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Keywords:	Wage Inequality, Skill, Covariance structure

The Evolution of Wage Inequality in Italy

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November 7, 2006

Abstract

This paper analyses the evolution of inequality in yearly and daily wages between and within groups of blue and white collar, using the INPS-ISFOL database for the period 1985-1999 in Italy. Between-group inequality increased in the '90s as clerical wages grew slowly whereas blue collars wages remained nearly constant. Within-group inequality increased only if measured by daily wages. The covariance structure analysis shows that inequality comes from persistent differentials among older workers and from high income volatility for younger cohorts. Within inequalities in office and manual workers are driven by the growth of permanency for the older cohorts (individual abilities, say experience, matter more) and by the growth of income volatility for the younger cohorts (luck in the labor market). Within each group, low paid workers during their career acquire earning gains for their abilities and reduce differentials with respect to high paid workers.

Keywords: Wage Inequality, Skill, Covariance Structure

JEL classification: J31, J62, C23, D31

1 Introduction

The increase in wage inequality in the US labour market has given rise to a large body of theoretical and empirical analyses (Murphy and Welch, 1993 and Juhn et al., 1993). The theoretical explanations are mainly based on the Skill Biased Technical Change hypothesis (SBTC thereafter, see Acemoglu, 2002) and have found a counterpart in the US labour market, where

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a strong empirical evidence of changes in relative market prices for skilled and unskilled workers has been provided.

Other theoretical explanations than the one proposed by the SBTC hypothesis can be found in economic literature. Particularly, product market liberalization has played a role in inequality growth: increasing trade should have changed the relative wage between skilled and unskilled workers (Wood, 1995). Nevertheless, the impact of trade liberalization on inequality seems to be negligible when measured empirically (Richardson, 1995). Also institutional changes occurred in the last decades of the 20th century have played a role. In Europe, labor market reforms aimed to raise flexibility[1] and, in the US, the falling minimum wage and the "deunionization" of workers can explain the increase in wage inequality[2].

Empirical analyses suggest that the increase in wage inequality is not fully explained by observable workers' characteristics (as educational level and qualification, the "between group" inequality) but it also depends on non-observable factors (the "residual" or the "within group" wage inequality.) that, interacting with technical and organizational change, determine the increase in wage disparity between workers with similar observable characteristics[3].

Furthermore, the increase in *within* inequality - disparities between individuals with similar observable characteristics - may depend both on permanent shocks (changes in wages with a high degree of persistence) and transitory ones (changes in wages which tend to last some periods and then disappear).

This decomposition is fundamental in highlighting the role played by increasing returns to scale of the "innate ability", and the role played by "luck" in the matching process. It is also important in determining the effects of inequality on welfare and for economic policy decisions. In fact, if the increase in inequality (within groups) is mainly transitory, the explanations based on a higher generality of the new information technologies (Aghion et

[1]The same technological change occurring in different institutions in the labor market has given rise to different outcomes in Europe and in the United States. Because of labour market rigidities, the common technological shock caused a pronounced effect on employment in Europe (Ljunqvist and Sargent, 1998), while in the United States this shock was mainly absorbed by prices, modifying the wage structure (Bertola and Ichino, 1995). Nevertheless, even in Europe wage distribution shifted towards rising inequality (Glyn, (2001), Ayala et al. (2002)).

[2]See DiNardo et al. (1996) and Leslie and Pu (1995) for empirical support of this viewpoint.

[3]To cope with this evidence, Aghion, Howitt and Violante (2002) relate "high generality" of new technology to the amplification of the role of luck in the labour market. Furthermore, SBTC would have led to changes in firm organization and job tasks, from centralized, non-flexible, hierarchical and large firm structures to horizontal structures based on team work. Caroli and Van Reenen (2002) analyzed the effect of the process of firm reorganization, that was driven by massive injection of information technologies, on wage structure.

al., 2002) become more important, suggesting policies aimed to boost the matching process. However, aggregate demand could be negatively affected by higher income volatility, calling for proper insurance schemes design[4]. On the other hand, growing persistent inequalities could reveal that some mechanisms other than technology are working[5].

