ISSN 1988-088X

Department of Foundations of Economic Analysis II
University of the Basque Country
Avda. Lehendakari Aguirre 83
48015 Bilbao (SPAIN)
http://www.ehu.es/FAEII

DFAE-II WP Series

2007-02

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ISSN: pending

Inequality for Wage Earners and Self-Employed: Evidence from Panel Data*

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March 2007

Abstract

In this paper we study the evolution of income inequality for employees and self-employed workers. We highlight the importance of separately analyze these different sources of income to gain a broader understanding of inequality. Using Spanish panel data on income and consumption from the ECPF for the period 1987-96, we decompose income shocks into a permanent and a transitory component. We find that there are noticeable differences in the evolution of income inequality, as well as in the relative importance of the permanent and transitory components across these groups. Our results points that the evolution of inequality can be basically explained by movements in the transitory component of income for the self-employed, while for the employees it is mainly driven by the permanent component, specially at the end of the period. Given these disparities, it seems that these two sources of income should be studied separately and that different policies are suitable for each group.
JEL classification: D12, D31, D91, E21.

Keywords: Permanent income inequality, transitory income inequality, consumption, self-employment, panel data.

*We are grateful to J.C. Berganza, Lola Collado, J.M. Labeaga, and participants at the Ramón Areces Conference on Income and Consumption Inequality, the CAM Workshop on Applied Microeconometrics, the 12th Conference on Panel Data, and IAE seminar for helpful comments on this work. All remaining errors are our own. Research funding from Fundación Ramón Areces and the Spanish Ministry of Education, Grant SEJ 2005-08783-C04-01 is acknowledged.

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1 Introduction

The evolution of income inequality has been widely analyzed in the literature over the last years. The existing literature is predominantly from US and UK data (Gottschalk and Moffit, 1995, 2002, Blundell and Preston, 1998). Many of these studies have used either income or income and consumption data to identify the contribution of permanent and transitory shocks to the variation in inequality. Accounting for these two different sources of risk is crucial since they have very different implications for welfare and policy. In general, changes in the permanent component of income inequality have been associated to changes in the price of skills, while changes in the transitory component have been related to income uncertainty, changes in labour market instability and also measurement error.

Typically, the literature has focused on this distinction by making comparisons across cohorts of individuals, mainly due to lack of individual data. However, much less attention has been paid to the differences in income inequality across occupations. Most of the empirical work on income inequality pool together two distinct groups of workers: self-employed and employees. This can be problematic to the extent that, as we will show, self-employed are essentially different from employees in the risk they face.

In this paper we analyze the role that the self-employed play in estimating income inequality. We show that, when pooling together individuals that are heterogeneous in relevant dimensions, misleading conclusions can be obtained about the evolution and relative contribution of permanent and transitory shocks.

The data we use come from the Spanish Family Expenditure Survey (Encuesta Continua de Presupuestos Familiares, ECPF hereafter), a rotating panel that covers the period 1986-1997. Following Blundell and Preston (1998) and Blundell et al. (2004), we use the evolution of the variances and covariances of income and consumption to identify the contribution of permanent and transitory shocks to the evolution of income inequality, separately for self-employed and employees. We compare these results with the standard case where this distinction is neglected.

Our data set provides information on both income and consumption for the same household over several consecutive periods. This entails two main advantages with respect to other microeconomic data used in most of the literature so far. For example, Blundell and Preston (1998) use Family Expenditure Survey (FES) data from the UK, which contains information on both consumption and income but lacks longitudinal information. Therefore, they have to aggregate data within cohorts and impose restrictive assumptions. On the other hand, Blundell et al. (2004) combine US panel data on income from the Panel Study of Income Dynamics (PSID) with consumption data from repeated Consumer Expenditure Survey (CEX) cross-sections. They create a panel with income and imputed consumption, which introduces additional noise in data. In this paper we overcome these problems by exploiting the unique characteristics of the ECPF: the longitudinal dimension of our data allows us to avoid incurring in aggregation bias, and the information on consumption allows for a more precise estimation of both the permanent and transitory components of income inequality.[1]

Self-employment is of considerable interest in their own right. On the one hand, self-employment rates have been increasing in many OECD countries over the last years[2], being Spain one of the countries with the highest rates. On the other hand, many governments have promoted policies to foster self-employment as a way to alleviate unemployment. Therefore, it may be useful for policy-makers to take into account possible side effects of such policies in

[1] Cutanda (2002) and Cutanda et al. (2004) also use the ECPF to decompose the changes in inequality into a permanent and a transitory component. However, they do not exploit the panel dimension of the data and focus on differences in inequality across cohorts. On the other hand, Cervini and Ramos (2006), exploiting the panel dimension of the ECHP, analyze inequality for Spanish male earnings for the period 1993-2000 using only data on earnings.

[2] Blau (1987) and Hamilton (2000) documented this trend for the US and Martinez-Granado (2002) for the UK and some other European countries, including Spain.

terms of inequality.

Recent papers have stressed the importance of accounting for heterogeneity between individuals when analyzing income inequality (Guvenen, 2005, Primiceri and Van Rens, 2006). They assume that income is subject to heterogeneous shocks predictable to the individual, but unobservable to the econometrician, as well as to permanent and transitory shocks, and estimate the contribution of each to total inequality. Following a different methodology, Dickens (2000) analyzes the covariance structure of individual earnings by cohort in the UK and stresses the differences in the evolution of permanent and transitory components across skills groups. A different strand of the literature has also provided some evidence that occupation is an important factor in explaining inequality trends. In particular, Jenkins (1995), using decomposition of inequality indices, finds that self-employment income changes are among the key explanations for the changes in UK inequality in the 1980's. Parker (1999) analyzes UK self-employment and employee incomes separately and finds that the trend of employment and self-employment income inequality are largely explained by changes in the occupational structure. Falter (2006), using Swiss data, identifies the variables that drive the earnings inequality differential. Torrini (2006) documents that self-employment is responsible for a significant part of the observed cross-countries differences in income inequality.

Our results show that self-employed face higher risk than employees and that there are noticeable differences in the evolution of income inequality, as well as in the relative importance of the permanent and transitory components across these groups. Specifically, we find that income inequality for employees follows a similar pattern to the sample which includes self-employed, employees and unemployed: it decreased until beginning of the 90s, went up approximately until 1994 and down again in the last two years of the sample. In turn for the self-employed there was a strong increase between 1986 and 1990 and a sharp decrease from 1990 to 1992, to increase slightly at the end of the period. These trends can be mainly explained in terms of the transitory component of income for the self-employed, while the evolution of inequality for the employees is mainly driven by the permanent component, specially at the end of the period. Given these disparities, it seems that these two sources of income should be studied separately and that different policies are suitable for each group. Also, there is no evidence that the transitory shocks are transmitted into consumption for any of the groups. Therefore, although the self-employed face higher income risk than the employees, it seems that they are able to insure it.

The rest of the paper is structured as follows. Section 2 presents the theoretical framework of the analysis and the identification strategy. Section 3 describes the data set used and discusses the evolution of income and consumption in the raw data. Section 4 presents the results and Section 5 concludes.

2 Model

In this Section, we first describe the income process. As it is customary in the literature, we assume that income is subject to both permanent and transitory shocks. In our case, these shocks will be different for self-employed and for employees. Second, we propose a standard linearized model of life cycle consumption which allows us to link income shocks and consumption. Finally, we explain how the contributions of permanent and transitory components to income inequality can be identified.

2.1 Income Dynamics

We consider a stochastic process for the log of real income, $\ln Y$, given by:

$$\ln Y_{it} = \psi' Z_{it} + \lambda_t + \sum_{q=1}^{4} \eta_{iq} d_{qt} + P_{it} + v_{it}, \tag{1}$$

where i, q and t denote household, quarter, and time respectively. Z_{it} is a set of observable demographic characteristics and λ_t is an aggregate shock that is picked up through time dummy variables. The variables η_{iq} $(q = 1, ..., 4)$ are individual specific fixed quarterly effects and d_{qt} is a dummy variable that takes value 1 if the observation in period t corresponds to the quarter q and zero otherwise. The inclusion of these quarterly individual fixed effects responds to the particular payment system of a considerable number of employed workers in Spain, that get two extrapayments per year, one in December and the other in July. The payment scheme for a worker, unobservable for the econometrician, is determined by his job and can reasonably be taken as exogenous to the individual's choices. Then, the seasonal pattern of income varies randomly from one individual to another.[3]

The rest of the unexplained income is decomposed into two terms: a permanent component, P, and a transitory (mean reverting) component, v. As in previous empirical studies (e.g., Blundell and Preston, 1998, Blundell et al. 2004), we assume that the permanent component follows a random walk of the form:

$$P_{it} = P_{it-1} + \zeta_{it}, \tag{2}$$

where ζ_{it} is a random term orthogonal to v_{it}.

Combining Equations (1) and (2), it follows that income growth is

$$\Delta \ln Y_{it} = \psi' \Delta Z_{it} + \Delta\lambda_t + \sum_{q=1}^{4} \eta_{iq} \Delta d_{qt} + \zeta_{it} + \Delta v_{it}. \tag{3}$$

Our empirical specification of the income process will allow for heterogeneity in two different ways. First, the effect of observable factors Z_{it} on income can be different for self-employed and employed workers. On the other hand, (unexplained) income changes because of a shock to permanent income, ζ_{it}, and because of a change in the shock to transitory income, Δv_{it}. We will also allow for the variance of these shocks to be different for each occupation.

[3] See Alvarez (2004) or Albarrán (2000) for further details. As we will show, this issue is not relevant for the self-employed.

2.2 Consumption Growth

Under plausible assumptions about preferences for intertemporal consumption (see Browning and Lusardi, 1996), it can be shown that the optimal consumption growth can be expressed as:

$$\Delta \ln C_{it} = \frac{1}{\rho} \ln(r_t - \delta) + \frac{1}{\rho} \beta' \Delta Z_{it} + m_{it} + \varsigma_{it}, \tag{4}$$

where C is consumption, Z is a vector of demographic variables (taste shifters), r and δ are the real interest rate and the subjective discount rate respectively, m_{it} depends on the conditional variance of consumption, which can be interpreted as accounting for the precautionary motive for saving, and ς_{it} is an innovation to consumption growth. Equation (4) holds for any household.

