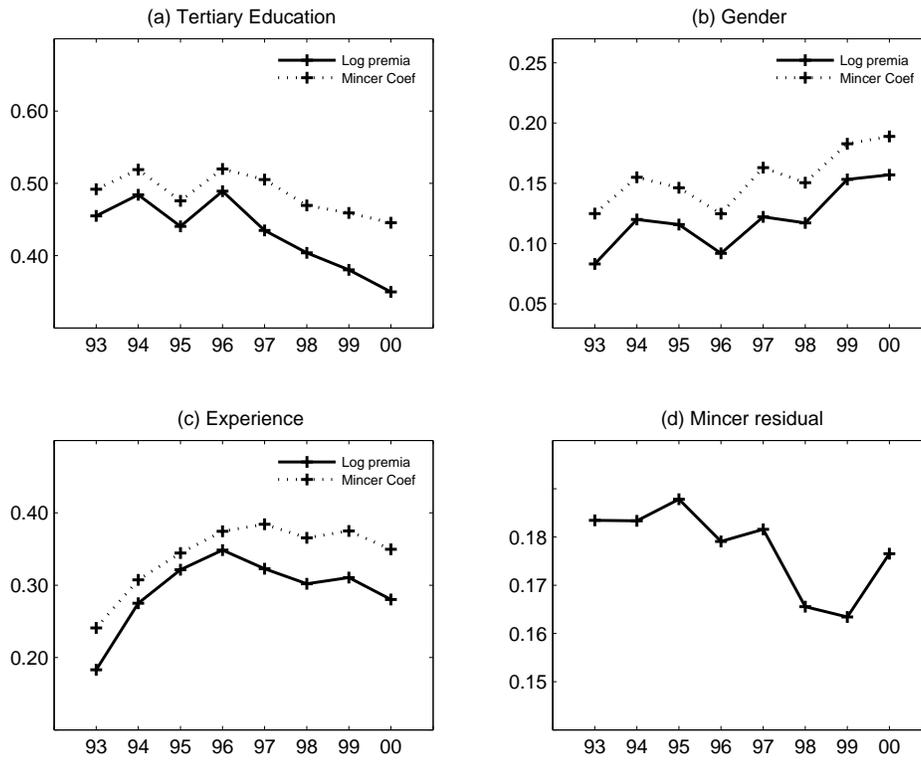
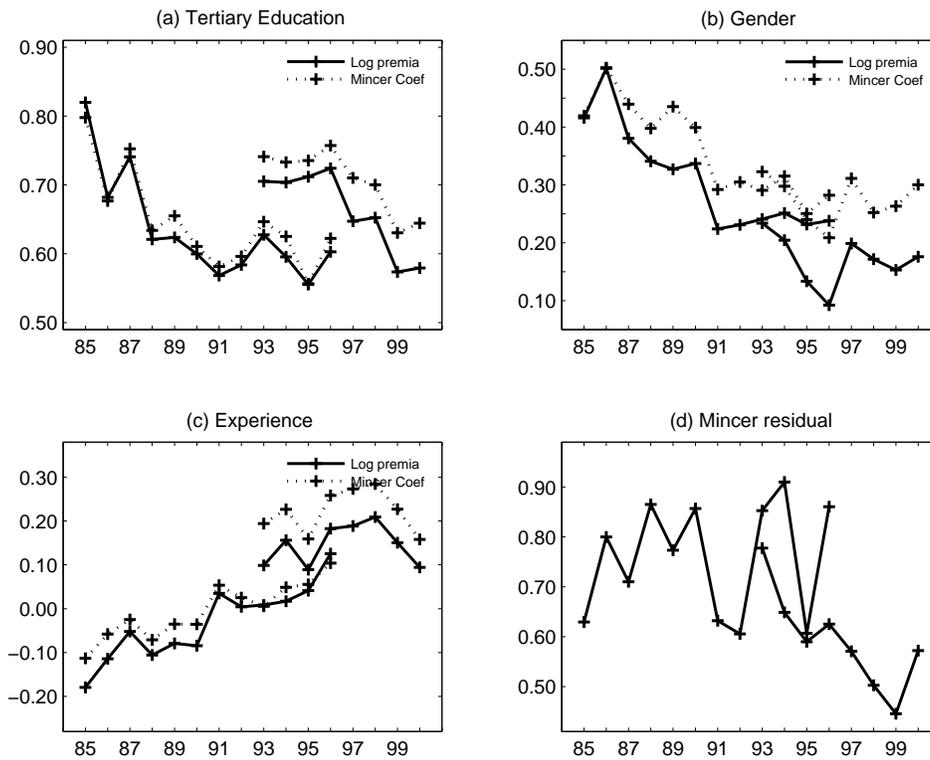