Some Authors have proposed measures for this decomposition among transitory and permanent component of wage inequality. For the US, Moffit and Gottshalk (2002) showed an increase in residual inequality for the period 1970-1990. According to their results, persistent inequality grew in the '70s and '80s, whereas transtitory inequality increased in the '80s and decreased in the following period. For the UK, Ramos (2003) found a fall in the permanent component of inequality in the '90s while the transitory one turned out to be much persistent. For Germany, Biewen (2005) showed that inequality was mainly characterized by the persistent component and that in East Germany persistency grew until it reached the West German levels. In Spain, during the '90s, within inequality was almost stable. Its persistent component grew whereas its transitory component declined, probably because labour market reforms made temporary jobs more stable (Cervini and Ramos, 2006).

In Italy a slight but constant increase in wage inequality occurred with a delay of two decades with respect to the United States (Brandolini et al., 2001, Manacorda, 2002, Bratti e Matteucci, 2004, Casavola et al., 1996).

Borgarello and Devicienti (2002), applying various econometric-based decompositions, concluded that growth in inequality was mainly due to the changing returns to observable workers' characteristics.

Lilla (2005), using quantile regression on survey data (Bank of Italy Survey on Household Income and Wealth), measured the role of education, experience and qualification to explain the increase in overall wage inequality. These observable workers' characteristics explained less than one half of the total increase in inequality in many points of wage distribution, calling for a deep investigation of the dynamics of within-group inequality.

Recently, thanks to the availability of longitudinal data (earnings profiles), some studies have analyzed the dynamics of wage inequality in Italy by separating the differential due to persistent individual characteristics, as ability and human capital, from the differential due to transitory components. Analysing the differences between white collars employed in the private and those in the public sector, Cappellari (2002) showed that the volatility of earnings was higher in the private sector as regards the perma-

[4]Income inequality leads to consumption inequality, ending in different economic growth patterns, see Blundell and Preston, 1998.

[5]Some facts should lead us to remark the impact of institutional change on inequality, for instance the widespread use of temporary contracts that made young workers less secure in their income than the older ones, lack of on-the-job training that reduces upward mobility for less-qualified workers and so on.

nent/transitory analysis . Moreover, Cappellari (2004) highlighted that the increase in inequality was explained by the growth of permanent earning component, which affected less-paid workers especially.

The aim of this paper is to highlight the dynamics of wage inequality in Italy for blue and white collars in the last fifteen years of the last century. We assume that both technology and institutional changes had played a role in explaining it. The former should lead to inequality changes for all workers' cohorts, whereas the latter should make an impact especially on younger workers. Therefore our analysis are performed on workers grouped by cohorts.

Furthermore, we consider the white/blue collar classification as a proxy of skilled/unskilled dichotomy and we use daily and yearly wages assuming that the former refers more closely to productivity issues whereas the latter allows welfare considerations. In all the above cases we decompose within inequality in the permanent and transitory components. Therefore, our analysis highlights the evolution of inequality for blue and white collars over time in terms of worker productivity (permanent variability) and their luck in the searching process (transitory variability).

We are aware that institutional changes in Italy have been fundamental in explaining labour market evolution in the last decades. According to OECD (see OECD 2004) during the '70 and the '80th the employment protection legislation (EPL) in Italy was one of the strictest among European countries. Individual firing, hiring rules, temporary and part time work were regulated both by law and by collective agreements. Trade unions membership and participation of workers in collective actions were both intense, and collective bargaining was mainly centralized. Nevertheless, given that EPL concentrated mostly on firms with at least 15 workers, some flexibility in Italian labour market was guaranteed by the strong presence of small firms.