The innovation of consumption, ς_{it}, can be directly related to the innovations to income. In particular, we follow Blundell and Preston (1998) and Blundell et al. (2004) and assume that the precautionary saving component in Equation (4) can be picked by cohort, j, and time, t, specific constants, Γ_{jt}, plus some household specific deviation from these, ε_{it}, which is white noise. Additionally, we assume that no part of the permanent shocks can be insured through precautionary saving and that the transitory shocks follow a MA(l) process,

$$v_{it} = \sum_{k=0}^{l} \vartheta_k u_{it-k},$$

with $\vartheta_0 \equiv 1$ and where the order of the moving average, l, would be empirically determined.

Under these simplifying assumptions, we can derive the following equation that relates the growth of consumption to the permanent and transitory shocks to income:

$$\Delta \ln C_{it} = \Gamma_{jt} + \varepsilon_{it} + \theta' \Delta Z_{it} + \zeta_{it} + \varphi u_{it}, \tag{5}$$

where the parameter φ captures how transitory shocks are transmitted into consumption growth and the rest of the variables are as before.[4] Notice that

[4]See Blundell et al. (2004), for further details. For instance, this parameter φ could vary

our maintained assumption is that the permanent component of income cannot be insured by the households, while in principle the transitory component can ($\varphi \leq 1$).

2.3 Decomposition of Inequality

The main parameters of interest are the variance of the permanent shock to income, $Var(\zeta_{it})$, and the variance of the transitory shock to income, $Var(u_{it})$. These can be estimated using a panel of individuals with only information on income. Nonetheless, availability of consumption data allows for a better identification and more precise estimation of these two components and, as a by-product, allows also for the estimation of other interesting parameters like the variance of the consumption shock, $Var(\varepsilon_{it})$, and the degree of insurability of the transitory shocks, φ. We can identify all of them through a set of variances and covariances restrictions between income and consumption.

First, we remove the effect of demographic characteristics and aggregate terms in income and consumption growth:

$$\Delta y_{it} = \sum_{q=1}^{4} \eta_{iq} \Delta d_{qt} + \zeta_{it} + \Delta v_{it}, \tag{6}$$

$$\Delta c_{it} = \varepsilon_{it} + \zeta_{it} + \varphi u_{it}, \tag{7}$$

where $\Delta y_{it} = \Delta \ln Y_{it} - \psi' \Delta Z_{it} - \Delta \lambda_t$ and $\Delta c_{it} = \Delta \ln C_{it} - \Gamma_{jt} - \theta' \Delta Z_{it}$.

Then, we exploit the panel structure of the data and derive the following moment conditions:

$$cov(\Delta y_{it}, \Delta y_{it+s}) = \begin{cases} \sum_{q=1}^{4} var(\eta_{iq}) \Delta d_{tq}^2 + var(\zeta_{it}) + var(\Delta v_{it}) & \text{for } s = 0 \\ \sum_{q=1}^{4} var(\eta_{iq}) \Delta d_{tq} \Delta d_{t+s,q} + cov(\Delta v_{it}, \Delta v_{it+s}) & \text{for } s \neq 0 \end{cases} \tag{8}$$

$$cov(\Delta c_{it}, \Delta c_{it+s}) = \begin{cases} var(\varepsilon_{it}) + var(\zeta_{it}) + \varphi^2 var(u_{it}) & \text{for } s = 0 \\ 0 & \text{for } s \neq 0 \end{cases} \tag{9}$$

$$cov(\Delta c_{it}, \Delta y_{it+s}) = \begin{cases} var(\zeta_{it}) + \varphi var(u_{it}) & \text{for } s = 0 \\ \varphi cov(u_{it}, \Delta v_{it+s}) & \text{for } s \neq 0 \end{cases} \tag{10}$$

with time.

As it can be seen from the set of conditions (8)-(10), this strategy involves the estimation of the variance of the seasonal fixed effects (four additional parameters). Notice that we could also take four differences in income to get rid of these seasonal fixed effects and use a consumption growth equation also in fourth differences.[5] Thus, similar moments conditions could be used. If we followed this approach, only individuals that had been at least five consecutive periods in the sample could be used. In that case, more than 15% of the sample observations would be dropped. Therefore, our preferred strategy is to use the set of conditions based on the first differences of the consumption and income equations. The estimates of the variances through the set of conditions in fourth differences were just calculated as a robustness check of our results.

All these moments can be computed for any group of individuals (either employees or self-employed). Estimation of the parameters of interest is done by (Equally Weighted) Minimum Distance. Empirical results remain unchanged when using Diagonally Weighted Minimum Distance and Optimal Minimum Distance.

The availability of panel data has several advantages over a repeated cross-section analysis. In the latter case, identification requires making strong assumptions to get identification of the parameters of interest. In particular, one needs to assume cross-section orthogonality of consumption and income to past shocks, lack of serial correlation in transitory shocks, and lack of measurement error in consumption and income. Moreover, although with panel data identification of the variances of shocks to income strictly requires only data on income, consumption (which is closely related to permanent income) is an additional source of relevant information. Thus, the joint use of panel data on

[5]In that case we obtain:

$$\Delta_4 \ln Y_{it} = \psi' \Delta_4 Z_{it} + \Delta_4 \lambda_t + \zeta_{it} + \zeta_{it-1} + \zeta_{it-2} + \zeta_{it-3} + \Delta_4 v_{it},$$

which does not contain seasonal fixed effects although introduces higher persistence with respect to the immediately previous periods that has to be accounted for.

consumption and income provides a richer set of overidentifying restrictions and improves efficiency of the estimates.

At this point a few words are due regarding the identification of the parameters of interest if consumption and income were subject to measurement error. Our main purpose is to get consistent estimates of the transitory and permanent variances. The variance of the permanent component is identified under the maintained assumptions, but also under the presence of classical measurement error (additive and independent) either in the log income or in the log consumption. The only requirement for identification in that case is that the measurement error of log income is uncorrelated with the measurement error of log consumption.

With respect to the transitory component, the presence of measurement error in log consumption does not affect its identification: the variance of consumption shock ($var(\varepsilon_{it})$) would incorporate the variance of the measurement error. Moreover, the variance of the measurement error could be separately identified from $var(\varepsilon_{it})$ through the correlation between the growth in log consumption in t and $t+1$. Nonetheless, we do not estimate them separately since $var(\varepsilon_{it})$ is not among our main parameters of interest. The presence of measurement error in log income is more problematic, since the estimated variance of the transitory component would be a mixture of the variance of the true transitory component and the variance of the measurement error. Unfortunately, it is not possible to disentangle both. Although the use of consumption data helps, it does not make disappear the problem. So in the presence of measurement error in income the variance of the transitory component would be over-estimated. This problem is likely to be more important among self-employed individuals for whom income is usually measured with more noise (see Blundell et al., 2004).

3 Data

This section is divided in two subsections. First, we describe the data set and our sample selection. Our samples for self-employed and employees only include households whose head is in the same activity (either self-employment or employment) for three consecutive quarters. We have also carried out estimates for the usual sample selection in the literature, which includes households whose head is, at a given period of time, self-employed, employee or unemployed; we call this sample "All". Second, we present some descriptive statistics about the characteristics of these three samples.

3.1 The Data Set

The data we use come from the Spanish Family Expenditure Survey (ECPF) that covers the period between the 1st quarter of 1985 and the 1st quarter of 1997.[6] The ECPF is a rotating panel conducted by the National Institute of Statistics (INE). Out of the approximately 3,100 households interviewed, one eighth is renewed every quarter. As a result, we can follow a household for a maximum of eight consecutive quarters. Since the purpose of the ECPF is to compute the CPI for Spain, it contains comprehensive information on expenditure, disaggregated in 226 categories of goods and services. It also contains detailed information on income and demographic characteristics of the household. As pointed out before, these two features make this data set unique compared to other data typically used in similar studies for other countries, which either lack the longitudinal dimension or the information on both income and consumption.

We define consumption as quarterly household expenditure on non-durable goods, which is composed by the sum of expenditure on food, drinks, tobacco, clothing and footwear and energy and transport. Our data set also contains in-

[6] The survey changed its methodology after the 2nd quarter of 1997 and it is not possible to link the two versions.

formation on expenditure on durable goods, but not on consumption of service flows. Since this is the relevant measure for us, we prefer to exclude durable expenditures from our measure of consumption. Nonetheless, other studies which do include some approximate measure of these flows do not find significant differences (see Blundell and Preston, 1998, and Blundell et al., 2004).

Income is defined as the quarterly monetary income earned by any member of the household net of taxes. Given that we focus on household inequality, it seems reasonable to use family income (instead of income of the head of the household), jointly with household consumption. Note that, as a consequence, we implicitly allow for insurance among family members. We exclude the returns from capital and income from assets, since typically these are imprecisely measured in survey data.[7] This means that for the self-employed our measure of income includes the part of the net profit that these individuals withdraw from their business in the form of salary and also exclude capital gains or losses.[8]

Income and consumption variables are in real 1992 pesetas, deflated by the CPI published by the INE. Both variables are adjusted onto comparable basis for different families using equivalence scales based on McClements (1977) that account for the number of adults and children in various age ranges.

A household is classified as self-employed (employed) in period t when its head receives income from self-employment (paid-employment) in period t. A few households whose head declares to have both income from employment and from self-employment are excluded from their respective samples (although they are kept in the sample of "All"). Using household's heads to characterize households' occupations seems reasonable since in our sample around 80% of the household income is earned by the household head.

[7] The comparison of income and consumption from the ECPF and the corresponding measures from the National Accounts shows that: (i) the levels are systematically lower for income, specially capital income, and for some items of consumption in the ECPF, and (ii) the growth rates are basically identical. Therefore, underreporting seems to be constant.

[8] Hamilton (2000) points out that the drawn and a measure of earnings that accounts for capital gains are highly correlated.