Figure 24: Mincer coefficients: labor earnings



and 2000 measured in the ECHP is more moderate when we use the Mincer coefficients than the gross premium in logs. This was also the case when we looked at hourly wages with the sample of individuals. This suggests that changes in the age and sex composition of the tertiary educated group may have played a role in the decrease in the tertiary education premium for those years. This would be consistent with the entrance of new cohorts of young workers which are more educated and more balanced in sexes. We will come back to this point in Section D.3.

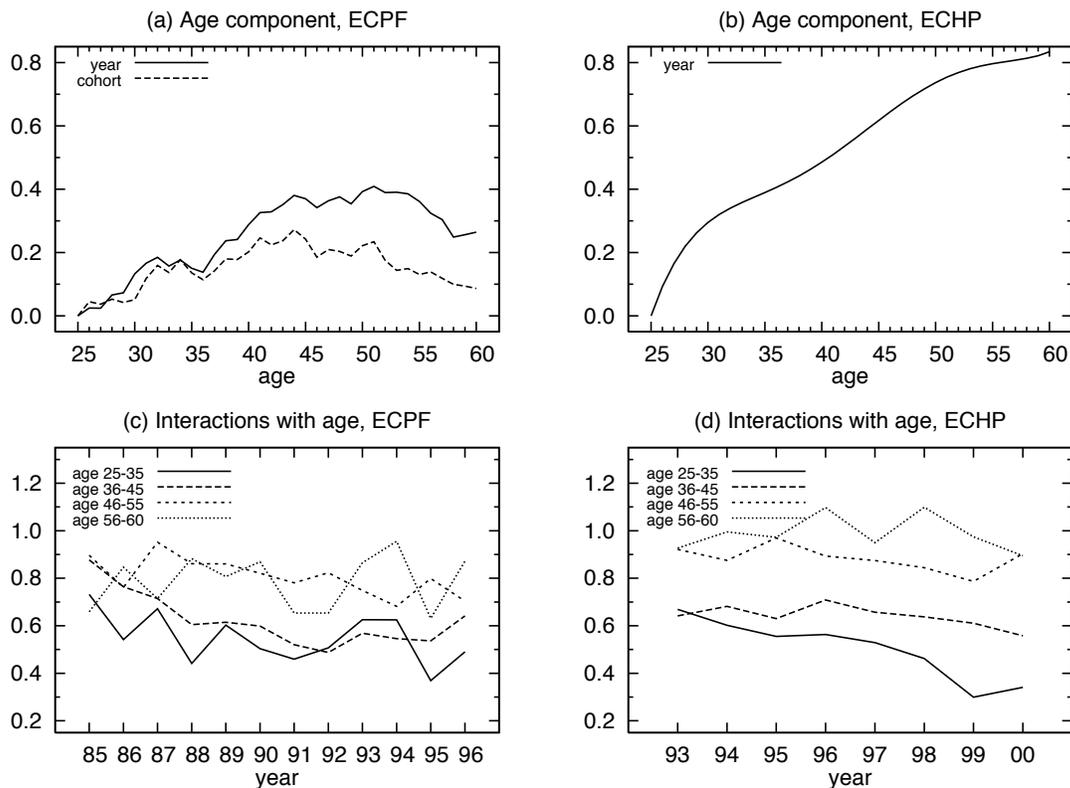
Regarding the experience premium, Figure 24 shows three important differences. First, between 1985 and 1996 in the ECPF, the premium in logs is around 10 percentage points smaller than the premium in levels, but the rates of growth are very similar. Second, the ECHP shows that between 1993 and 2000 the experience premium in levels kept growing but the premium of the logs remained stable. These two findings are consistent with the fact that the unemployment rate was larger for young workers and that the unemployment increase in the recession of the early 90's was specially severe for them. Finally, in the ECHP the mincer coefficients are around 5 percentage points larger than the raw premium of the logs, which is consistent with the fact that the pool of older workers contains less educated people.