Since the mid '80s, this institutional framework has changed. Since 1985 collective agreements have allowed for a widened use of temporary contracts. During the following years some degree of flexibility came from bargaining, and in 1997 the "Treu reform" institutionalized these changes by weakening the regulation on fixed term contracts. During the last 20 years, therefore, Italian labour market has surely become more flexible and, in this way, low-paid workers have become less guaranteed not only in terms of job security but also in terms of wage levels.

Italian industrial relation, since the "marcia dei quarantamila" [6] appears to be less favorable to unions, that had to face a strong decline in membership and participation (see Baici and Samek Lodovici, page 68). In 1993 the government and social partners signed the "Protocollo sulla politica dei

[6] In 1984, in Turin, 40,000 white collar workers and managers of the FIAT demonstrated against the 35-day-strike decided by the FLM (the most important union in the metallurgical sector in Italy) in order to avoid 15,000 dismissals.

redditi e dell'occupazione" that gave rise to a period of calm in industrial relation and introduced in bargaining the method of "concertazione", (some degree of corporatism that, in fact, generated some sort of cooperative behaviour) and the two-tier bargaining system, both at sectoral and firm level. Given that one of the main goals of italian trade unions concerned reducing wage inequality between skills, the loss of union power can probably be considered one of the "institutional factors" that increases inequality.

Our analysis concludes that inequality in Italy has grown mainly because of the increasing differences in the wage "between" blue collars and white collars and marginally because of an increase in inequality "within" qualifications, but only if evaluated on daily (and not yearly) wages. Low wage blue collars (the 10th percentile) have seen their real revenue falling in the early '90s. Younger cohorts suffer a higher degree of inequality than workers born in the '40s and '50s. Within group inequality in yearly wages is explained mainly by individual abilities for older cohorts and by a higher degree of uncertainty for young workers. Office workers show higher persistence in inequality than manual workers. Daily wages show different trends: the increase in within group inequality is much higher for younger cohorts, whereas for older manual workers, the increase in inequality comes mainly from the growing differentials in reward for individual abilities.

The paper is organized as follows: in the second section we present the database. In the third section we offer a brief description of the evolution of wage inequality using the blue collar/white collar dichotomy. We also measure wage evolution by cohorts of individuals born in the period between 1939 and 1968. In the fourth section wage variability is decomposed into permanent (due to individual characteristics, modelized by a random-growth process) and transitory components (a less persistent component due to individual shocks and to the matching process) for white and blue collars. Model estimation, which therefore considers both the long run growth and short run fluctuations, allows us to measure permanent and transitory component of wage inequality. Section 5 concludes.

2 The Data

The Italian Institute for National Social Security (INPS thereafter) collects data on all Italian workers employed in the private sector (except agriculture) through an administrative procedure based on firms' declarations. Because of the administrative nature of the data, only little information is collected on workers. Annual gross wages[7], weeks and days of work, gender, age, qualification, sector, region of work are available but, unfortunately, educational levels, family composition and family background are missing.

[7]Gross wages are the sum of net wages, taxes and social contributions on workers; social contributions on firms are not included in gross wages.

Data are available from 1985 to 1999.

We use a sample of the whole dataset rearranged by ISFOL[8]. This sample collects information on all workers born the 10th of March, June, September and December of each year, so that 1 worker out of about 91 is included in the sample[9]. The longitudinal structure of the database allows us to analyze permanent and transitory components of the total variability of wages.

We extract a sub-sample from the database. First of all, we consider only male population because of the specificity of entry and exit flows of women in the labor market which may affect wage variability. Secondly, in order to avoid starting and ending points of working careers, we consider only workers born between 1939 and 1968. Finally we drop outlier observations in wages truncating the yearly and daily wage distributions at the bottom and top 0.1%[10].

Therefore our sample is composed of 116,303 individuals and of 864,567 observations. 569,710 of them refer to blue collars and 294,867 to white collars. In our sample we observe 12,898 transitions between the two categories of workers, concerning 11.1% of the individuals. Observations regarding these cases are nevertheless included in the sample for the relative period of their working career[11]

Table 1 shows the number of presences of workers in our (unbalanced) panel. 21,631 individuals with only one observation therefore contribute to cross-sectional analysis alone.