The step-by-step selection of our sample is illustrated in Table 1. We focused on households headed by a male at working ages during the sample period; thus he was born between 1920 and 1964 and additionally he is always less than 65 years old. We eliminated households with permanent visitors or that experienced a big change in their structure over the sample period, namely those in which the head changed marital status and those that experienced a change in the number of members bigger than one. We have also excluded households for whom relevant information was missing (they did not fully answer the survey or reported zero consumption or income). We also dropped households whose head worked in the agricultural sector, given the particular characteristics of self-employment in this sector. Finally, we chose households that were interviewed at least for three consecutive periods, since we need this time length to apply the moment conditions described in the previous section.

As noted above, we use information on employment status of the head to allocate households to the three different samples. The final sample of employees is composed of 30,889 observations and 6,138 households, the sample of self-employed is composed of 5,535 observations and 1,494 households, and, finally, the sample of heads either in self-employment, employment or unemployment contains 55,852 observations and 9,292 households. For each sample this represents on average 997, 197, and 1,660 households per year, respectively.

3.2 Descriptive Analysis

Table 2 shows descriptive statistics for our three samples. As it can be seen, self-employed household heads are on average older, less educated and tend to live in smaller municipalities than employees. Their wives also tend to be self-employed more often than employees' wives.

Regarding the occupation, unfortunately the ECPF only includes extremely basic information about sector of activity or type of occupation. Specifically, it only distinguishes among self-employed with employees and professionals and self-employed without employees. Most of the self-employed in our sample (75.2%) belong to the latter category. To add further evidence we use data from the Spanish Labour Force Survey (EPA). Using a comparable sample, according to the EPA in the period considered self-employment is relatively more frequent in retailing and construction, while employment is more frequent in services and manufacturing. Table 3 presents the distribution of self-employed and employees across occupational groups for the period 1994-1997.[9] Most self-employed are managers of small business or skilled workers. The percentage of professionals has increased in both groups, although they represent a bigger proportion of employees than of self-employed. According to these figures heterogeneity among the self-employed does not seem to be bigger than among employees.

According to the EPA, self-employment rate in Spain is around 24% of the Spanish working male population for the period considered in this paper; this figure is well above the average in OECD countries.[10] Our data replicate the magnitude and the evolution of this rate. Figure 1 shows that the percentage of self-employed has been generally higher for those households in the lower tail of the consumption distribution (below the 20th percentile) and has increased more among those in the upper part of the distribution (above the 80th percentile).

Table 4 provides a description of the distribution of income and consumption for our three samples (Employees, Self-Employed and All). We present the mean and standard deviation of both variables for the whole period, as well as different percentiles. The table shows that, except for the 99 percentile, household income of the self-employed is consistently bellow and exhibits greater dispersion than those of employees.[11] It is worth noticing that we measure total

[9]In 1994 there was a change in the National Classification of Occupations (CNO). Given the aggregation of the occupational codes in the EPA, it is not possible to link data from 1994 onwards with data from previous years.

[10]In US, UK and EU15 the average self-employment rates are 7.48%, 11.88%, and 12.82% respectively.

[11]Hamilton (2000) and Carrington et al. (1996) find a similar pattern for the US.

income and not earnings per hour. Therefore, we implicitly assume that self-employed households might have already insured their higher risk in earnings per hour by working more hours.[12] Thus, our measure of risk is net of this possible insurance through the household labor supply. Furthermore, consumption is also lower and more volatile for self-employed households than for employees, although the differences are less pronounced than for income. Since consumption is less subject to underreporting than income, the fact that it is lower and more volatile for self-employed suggests that it is not only measurement error which is driving the differences in income.

4 Results

We first show the general evolution of inequality in Spain for our sample period; specifically we compare trends for employees and self-employed. Then we discuss the relative importance of permanent and transitory shocks in explaining such trends for each occupation. Finally, we carry out some robustness checks to confirm that different pattern across occupations remained for groups defined according to year-of-birth cohort and education.

4.1 Income and Consumption Inequality

Figure 2 shows the paths of the cross-sectional variances of log income and log consumption for the three samples of households: Employees, Self-Employed and All.[13] Three features can be highlighted from this figure. First, the evolution of income and consumption inequality is quite different for the different samples. Second, employees have lower income and consumption inequality than the other two groups of households. And, third consumption inequality tracks more closely income inequality for employees than for the other two samples.

Specifically, we can see that for the sample that includes all households

[12] See Parker et al. (2005).

[13] These variances can be interpreted as measures of inequality. Alternative measures as the Gini or Atkinson coefficients show the same pattern.

income inequality tended to decrease during the late 1980's and to increase from 1992 to 1994. After this point, it decreased again. However, the variance of consumption remained more or less constant over the whole period.

Nevertheless, a different picture is obtained when we distinguish by occupation. Income inequality for employees follows a similar pattern to the sample of all households, with two main differences: as expected the level is lower, since the unemployed and self-employed are excluded from this sample, and the 1992 increase is less marked. However the differences in consumption inequality are substantial, since for this group of individuals the variance of consumption co-moves with the variance of income (the slope of both variances are almost equal). On the other hand, for self-employed the pattern of income inequality presents two distinctive periods. Before 1992 it is very different from the one found for the employees and for the "All" sample. It is characterized by a strong initial increase and by a strong decrease. After 1992 the evolution is more similar to that of the sample of all individuals. Moreover, the variance of consumption remains more or less flat up to 1992 but it experiences a slight increase, closer to the evolution of the variance in income, since then.

Given this different evolution, it seems reasonable to separately analyze these two groups of households. Additionally, the fact that income and consumption inequality for the whole period is higher for self-employed than for employees is evidence in favor of the greater risk of income faced by the self-employed. It is also noticeable that the variance of consumption is in general bellow the variance of income, which might be reflecting the fact that individuals are able to insure (at least partially) the risk associated with their occupations.

4.2 Estimation Results: Permanent and Transitory Inequality

We follow the procedure described in Subsection 2.3 to decompose income inequality into a permanent and a transitory component. We first remove the deterministic effect of observable characteristics on income and consumption. For that, we regress the growth of log income and log consumption on dummies for education, marital status and full-part time employment of the head, occupation of the wife, dummies for population size, year and week. Separate regressions are carried out for households belonging to different cohorts defined by head's year of birth.[14] We work with the residuals of these regressions exploiting the set of restrictions in (8)-(10) for the samples of "Self-Employed", "Employees" and "All".

Table 5 presents a battery of tests of joint significance of all the variances and covariances involved in the equations (8)-(9). A close look to the figures in the table shows that the restrictions posed in (8)-(9) seem reasonable. Three points are worth to mention. First, for employees and the sample of all households the autocovariances of income growth are significant to the fifth order, while for the self-employed only the first order autocovariance is significantly different from zero. Both facts are compatible with the model proposed in section 2.3 in which there is seasonality in income only for employees. Moreover, these results suggest that for the self-employed the transitory component has little or no persistence. Second, the first order autocovariance of consumption growth is different from zero for the three samples. This can be interpreted as a sign for the presence of measurement error in consumption. Third, for the three samples, the covariance between current consumption and current income growth is significantly different from zero, while the covariances between current consumption growth and future income growth are statistically equal to zero. This suggests that the parameter φ equals zero, which means that transitory shocks of income are not transmitted to consumption but insured away.

We now turn to the Minimum Distance Estimation. Table 6 presents the results for the basic specification. Along the lines of previous studies we obtain

[14] See Table 2 for cohort's definition.

statistically significant estimates of most of the parameters of interest. It is also worth mentioning that the variances of the seasonal component for the employees are significant; thus Spanish pay system induces a particular within year income dispersion for wage earners. In spite of the fact that seasonality can be important in some business sectors, we do not find such an effect for the self-employed.

The estimates of the MA and φ parameters confirms the descriptive evidence shown in Table 5. Specifically, for the sample of employees and of all households there is evidence of a MA(2) and for the self-employed there is no persistence of the transitory shocks. The estimate for the parameter φ, that reflects how transitory shocks are transmitted into consumption, is not significantly different from zero. This suggests that transitory income shocks are insured away by the households and only permanent income shocks are transmitted through to consumption. Blundell et al. (2004) reach a similar conclusion using US data, although in their model they also allow for partial insurance of the permanent component. Finally, the variance of consumption shock is precisely estimated and it accounts for a considerable amount of the cross-sectional variation in consumption. As mentioned above, this variance could partly include measurement error in consumption.

The estimated variances of the transitory and permanent shocks are more or less of the same magnitude for the employees. In turn, for the self-employed the relative contribution of the transitory shock to the variation in inequality is considerably higher: the variance of the transitory component is four times larger than the variance of the permanent shock. This could be partly attributed to the fact that the estimated transitory component incorporates the variance of the measurement error, which could be more important for self-employment income. But it is hard to believe that measurement error can evolve as much over time as to lead the time pattern of this component. Notwithstanding, the permanent component for self-employed is much lower than for employees and for the sample which includes unemployed workers, while the opposite occurs with the transitory one. Table 7 presents the χ^2_{12} tests of joint equality of permanent and transitory variances between samples. We find statistically significant differences for all cases, except for the permanent component between the sample of employees and "All".