### **D.3 The fall in the college premium and the increase of young college workers**

As we argue in the Introduction, the period 1985-2000 witnessed important demographic changes in the Spanish labor market. Panel (c) in Figure 1 shows that the share of college educated workers raises from 10 to almost 20 percent between 1985 and 2000. The gradual increase in the college workers is due to the large increase in college graduates of the young cohorts entering the labor force. If returns to college are age-dependent, and in particular if they increase with experience, the observed fall in the college premium could be largely driven by the fall in the average experience of the pool of college workers (compositional effect).

To look into this possibility, we use our samples of household heads of the ECPF and the ECHP and compute the life-cycle profile of the college premium by dividing annual earnings of college graduates and annual earnings of the rest of workers at every age. We do as in Section 6 and for the ECPF sample we provide a life-cycle profile when controlling for year effects and when controlling for cohort effects. For the ECHP sample we provide a life-cycle profile when controlling for year effects only. In panel (a) of Figure 25 we report for the ECPF the age profiles of the college premia in logs as difference of the college premia at age 25. We find that the college premium grows substantially over the life cycle, at least until age 45 or so. When controlling for year effects (see the solid line) the increase is of around 40 percentage points until age 50, and the profile decreases afterwards. When controlling for cohort effects (see the dashed line), the increase is not so large, around 25 percentage points until age 45, and there is again a fall afterwards. In panel (b) of Figure 25 we report the age profile of the college premium in the ECHP. For this data set we obtain an almost linear increase over the life cycle, with the college premium being 70 percentage points larger for 50 years old workers than for young workers.

Figure 25: College premium and age



Hence, our data seem to confirm an interaction between experience and education such that the returns to college are larger for more experienced workers.

To check whether the fall over time of the college premium is due to the entrance in the labor force of young and unexperienced college graduates, we run again our Mincer regressions, but adding now interaction terms. In particular we regress log earnings against the gender dummy, the experience dummies and the experience dummies multiplied by the college dummy. In panel (c) of Figure 25 we report the coefficient of these interaction terms for the ECPF. We observe that the college premium is actually falling for the age groups 25-35, 36-45 and 46-55, while for the older workers it seems trendless. This age group has fewer workers and very few college graduates, which makes the premium fluctuate substantially during the period.<sup>50</sup> In panel (d) of Figure 25 we report the coefficients of the interaction terms for the ECHP. Again we find a clear falling pattern for the age groups 25-35 and 46-55, whereas for the other two groups there seems to be no clear trend. Therefore, the fall in the college premium seems to be present within age groups in both samples, except in the group of the oldest workers.

**To sum up.** It is hard to believe that the fall in the college premium seen in Spain

<sup>50</sup>The coefficients on the gender dummy and the experience dummies display the same patterns as in the Mincer equations without interactions that we showed in Section 4.1. Therefore we do not report them here.

is an artifact of a fall in the average age of the pool of graduates. Of course, if workers of different ages are poor substitutes, the big entrance of young college graduates in the labor force could explain the clear fall in the college premium of the young workers. But it would not explain the fall in the college premium of older workers.

## **E Life cycle controlling for cohort effects**

In the main text we have reported the life cycle profiles when we ignored cohort effects. In Figure 26 we report the age profiles for the variance of logs of different variables when we ignore the year effects and control for differences in cohort effects. The overall picture is very similar to the profiles that control for year effects. In panel (a) we see that the growth in inequality of labor earnings of the head is slightly smaller than when controlling for year effects, around 17 percentage points. However, inequality at age 25 is the same. In panel (b) we see that inequality in labor earnings at the household level increases more than inequality in labor earnings for the heads. The size of the increase is around 34 percentage points. Inequality in total disposable income grows around 14 percentage points, but the increase does not really start until age 42 or 43. Panel (c) shows that inequality in the equivalized definition of household earnings is again very similar to the raw counterpart. Regarding equivalized household disposable income we observe that the variable equivalized with the OECD scale remains more or less constant over the life-cycle, whereas the variable equivalized with the scale derived from the regression in consumption grows 8 percent. Finally, panel (d) shows that inequality in consumption grows around 7 percentage points for the raw series and 4 percentage points for the series equivalized through regression. However, the dispersion of the series equivalized with the OECD equivalence scale remains constant over the life-cycle.

Figure 26: Inequality over the life-cycle controlling cohort effects, ECPF