We use the "Consumption price index for family of white and blue collars" (ISTAT) to deflate gross nominal wages of the ISFOL database.

Table 2 shows some descriptive statistics of real wage data for total observations and distinguishes the *between* component, obtained by the variability of revenue between individuals and the *within* component, obtained by the variability of revenue in time for the same individual[12]. Notice that the standard deviation *within* is lower than the standard deviation *between* for the yearly wages but not for the daily wages.

According to the date of birth, blue and white collar workers have been collected in ten cohorts. Each cohort is composed of workers born within a 3-

[8] *Istituto per lo sviluppo della formazione professionale dei lavoratori*, Institute for Training Workers

[9] For a detailed description of the dataset, see Centra and Rustichelli (2005)

[10] In that way, we drop 7657 observations, that is a higher number than the expected one, (0.2% of the whole sample) firstly because we drop observations where the yearly *or* daily wage was in one of the two tails described above and secondly because all individuals with zero wages were obviously included in the lower percentile. In fact, we drop 441 individuals whose observations were in the two tails for the whole period.

[11] In fact, we consider these workers as two different individuals for the sub-period of their career. Individuals with the same qualification but with different jobs during the same year are also considered because our analysis leaves aside job characteristics; their yearly revenue is the sum of revenues in the different jobs.

[12] Calculated as *revenue of the individual - average revenue of the individual + average global revenue*, so that it can be negative.

Table 1: Number of presences of workers in the panel data

number of presences	Freq.	Percent	Cum.
1	21,631	18.6	18.6
2	10,063	8.65	27.25
3	6,884	5.92	33.17
4	5,906	5.08	38.25
5	5,644	4.85	43.1
6	5,090	4.38	47.48
7	6,452	5.55	53.03
8	4,690	4.03	57.06
9	5,027	4.32	61.38
10	4,757	4.09	65.47
11	4,641	3.99	69.46
12	5,502	4.73	74.19
13	6,394	5.5	79.69
14	10,240	8.8	88.49
15	13,382	11.51	100
Total	116,303	100	

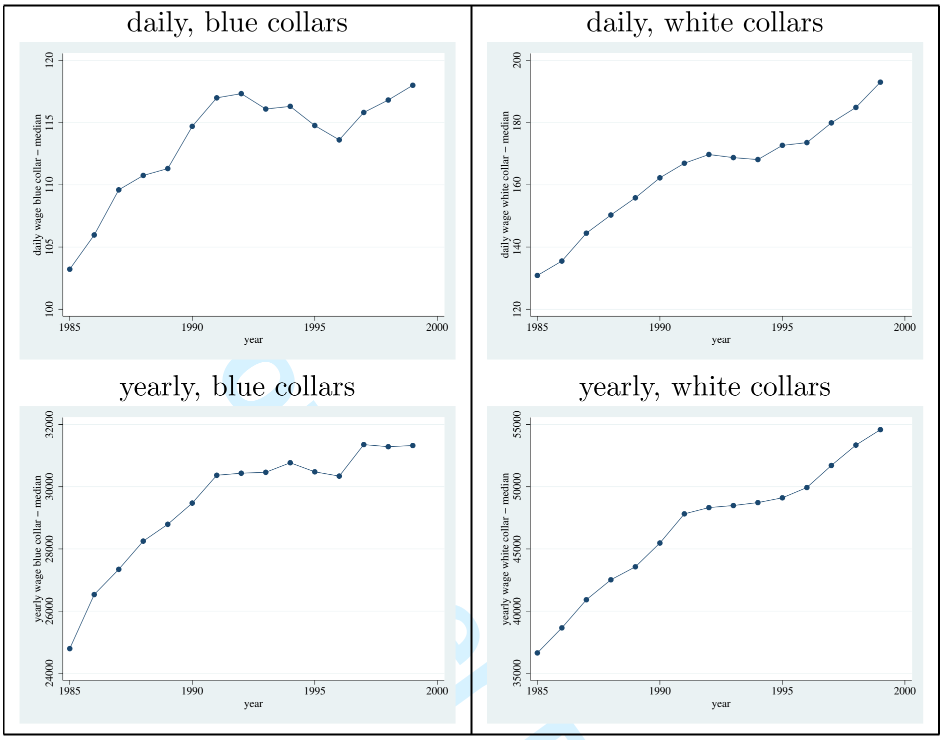
Source: panel ISFOL on INPS data.