In Figures 3 and 4 we plot the Minimum Distance estimates of the variance of the permanent and transitory shocks against time. The estimates are smoothed in the figures by taking three-year moving averages. In general Figure 3 points to an overall increase of the permanent inequality for the three samples. For employees, the increase (of around 45%) stops by 1992, remaining stable afterwards. For self-employed the increase is stronger and lasts until 1994; overall the variance of the permanent component for self-employed double between 1987 and 1996. Employees display a behavior more similar to that of "All" than self-employed. The evolution of transitory component (Figure 4) displays a clear co-movement with business cycle, although of different sign for employees and for the self-employed. While the Spanish economy slowed down from 1987 until the 1991-92 crisis, the transitory component increased by 23% for employees and by 14% for the sample of all households. This is more than compensated by the decrease observed during the recovery period (1992-1996). On the other hand, for the self-employed the variance of the transitory component is clearly pro-cyclical: it decreased by 43% in the 1987-1992 period and increased around 46% thereafter.[15] The increase of the variance of the transitory component for the samples of employees and "All" also coincides with a period of higher employment instability in Spain due to the widespread use of temporary contracts introduced around 1984. The reduction of the variance of

[15]We find that transitory component of income inequality is negatively correlated with the GDP growth for the employees, whereas it is positively correlated for the self-employed. The estimated correlation coefficients are -0.5522 (with standard error 0.0626) and 0.5510 (with standard error 0.0634), respectively.

the transitory component for the same groups from 1993-1994 coincides with the implementation of additional labour market reforms aimed at reducing the indiscriminate use of this type of contracts.[16]

As to the relative importance of both components, our results show that the relative contribution of the transitory component for the self-employed has basically not changed over the period and it is around 80%. In turn, for the employees the relative contribution of the transitory component fell from 55% in the period 1986-89 to around 40% in the period 1996-97.[17]

These results show the importance of separating these two groups of workers: once we account separately for self-employed individuals, the picture of the evolution of the permanent and the transitory component of income shocks changes significantly. The same conclusions hold when using the estimates from the specification in fourth differences for the employees and for the estimates using only income data,[18] although in this case some of the effects become just marginally significant.

4.3 Robustness check

We have shown remarkable differences in the evolution and relative importance of inequality components for employees and self-employed. It could be thought that such differences are not genuinely driven by occupation but by some other characteristics correlated with the type of occupation, such as year-of-birth cohort and education. We control for these variables in modelling the income process, but one may wonder whether income inequality itself varies across cohorts and levels of education for employees and self-employed. Ideally we would like to separately compute permanent and transitory components of income variance by groups defined in terms of occupation, cohort and educational level. How-

[16] Cervini and Ramos (2006) also find for employees a reduction in the transitory volatility from 1993 onwards using only income data in the estimation.

[17] This "relative contribution of the transitory component" is computed as the variance of the transitory shock over the sum of the variance of transitory and the the permanent shock.

[18] They are available from the authors upon request.

ever, sample size limitations deter us from doing it. Alternatively, we repeat the previous exercise by splitting the sample firstly by cohort and occupation and, secondly, by educational level and occupation. To the extent that differences by occupation still remain, we can be more or less confident that occupation has a genuine role.

Consequently, we split the sample into four groups based on cohort and occupation; employees born in 1920-1944, employees born in 1945-1964, self-employed born in 1920-1944, and self-employed born in 1945-1964. Then, we perform the analysis by splitting the sample into other four groups based on education and occupation; employees with low level of education (lees than secondary school), employees with high level of education, self-employed with low level of education, and self-employed with high level of education.

Figures 5 and 6 present the variance of log income and log consumption for employees and self-employed for each cohort and educational group. We can see that both the level and the evolution of income inequality are noticeable different for employees and self-employed, specially among older and more educated individuals.

To compare the permanent and transitory inequality across occupation-cohort and occupation-education groups, we estimate the model presented above for each group. The Minimum Distance estimates are presented in Tables 8 and 9. In both cases we also estimate the model for the sample of “All” individuals.

The relevant exercise for us here is to compare the results between the employees and the self-employed by cohort and education. The differences between these groups can be seen more clearly in Figures 7 and 8, where we have plotted the permanent and transitory components of variance. Again, we observe that in general the pattern for the sample of employees is quite similar to the pattern for the sample including all individuals. The average relative contribution of the transitory component is considerably higher for the self-employed than for the employees in all cohorts and education groups. For instance, for the low educated group it represents around 30% for employees and almost 90% for the self-employed; and for the oldest cohort these figures are 60% and 75% respectively. We have also performed a test of equality of coefficients between employees and self-employed. Basically, we obtain that for some years the null hypothesis of equality cannot be rejected at conventional levels, specially for the permanent component. Nonetheless, this result is not surprising given the small sample size of some of the groups considered.

5 Conclusions

In this paper we have used Spanish panel data on income and consumption to analyze the evolution of income inequality for self-employed and employees over the period 1986 to 1997. In general, our results show that there are notable differences in the evolution of income inequality, as well as in the relative importance of the permanent and transitory components, across these groups. Specifically, we find that income inequality for employees follows a similar pattern to the sample of all households: it decreased until beginning of the 90s, went up approximately until 1994 and down again in the last two years of the sample. In turn for the self-employed there was a strong increase between 1986 and 1990 and a sharp decrease from 1990 to 1992, to increase slightly at the end of the period. We also find that the self-employed face higher risk than employees.

Our results points that these trends can be basically explained by movements in the transitory component of income for the self-employed, while the evolution of inequality for the employees is mainly driven by the permanent component specially at the end of the period. Also, there is no evidence that the transitory shocks are transmitted into consumption for any of the groups. Therefore, although the self-employed face higher income risk than the employees (mainly due to transitory shocks), it seems that they are able to insure it.

Our finding that in Spain income inequality has not increased over the period considered partly differs from the evidence for US and UK. The increase in cross-sectional inequality in these labour markets over the 1980s has been widely documented. Moffit and Gottschalk (2002), using a different methodology and PSID data find that the variance of the transitory component of earnings increased over the 1970s and 1980s in approximately equal magnitude to an increase in the variance of the permanent component. Dickens (2000) uses the same approach as Gottschalk and Moffit and obtains similar results for the UK in 1975-95. The results by Blundell and Preston (1998), who follow an approach similar to ours, are also consistent with Dickens (2000).

However, none of these papers have investigated the importance of accounting separately for self-employment and employment incomes. We have found that the relative importance of the transitory and permanent components varies across occupations, having a higher weight the transitory component for the self-employed. Given that changes in income inequality driven by transitory shocks will only have small effects on consumption inequality and welfare, our results suggests that it would be useful to do a separate analysis.

References

[1] Albarrán, P. (2000), Income uncertainty and precautionary saving: Evidence from household rotating panel data. Working Papers 0008, Centro de Estudios Monetarios y Financieros.

[2] Alvarez, J. (2004), Dynamics and seasonality in quarterly panel data: An analysis of earnings mobility in Spain. *Journal of Business & Economic Statistics*, **22**, 443–457.

[3] Blau, D. M. (1987), A time-series analysis of self-employment in the United States. *The Journal of Political Economy*, **95**, 445–467.

[4] Blundell, R., Pistaferri, L., and Preston, I. (2004), Consumption inequality and partial insurance. IFS Working Papers W04/28.

[5] Blundell, R. and Preston, I. (1998), Consumption inequality and income uncertainty. *Quarterly Journal of Economics*, **113**, 603–640.

[6] Browning, M. and Lusardi, A. (1996), Household saving: Micro theories and micro facts. *Journal of Economic Literature*, **34**, 1797–1855.

[7] Carrington, W. J., McCue, K., and Pierce, B. (1996), The role of employer/employee interactions in labor market cycles: Evidence from the self-employed. *Journal of Labor Economics*, **14**, 571–602.

[8] Cervini, P. and Ramos, X. (2006), Permanent and transitory earnings inequality in Spain, 1993-2000. Mimeo.

[9] Cutanda, A. (2002), La medición de la desigualdad a través de un modelo de elección intertemporal. *Hacienda Pública Española*, **163**, 93–117.

[10] Cutanda, A., Labeaga, J. M., and Mochón, F. (2004), Análisis de la desigualdad en España y su relación con algunas variables demográficas. Mimeo.

[11] Dickens, R. (2000), The evolution of individual male earnings in Great Britain: 1975-95. *The Economic Journal*, **110**, 27–49.

[12] Falter, J.-M. (2006), Self-employment and earnings inequality. *Journal of Income Distribution*. Forthcoming.

[13] Guvenen, F. (2005), An Empirical Investigation of Labor Income Processes. University of Texas at Austin. Mimeo.

[14] Hamilton, B. H. (2000), Does entrepreneurship pay? An empirical analysis of the returns of self-employment. *The Journal of Political Economy*, **108**, 604–631.

[15] Jenkins, S. P. (1995), Accounting for inequality trends: Decomposition analyses for the UK, 1971- 86. *Economica*, **62**, 29–63.

[16] Martinez-Granado, M. (2002), Self-employment and labour market transitions: a multiple state model. Discussion Paper 366, CEPR DP366.

[17] McClements, L. D. (1977), Equivalence scales for children. *Journal of Public Economics*, **8**, 191–210.

[18] Moffitt, R. A. and Gottschalk, P. (2002), Trends in the transitory variance of earnings in the United States. *The Economic Journal*, **112**, C68–C73.

[19] Moffitt, R. A. and Gottschalk, P. (1995), Trends in the variances of permanent and transitory earnings in the U.S. and their relation to earnings mobility. Boston College Working Papers in Economics 444, Boston College Department of Economics.

[20] Parker, S. C. (1999), The inequality of employment and self-employment incomes: A decomposition analysis for the U.K. *Review of Income and Wealth*, **45**, 263–74.

[21] Parker, S.C., Belghitar Y. and Barmby, T. (2005), Wage uncertainty and the labour supply of self-employed workers. *The Economic Journal*, 115, C190-C207.

[22] Primiceri, G. E. and van Rens, T. (2006), Heterogeneous life-cycle profiles, income risk and consumption inequality. Mimeo.

[23] Torrini, R. (2006), Self-employment incidence, overall income inequality and wage compression. Bank of Italy. Mimeo.

Table 1: Sample Selection: number of observations

	# Dropped	# Remain
Initial sample (1985 1st Q-1997 1st Q)	0	151,793
Not fully interviewed	33,586	118,207
Aged 65 or more	29,673	88,534
With permanent visitors	547	87,987
Female head	12,526	75,461
Change in marital status	354	75,107
Change in family composition bigger than 1	1,236	73,871
Invalid income	2,164	71,707
Invalid consumption	721	70,986
Born before 1920 or after 1964	2,187	68,799
Ever in agriculture	7,530	61,269
Interviewed < 3	5,417	55,852
N^o Obs. Sample Employees (E)	30,889	
N^o Obs. Sample Self-employed (SE)	5,535	
N^o Obs. Sample All	55,852	

Table 2: Sample Statistics

	E		**SE**		**All**	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age	42.258	9.540	44.958	9.979	45.327	11.041
Cohort 1920-34	0.124	0.330	0.189	0.392	0.241	0.428
Cohort 1935-44	0.227	0.419	0.252	0.434	0.222	0.416
Cohort 1945-54	0.356	0.479	0.326	0.469	0.298	0.457
Cohort 1955-64	0.293	0.455	0.232	0.422	0.239	0.426
Without studies	0.084	0.278	0.104	0.305	0.149	0.356
Primary School	0.613	0.487	0.709	0.454	0.612	0.487
Secondary School	0.175	0.380	0.123	0.329	0.139	0.346
High School	0.128	0.334	0.064	0.246	0.100	0.300
Married	0.965	0.184	0.969	0.175	0.955	0.207
Number of children	1.505	1.119	1.408	1.177	1.323	1.174
Popul. < 10,000	0.176	0.381	0.284	0.451	0.216	0.411
Popul. 10-50,000	0.194	0.395	0.255	0.436	0.219	0.414
Popul. 50-500,000	0.466	0.499	0.353	0.478	0.419	0.493
Popul. > 500,000	0.164	0.371	0.108	0.311	0.146	0.353
Full time worker	0.976	0.152	0.962	0.192	0.783	0.412
Wife working	0.252	0.434	0.152	0.359	0.224	0.417
Wife SE	0.043	0.203	0.134	0.341	0.059	0.236
N^o observations		30,889		5,535		55,852
N^o households		6,138		1,494		9,292

Table 3: Type of occupation

	SE			
Year	*1994*	*1995*	*1996*	*1997*
Managers	36.12	38.84	38.18	39.84
Professionals	11.50	11.98	13.36	13.52
Clerks	1.40	1.22	1.07	0.89
Workers in Acc. Foodservices	1.07	0.78	0.76	0.70
Personal Services	1.50	1.66	1.05	0.93
Sales workers	1.40	0.78	0.67	0.56
Craft and related trades	15.64	15.13	16.06	15.72
Skilled mining workers and similars	8.44	7.06	6.98	7.79
Skilled manufacturing workers	7.26	6.60	6.08	5.55
Plant machine operators and assemblers	13.15	13.15	13.15	12.07
Domestic service	0.24	0.29	0.17	0.29
Unskilled workers	2.28	2.50	2.47	2.15
	E			
Year	*1994*	*1995*	*1996*	*1997*
Managers	4.15	4.17	4.36	4.67
Professionals	18.69	20.17	22.37	23.02
Clerks	11.01	10.17	9.74	9.67
Workers in Acc.Foodservices	2.70	2.72	2.82	2.73
Personal Services	4.95	5.24	5.62	5.81
Sales workers	2.92	2.69	2.68	2.69
Craft and related trades	11.15	11.78	11.54	12.34
Skilled mining workers and similars	11.54	11.01	10.76	10.36
Skilled manufacturing workers	4.21	3.99	3.64	3.76
Plant machine operators and assemblers	17.67	17.71	16.66	16.13
Domestic service	0.73	0.63	0.61	0.59
Unskilled workers	10.27	9.73	9.19	8.22

Source: EPA; Sample: working males, non in agriculture, head of household, age between 20-64, and born between 1920-1964. N^o Observations: 84,521.

Table 4: Distribution of income and consumption

	Income			Consumption		
	E	**SE**	**All**	**E**	**SE**	**All**
Mean	387,418	354,491	357,971	229,860	225,704.	221,835
Std. Dev.	215,014	322,720	236,747	116,532	121,700	118,754
1st percentile	116,580	89,326	76,854	66,601	62,599	59,135
25th percentile	247,147	212,521	218,574	153,173	144,678	144,770
50th percentile	333,723	297,464	305,757	206,554	197,059	197,873
75th percentile	470,349	420,496	436,695	27,9112	276,244	269,867
99th percentile	1,139,339	1,173,133	1,128,818	621,412	657,816	621,800

Table 5: Test of Joint Significance of Variances and Covariances

	E			SE			All		
				$cov(\Delta c_{it}, \Delta c_{i,t+s})$					
	χ^2_{df}	df	p-value	χ^2_{df}	df	p-value	χ^2_{df}	df	p-value
s=0	4998.34	45	0.000	974.81	45	0.000	7670.26	45	0.000
s=1	1874.68	44	0.000	284.51	44	0.000	2983.61	44	0.000
s=2	45.18	43	0.381	37.65	43	0.702	38.15	43	0.681
s=3	44.19	41	0.338	30.00	41	0.898	67.59	41	0.006
s=4	79.05	39	0.000	24.44	39	0.967	95.22	39	0.000
s=5	37.42	37	0.445	77.90	37	0.000	46.48	37	0.136
s=6	20.49	35	0.976	17.20	22	0.752	24.94	35	0.896
				$cov(\Delta c_{it}, \Delta y_{i,t+s})$					
	χ^2_{df}	df	p-value	χ^2_{df}	df	p-value	χ^2_{df}	df	p-value
s=0	116.46	45	0.000	69.82	45	0.010	210.11	45	0.000
s=1	37.18	44	0.757	51.71	44	0.198	55.27	44	0.119
s=2	46.69	43	0.323	41.15	43	0.552	48.08	43	0.275
s=3	58.37	41	0.038	32.93	41	0.811	33.11	41	0.805
s=4	29.85	39	0.854	27.46	39	0.917	30.68	39	0.827
s=5	33.73	37	0.623	19.42	37	0.992	37.47	37	0.447
s=6	21.02	35	0.970	12.35	22	0.950	30.80	35	0.671
				$cov(\Delta y_{it}, \Delta y_{i,t+s})$					
	χ^2_{df}	df	p-value	χ^2_{df}	df	p-value	χ^2_{df}	df	p-value
s=0	1617.44	45	0.000	499.20	45	0.000	1777.69	45	0.000
s=1	910.19	44	0.000	178.02	44	0.000	957.42	44	0.000
s=2	151.08	43	0.000	46.30	43	0.338	70.04	43	0.006
s=3	150.55	41	0.000	44.75	41	0.317	163.79	41	0.000
s=4	169.41	39	0.000	23.49	39	0.977	163.93	39	0.000
s=5	69.83	37	0.001	26.74	37	0.894	88.35	37	0.000
s=6	18.96	35	0.988	10.81	22	0.977	29.38	35	0.736

Table 6: Minimum distance estimates

		E	SE	All
φ		-0.53682	-0.08692	-0.12487
		(0.43964)	(0.18558)	(0.10638)
θ_1		-0.12222	0.08692	0.03165
		(0.16015)	(0.10871)	(0.05864)
θ_2		0.12753	0.02043	0.07793
		(0.04551)	(0.05730)	(0.03108)
σ^2_ε		0.17012	0.16010	0.17665
		(0.00924)	(0.00984)	(0.00398)
$\sigma^2_{\eta_1}$		0.00486	0.00493	0.00507
		(0.00109)	(0.00534)	(0.00126)
$\sigma^2_{\eta_2}$		0.00675	0.00174	0.00602
		(0.00130)	(0.00480)	(0.00125)
$\sigma^2_{\eta_3}$		0.00604	0.00157	0.00826
		(0.00124)	(0.00299)	(0.00148)
$\sigma^2_{\eta_4}$		0.00596	-0.00577	0.00565
		(0.00109)	(0.00440)	(0.00129)
σ^2_ζ	*1986*	0.01296	0.00860	0.01005
		(0.00539)	(0.01216)	(0.00416)
	1987	0.00933	0.00956	0.00982
		(0.00476)	(0.01141)	(0.00355)
	1988	0.01082	0.00029	0.01176
		(0.00408)	(0.01272)	(0.00376)
	1989	0.01017	0.00654	0.01140
		(0.00432)	(0.01000)	(0.00307)
	1990	0.01738	0.00000	0.01250
		(0.00473)	(0.00872)	(0.00334)
	1991	0.01673	0.01240	0.01707
		(0.00551)	(0.00910)	(0.00451)
	1992	0.01280	0.01017	0.00879
		(0.00482)	(0.00812)	(0.00364)
	1993	0.01878	0.00974	0.01608
		(0.00629)	(0.00922)	(0.00494)
	1994	0.01257	0.01281	0.00962
		(0.00590)	(0.00890)	(0.00455)
	1995	0.01218	0.01691	0.01487
		(0.00463)	(0.00994)	(0.00379)
	1996	0.01678	0.00285	0.01219
		(0.00430)	(0.01016)	(0.00372)
	1997	0.01572	0.01678	0.01466
		(0.00765)	(0.01893)	(0.00676)

Table 6(Cont.): Minimum Distance Estimates

		E	**SE**	**All**
σ_u^2	*1986*	0.01538	0.02530	0.02958
		(0.00555)	(0.01219)	(0.00534)
	1987	0.01388	0.03975	0.02474
		(0.00533)	(0.01373)	(0.00388)
	1988	0.01061	0.06194	0.03114
		(0.00386)	(0.03164)	(0.00524)
	1989	0.01291	0.02148	0.02149
		(0.00438)	(0.00775)	(0.00335)
	1990	0.01196	0.03764	0.02523
		(0.00431)	(0.01461)	(0.00452)
	1991	0.01543	0.02421	0.03164
		(0.00617)	(0.00970)	(0.00569)
	1992	0.01198	0.02797	0.02599
		(0.00417)	(0.00882)	(0.00465)
	1993	0.01973	0.02065	0.03769
		(0.00749)	(0.00711)	(0.00684)
	1994	0.01609	0.02753	0.03412
		(0.00733)	(0.00731)	(0.00563)
	1995	0.01139	0.03066	0.02585
		(0.00365)	(0.00994)	(0.00379)
	1996	0.01093	0.02118	0.02607
		(0.00368)	(0.00668)	(0.00475)
	1997	0.01050	0.05422	0.02398
		(0.00531)	(0.01976)	(0.00704)

Table 7: Joint Test of Equality of Variances

	E vs. SE	**E vs. All**	**SE vs. All**
σ_ζ^2	21.4412	7.7450	26.5671
	(0.0443)	(0.8047)	(0.0089)
σ_u^2	22.3141	25.8434	28.6047
	(0.0341)	(0.0113)	(0.0045)

Note: Number in brackets are p-values. All the tests have 12 degrees of freedom.