Table 2: Yearly and daily wages for blue and white collars; between and within components; thousand of Italian lire, base 1999

constant wage-base 1999		Mean	Std. Dev.	Min	Max	Observations
blue collars	overall	28152	15162	1	3362295	N = 569710
yearly wages	between		14135	35	564056	n = 86759
	within		8752	-535634	2826391	T-bar = 6.56658
white collars	overall	52899	35289	1	1131491	N = 294867
yearly wages	between		31525	40	684533	n = 42442
	within		16252	-386316	963147	T-bar = 6.94753
blue collars	overall	128	177	1	74631	N = 569710
daily wages	between		90	2	10831	n = 86759
	within		161	-9634	66317	T-bar = 6.56658
white collars	overall	203	255	1	80232	N = 294867
daily wages	between		200	1	21760	n = 42442
	within		203	-21403	60320	T-bar = 6.94753

Source: panel ISFOL on INPS data

Figure 1: Median real daily and yearly wages, blue and white collars



Source: panel ISFOL on INPS data.

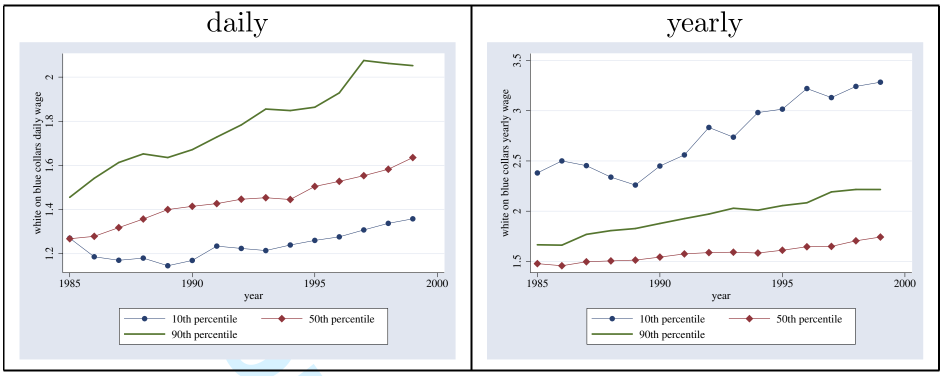
year range. These cohorts represent the base for the analysis of the following sections. Tables 5 and 6 in the Appendix show the sample composition for blue and white collars with respect to cohorts and years.

3 The evolution of wage inequality in Italy

In the period 1985-1999, real wages moved cyclically around a slightly increasing trend but, especially for blue collars, in some periods real wages decreased. This reduction was more pronounced for daily wages than for annual wages. Blue collars' purchasing power kept growing until 1991, but later it remained nearly constant whereas white collars' purchasing power grew in the whole period, but at decreasing rate in the last decade (see figure 1, that shows median wages for the two groups of workers; average wages -not shown in this paper- moved in a similar manner as median wages).