Table 8: Minimum distance estimates; by cohort

		Cohort 1920-1944			Cohort 1945-1964		
		E	**SE**	**All**	**E**	**SE**	**All**
φ		-0.2033	-0.0795	-0.3049	-0.0120	-0.2326	0.0824
		(0.4174)	(0.2036)	(0.2402)	(0.1702)	(0.3869)	(0.0803)
θ_1		-0.0406	-0.0050	0.0013	0.0000*	0.0326	0.0641
		(0.1635)	(0.1049)	(0.1099)	(0.0000)	(0.1662)	(0.0625)
θ_2		0.0964	-0.0337	0.0520	0.0000*	0.1038	0.0949
		(0.0747)	(0.0602)	(0.0513)	(0.0000)	(0.1463)	(0.0389)
σ^2_ε		0.1666	0.1568	0.1661	0.1880	0.1546	0.1879
		(0.0098)	(0.0137)	(0.0090)	(0.0049)	(0.0145)	(0.0038)
$\sigma^2_{\eta_1}$		0.0061	0.0108	0.0049	0.0044	-0.0031	0.0045
		(0.0025)	(0.0114)	(0.0021)	(0.0012)	(0.0030)	(0.0015)
$\sigma^2_{\eta_2}$		0.0037	0.0027	0.0030	0.0080	0.0033	0.0083
		(0.0026)	(0.0079)	(0.0018)	(0.0016)	(0.0068)	(0.0017)
$\sigma^2_{\eta_3}$		0.0106	-0.0009	0.0105	0.0046	0.0031	0.0068
		(0.0040)	(0.0045)	(0.0029)	(0.0011)	(0.0048)	(0.0016)
$\sigma^2_{\eta_4}$		0.0073	-0.0016	0.0068	0.0052	0.0019	0.0049
		(0.0021)	(0.0073)	(0.0020)	(0.0012)	(0.0040)	(0.0016)
σ^2_ζ	*1986*	0.0015	0.0267	0.0054	0.0144	0.0000	0.0175
		(0.0089)	(0.0170)	(0.0064)	(0.0054)	(0.0140)	(0.0057)
	1987	0.0000	0.0032	0.0062	0.0086	0.0224	0.0134
		(0.0076)	(0.0142)	(0.0056)	(0.0050)	(0.0145)	(0.0049)
	1988	0.0103	0.0000	0.0164	0.0011	0.0071	0.0046
		(0.0060)	(0.0178)	(0.0058)	(0.0055)	(0.0095)	(0.0051)
	1989	0.0113	0.0000	0.0147	0.0000	0.0252	0.0066
		(0.0070)	(0.0118)	(0.0059)	(0.0050)	(0.0126)	(0.0039)
	1990	0.0047	0.0000	0.0115	0.0156	0.0069	0.0101
		(0.0068)	(0.0110)	(0.0052)	(0.0061)	(0.0121)	(0.0047)
	1991	0.0056	0.0000	0.0135	0.0133	0.0309	0.0169
		(0.0071)	(0.0103)	(0.0067)	(0.0069)	(0.0137)	(0.0058)
	1992	0.0079	0.0157	0.0064	0.0048	0.0074	0.0057
		(0.0080)	(0.0117)	(0.0061)	(0.0061)	(0.0097)	(0.0046)
	1993	0.0203	0.0011	0.0184	0.0078	0.0226	0.0109
		(0.0113)	(0.0132)	(0.0083)	(0.0070)	(0.0125)	(0.0056)
	1994	0.0155	0.0305	0.0177	0.0002	0.0083	0.0000
		(0.0136)	(0.0126)	(0.0080)	(0.0062)	(0.0127)	(0.0052)
	1995	0.0223	0.0125	0.0242	0.0000	0.0222	0.0041
		(0.0108)	(0.0128)	(0.0062)	(0.0048)	(0.0143)	(0.0048)
	1996	0.0146	0.0136	0.0166	0.0084	0.0045	0.0048
		(0.0081)	(0.0162)	(0.0057)	(0.0051)	(0.0133)	(0.0050)
	1997	0.0444	0.0000	0.0241	0.0000	0.0307	0.0046
		(0.0168)	(0.0155)	(0.0099)	(0.0091)	(0.0240)	(0.0092)

Note*: These coefficients have been set to cero.

Table 8 (cont.): Minimum Distance Estimates; by cohort

		Cohort 1920-1944			Cohort 1945-1964		
		E	**SE**	**All**	**E**	**SE**	**All**
σ_u^2	*1986*	0.0239	0.0052	0.0291	0.0153	0.0421	0.0287
		(0.0094)	(0.0097)	(0.0071)	(0.0048)	(0.0202)	(0.0088)
	1987	0.0201	0.0490	0.0221	0.0168	0.0157	0.0280
		(0.0099)	(0.0203)	(0.0059)	(0.0044)	(0.0109)	(0.0050)
	1988	0.0085	0.0922	0.0271	0.0204	0.0123	0.0367
		(0.0039)	(0.0584)	(0.0082)	(0.0059)	(0.0056)	(0.0063)
	1989	0.0141	0.0181	0.0236	0.0204	0.0130	0.0207
		(0.0052)	(0.0095)	(0.0057)	(0.0056)	(0.0072)	(0.0042)
	1990	0.0126	0.0289	0.0202	0.0170	0.0326	0.0310
		(0.0049)	(0.0123)	(0.0062)	(0.0064)	(0.0204)	(0.0063)
	1991	0.0143	0.0137	0.0303	0.0216	0.0218	0.0335
		(0.0061)	(0.0075)	(0.0078)	(0.0084)	(0.0134)	(0.0085)
	1992	0.0132	0.0307	0.0246	0.0187	0.0158	0.0288
		(0.0056)	(0.0123)	(0.0070)	(0.0055)	(0.0082)	(0.0061)
	1993	0.0252	0.0181	0.0393	0.0262	0.0136	0.0383
		(0.0115)	(0.0104)	(0.0134)	(0.0077)	(0.0075)	(0.0071)
	1994	0.0294	0.0159	0.0341	0.0218	0.0249	0.0371
		(0.0207)	(0.0107)	(0.0106)	(0.0069)	(0.0095)	(0.0061)
	1995	0.0193	0.0226	0.0209	0.0160	0.0278	0.0319
		(0.0097)	(0.0094)	(0.0058)	(0.0036)	(0.0136)	(0.0050)
	1996	0.0108	0.0095	0.0217	0.0169	0.0176	0.0319
		(0.0067)	(0.0090)	(0.0081)	(0.0044)	(0.0085)	(0.0057)
	1997	0.0000	0.0327	0.0180	0.0239	0.0494	0.0302
		(0.0084)	(0.0160)	(0.0110)	(0.0072)	(0.0260)	(0.0092)

Table 9: Minimum distance estimates; by education

		Low Education			High Education		
		E	**SE**	**All**	**E**	**SE**	**All**
φ		-1.3457	-0.0957	-0.1774	-0.9372	-0.2545	-0.8055
		(0.6764)	(0.2125)	(0.1297)	(1.0223)	(0.4212)	(0.9510)
θ_1		-0.3002	0.0686	0.0168	-0.9694	-0.1456	-1.1269
		(0.1872)	(0.1162)	(0.0696)	(1.0940)	(0.1713)	(1.3851)
θ_2		0.1547	0.0000	0.0632	-0.1183	0.0441	-0.0881
		(0.0617)	(0.0547)	(0.0350)	(0.1288)	(0.1066)	(0.1412)
σ^2_ε		0.1459	0.1570	0.1683	0.1880	0.1645	0.1911
		(0.0137)	(0.0111)	(0.0049)	(0.0100)	(0.0218)	(0.0093)
$\sigma^2_{\eta_1}$		0.0060	0.0063	0.0055	0.0048	-0.0036	0.0048
		(0.0014)	(0.0058)	(0.0015)	(0.0017)	(0.0119)	(0.0026)
$\sigma^2_{\eta_2}$		0.0086	-0.0001	0.0066	0.0035	-0.0033	0.0043
		(0.0016)	(0.0035)	(0.0014)	(0.0020)	(0.0108)	(0.0029)
$\sigma^2_{\eta_3}$		0.0064	0.0019	0.0088	0.0069	0.0054	0.0075
		(0.0012)	(0.0029)	(0.0018)	(0.0028)	(0.0165)	(0.0028)
$\sigma^2_{\eta_4}$		0.0055	-0.0061	0.0052	0.0082	-0.0075	0.0079
		(0.0012)	(0.0049)	(0.0015)	(0.0024)	(0.0085)	(0.0027)
σ^2_ζ	*1986*	0.0129	0.0170	0.0105	0.0111	0.0000	0.0137
		(0.0039)	(0.0124)	(0.0042)	(0.0079)	(0.0162)	(0.0078)
	1987	0.0144	0.0100	0.0126	0.0102	0.0312	0.0110
		(0.0035)	(0.0127)	(0.0037)	(0.0068)	(0.0244)	(0.0064)
	1988	0.0166	0.0009	0.0148	0.0092	0.0078	0.0120
		(0.0035)	(0.0144)	(0.0044)	(0.0062)	(0.0170)	(0.0057)
	1989	0.0180	0.0093	0.0142	0.0000	0.0197	0.0107
		(0.0038)	(0.0113)	(0.0038)	(0.0045)	(0.0200)	(0.0051)
	1990	0.0202	0.0000	0.0129	0.0162	0.0161	0.0173
		(0.0043)	(0.0085)	(0.0039)	(0.0064)	(0.0246)	(0.0061)
	1991	0.0198	0.0010	0.0161	0.0137	0.0731	0.0302
		(0.0045)	(0.0094)	(0.0051)	(0.0069)	(0.0242)	(0.0091)
	1992	0.0146	0.0070	0.0081	0.0105	0.0210	0.0132
		(0.0039)	(0.0085)	(0.0042)	(0.0073)	(0.0197)	(0.0067)
	1993	0.0228	0.0076	0.0183	0.0133	0.0068	0.0137
		(0.0051)	(0.0093)	(0.0058)	(0.0071)	(0.01948)	(0.0071)
	1994	0.0187	0.0167	0.0141	0.0072	0.0063	0.0042
		(0.0054)	(0.0103)	(0.0052)	(0.0075)	(0.0164)	(0.0066)
	1995	0.0192	0.0199	0.0192	0.0048	0.0140	0.0077
		(0.0044)	(0.0109)	(0.0042)	(0.0069)	(0.0210)	(0.0064)
	1996	0.0215	0.0012	0.0139	0.0112	0.0220	0.0119
		(0.0045)	(0.0117)	(0.0043)	(0.0064)	(0.0261)	(0.0065)
	1997	0.0114	0.0048	0.0129	0.0272	0.0194	0.0227
		(0.0058)	(0.0167)	(0.0075)	(0.0146)	(0.0235)	(0.0129)

Table 9 (cont.): Minimum distance estimates; by education

		Low Education			High Education		
		E	**SE**	**All**	**E**	**SE**	**All**
σ_u^2	*1986*	0.0083	0.0140	0.0256	0.0078	0.0458	0.0123
		(0.0029)	(0.0079)	(0.0046)	(0.0068)	(0.0345)	(0.0162)
	1987	0.0064	0.0405	0.0228	0.0058	0.0177	0.0048
		(0.0022)	(0.0149)	(0.0039)	(0.0067)	(0.0127)	(0.0068)
	1988	0.0055	0.0662	0.0321	0.0033	0.0140	0.0038
		(0.0019)	(0.0345)	(0.0062)	(0.0037)	(0.0116)	(0.0051)
	1989	0.0100	0.0195	0.0230	0.0029	0.0132	0.0031
		(0.0037)	(0.0082)	(0.0042)	(0.0032)	(0.0115)	(0.0039)
	1990	0.0089	0.0265	0.0254	0.0035	0.0668	0.0069
		(0.0033)	(0.0086)	(0.0053)	(0.0037)	(0.0483)	(0.0089)
	1991	0.0116	0.0286	0.0316	0.0061	0.0005	0.0077
		(0.0049)	(0.0106)	(0.0061)	(0.0077)	(0.0131)	(0.0108)
	1992	0.0088	0.0224	0.0266	0.0049	0.0427	0.0066
		(0.0029)	(0.0082)	(0.0052)	(0.0055)	(0.0254)	(0.0086)
	1993	0.0141	0.0203	0.0396	0.0071	0.0171	0.0085
		(0.0070)	(0.0077)	(0.0087)	(0.0076)	(0.0109)	(0.0109)
	1994	0.0078	0.0255	0.0322	0.0093	0.0189	0.0097
		(0.0032)	(0.0077)	(0.0061)	(0.0122)	(0.0113)	(0.0133)
	1995	0.0083	0.0251	0.0248	0.0037	0.0481	0.0068
		(0.0028)	(0.0092)	(0.0042)	(0.0041)	(0.0276)	(0.0093)
	1996	0.0098	0.0218	0.0276	0.0026	0.0042	0.0041
		(0.0037)	(0.0072)	(0.0059)	(0.0029)	(0.0097)	(0.0054)
	1997	0.0023	0.0423	0.0205	0.0119	0.0235	0.0080
		(0.0035)	(0.0165)	(0.0074)	(0.0125)	(0.0135)	(0.0103)

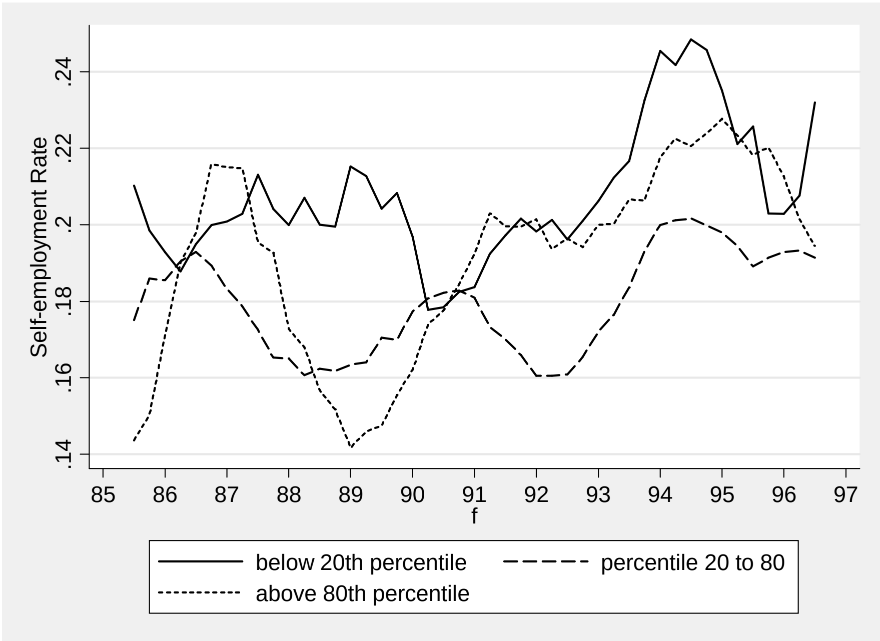

Figure 1: Self-employment rates by ln(c) distribution

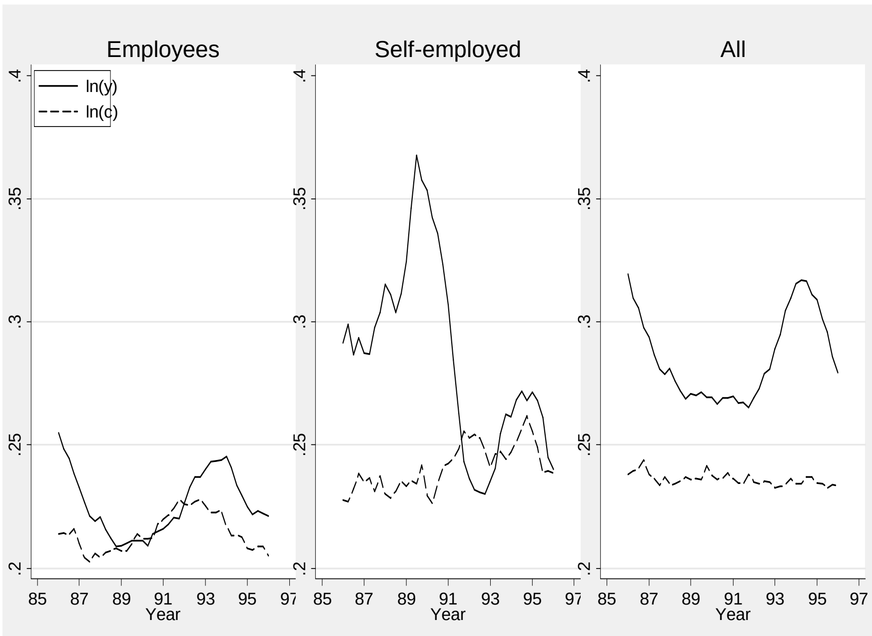

Figure 2: Variances of ln(y) and ln(c)