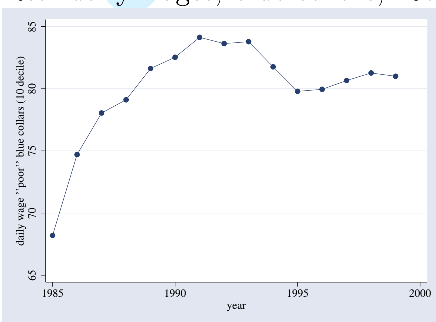
These patterns led to an increasing wage gap between the two groups of workers, as shown in figure 2 that plots the percentile ratios between blue and white collars. This gap increases during the whole period both for daily and yearly real wages, particularly for the "poorest" workers. As regards

Figure 2: Real daily and yearly wages, ratio between white and blue collars for the 10th, 50th and 90th percentiles



Source: panel ISFOL on INPS data

Figure 3: Real daily wages, blue collars, 10th percentile



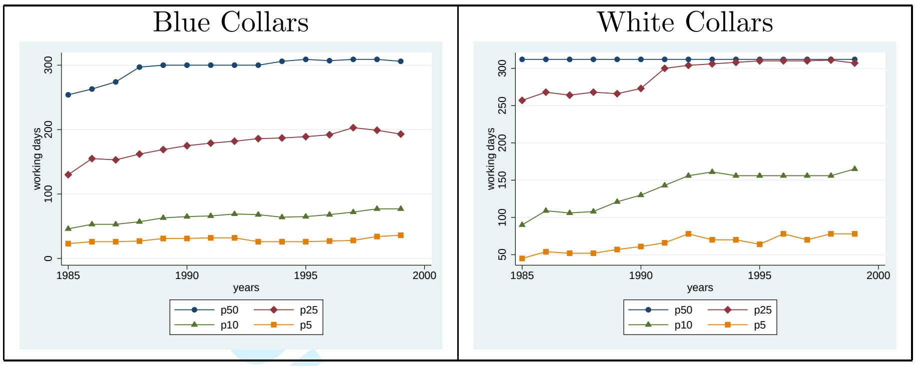
Source: panel ISFOL on INPS data

low-wages blue collars, real wages strongly decreased in the early '90s; in 1999 their wages were lower than in 1988, see figure 3)[13]).

Within group inequality measured by daily real wages grew for white collars, mainly if measured by the ratio between the 90th and the 10th percentiles, but remained stable if measured by yearly wages. Probably, low-wage workers, in order to compensate the shut in the daily earnings, increased their job attachment, working a higher number of days during the year (see figure 5). When we measure working days by percentiles, who worked less raised working days in the whole period as figure 4 shows.

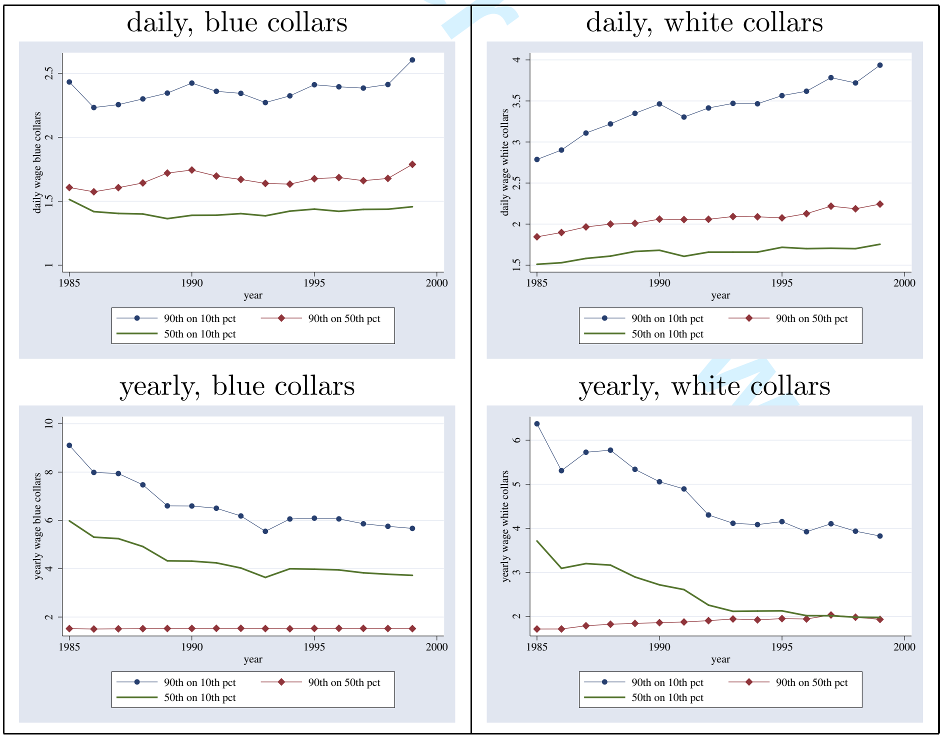
[13]For the United States DiNardo, Fortin and Lemieux (1996) analyzed the relationship between the reduction in minimum wages and inequality