Figure 3: Variance of the Permanent Component

Figure 4: Variance of the Transitory Component

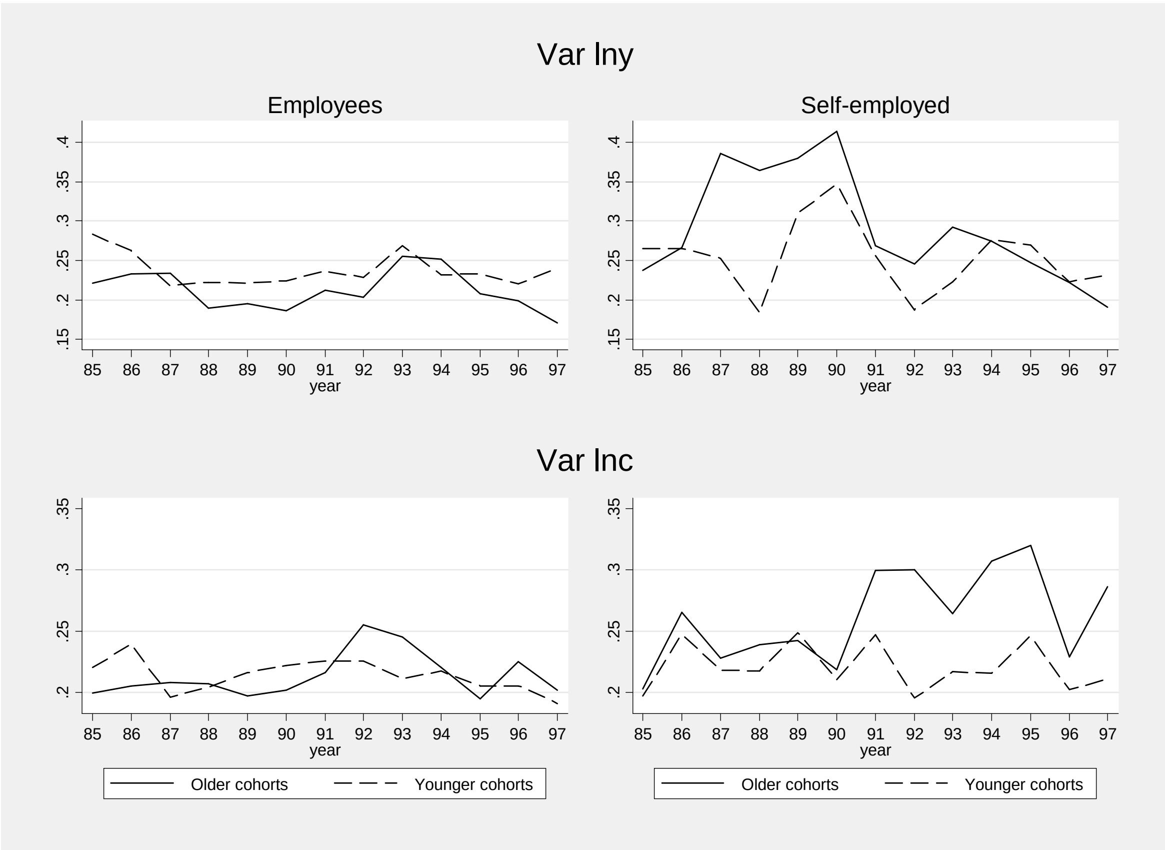

Figure 5: Variance of lny and lnc: by cohort

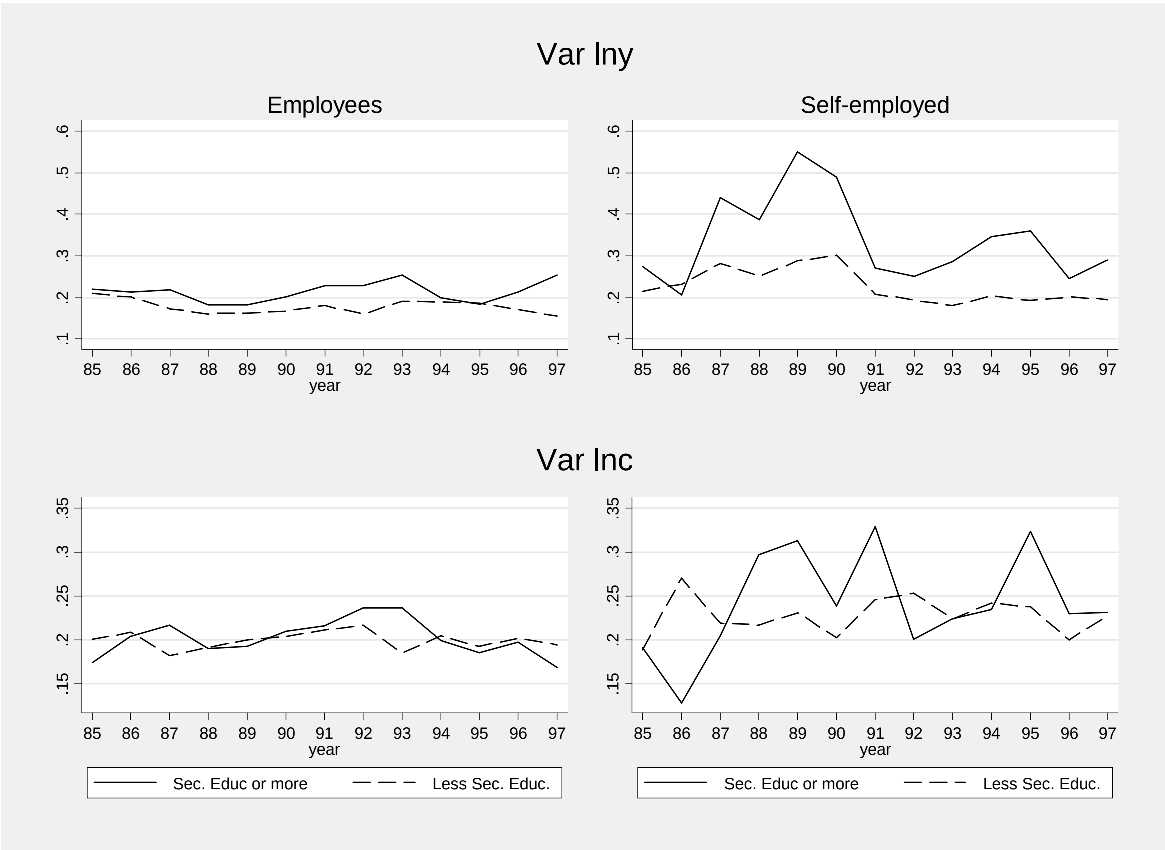

Figure 6: Variance of lny and lnc: by education

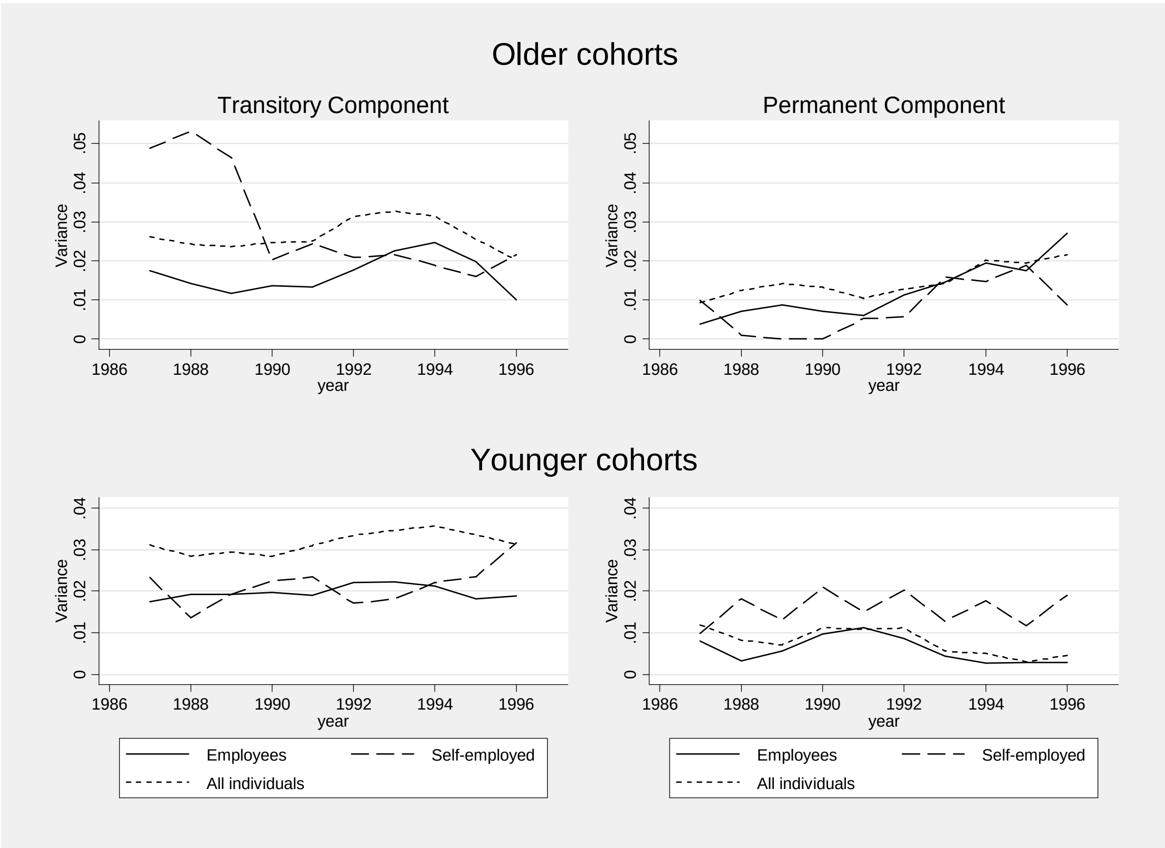

Figure 7: Variance of the Transitory and Permanent Components: by cohort

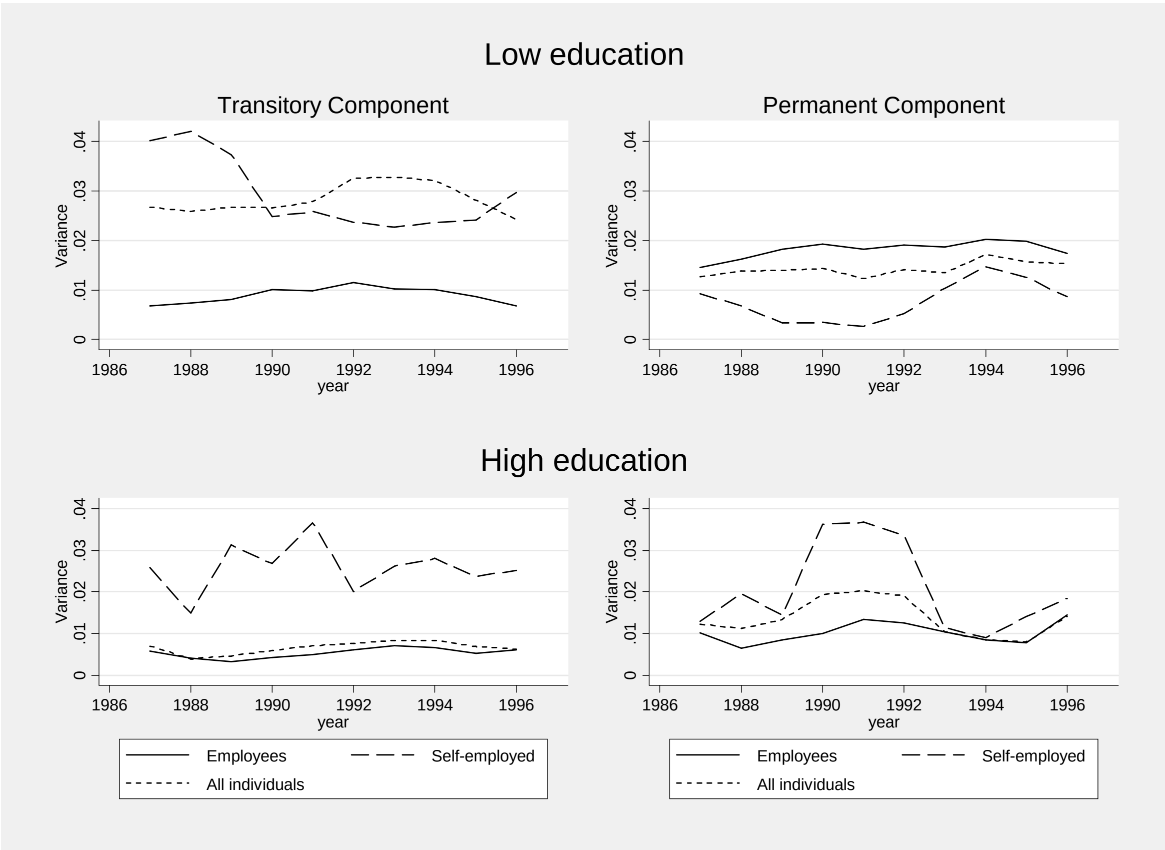

Figure 8: Variance of the Transitory and Permanent Components: by education