Figure 4: Working days, lowest percentiles and median, blue and white collars



Source: panel ISFOL on INPS data

Figure 5: Real daily and yearly wages, percentile ratios, blue and white collars



Source: panel ISFOL on INPS data

The Gini index is displayed in figure 6 for blue collars, white collars and all workers. The figure on the left shows daily real wages, the one on the right shows yearly wages. Inequality measured by daily wages grew both within categories and for the whole population. Inequality in yearly wages was stable within white collars whereas it was slightly reduced within blue collars. The Gini index for the whole population confirms that inequality between blue and white collars increased during the '90s.

Figures 11 and 12 in the Appendix show earning profiles (yearly wages) by cohorts (defined on a three year birth date period) and by ages[14]. White collars' earning profiles result upward sloping with respect to age (except for older workers born in the period 1939-1942 who show a constant sloping after the age of 50th.). Instead, blue collars earning profiles are upward sloping for younger cohorts but with a sort of reverse "U" shape for older cohorts, with a maximum at around the age of 50th.

Figures 13 and 14 in the Appendix show the ratio between the median real wage of white collars and blue collars, distinguishing by cohort and age, respectively for daily and yearly wages. It clearly emerges that inequality between the two groups is higher for older workers both on daily and yearly basis.

Nevertheless, the between-group inequality (ratio between white and blue collars median wages) is higher for cohorts born more recently. Therefore, inequality grows with the worker's age and it is higher for younger cohorts.

4 Permanency and volatility in wage inequality

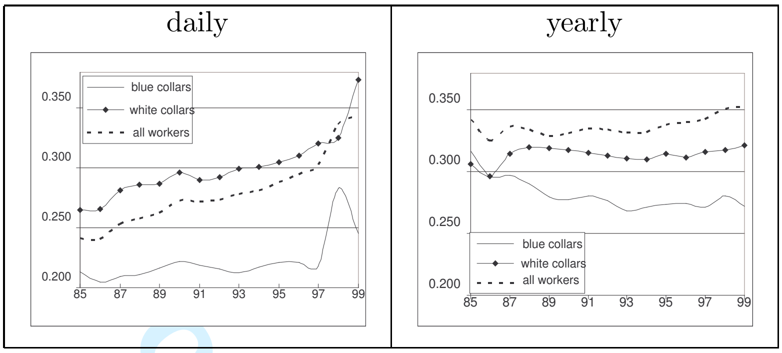
The covariance structure of individual wages can be investigated thanks to the panel nature of the dataset. In this section we decompose the total variability of individual earnings into permanent and transitory components. We apply this decomposition separately for four subsets of data, for white and blue collars and yearly and daily wages.

In order to perform this decomposition:

- in a first step, we have to refine the raw earnings. In particular, real log-wages have been regressed on a 4th degree polynomial of age interacted with cohorts and year dummies, separately for office workers and manual workers and for yearly and daily wages. Then we use the residuals of such OLS regressions to perform the permanent-transitory variance decomposition.

[14]To improve visibility, we do not plot observations with a yearly wage lower than 25,000,000 Italian lire. Doing so, we drop observation concerning younger cohorts in their youth.

Figure 6: Real daily and yearly wages, Gini index



Source: panel ISFOL on INPS data

- in a second step, we calculate the empirical variance-covariance matrix of such residuals distinguished by the four subsets.[15].
- in a third step we modelize the earning process into permanent and transitory components, where, from this point onward, by earnings we mean the residuals of the first stage regressions.

The simplest way to model the earning process is shown in equation 1:

$$\omega_{i,t} = \mu_i + \nu_{i,t} \quad \mu_i \sim (0, \sigma 2_\mu) \quad \nu_i \sim (0, \sigma 2_\nu) \quad E(\mu_i, \nu_i) = 0 \qquad (1)$$

where income is divided into an individual fixed intercept (μ_i) and a white-noise error term ($\nu_{i,t}$). Therefore, we can write the implied covariance structure (Σ) as:

$$E(\omega_{i,t}\omega_{i,k}) = \begin{cases} \sigma 2_\mu + \sigma 2_\nu & if \quad t = k \\ \sigma 2_\mu & otherwise \end{cases}$$

Although this specification is clearly unsuitable to model the earning process, we estimate this simple covariance structure. The transitory component accounts for 60% and 64% of white and blue collars total inequality in yearly wages. The permanent component should measure individual abilities and in the previous model it was assumed to be constant over time. This last hypothesis seems to be unrealistic, therefore we split the permanent component in an individual fixed intercept and a variable one varying with experience (random-growth model). Equation 1 becomes:

$$\omega^P_{i,t} = \mu_i + \gamma_i a_{i,t}$$

[15]We have 10 cohorts and 120 distinct elements in each variance-covariance matrix ($T = 15$, so $T \cdot (T + 1)/2 = 120$). As such the analysis is based on 1200 measured covariances for each subset of data

and the earning process is written as:

$$\omega_{i,t} = \mu_i + \gamma_i a_{i,t} + \nu_{i,t}$$

$$\begin{pmatrix} \mu_i \\ \gamma_i \end{pmatrix} \sim \left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma 2_\mu & \sigma_{\mu\gamma} \\ & \sigma 2_\gamma \end{pmatrix} \right]$$

Until now, the transitory component has been modeled as serially uncorrelated, implying that the shock which hits permanent earning in one period disappears immediately in the next one. To take into account some degree of persistence of temporary shocks on earnings, we model the transitory component as an $AR(1)$ autoregressive process:

$$\nu_{i,t} = \rho \nu_{i,t-1} + \epsilon_{i,t} \quad \epsilon_i \sim (0, \sigma 2_\epsilon) \quad \nu_{i,0} \sim (0, \sigma 2_0)$$

hence, the model can be written as:

$$\omega_{i,t} = (\mu_i + \gamma_i a_{i,t}) + (\rho \nu_{i,t-1} + \epsilon_{i,t}) \tag{2}$$

In this way the temporary shock may last more than one period. Higher values of the parameter ρ imply major degrees of uncertainty and a higher persistence of deviations from the permanent component. The model in equation 2 can be extended to consider explicitly the effects on earnings of economic cycles and secular growth. We introduce these changes by multiplying the two components for time (π and τ) and cohort (κ and λ) [16]:

$$\omega_{i,c,t} = \kappa_c \pi_t (\mu_i + \gamma_i a_{i,t}) + \lambda_c \tau_t (\rho \nu_{i,t-1} + \epsilon_{i,t})$$

so that the implied theoretical covariance structure can now be written as:

$$E(\omega^P_{i,t} \omega^P_{i,k}) = \sigma 2_\mu + \bar{a}_t \bar{a}_k \sigma 2_\gamma + (\bar{a}_t + \bar{a}_k) \sigma_{\gamma\mu}$$

$$E(\nu_{i,t}\nu_{i,k}) = \begin{cases} \sigma 2_0 & if \quad t = k = 0 \\ \sigma 2_\epsilon + \rho 2 E(\nu_{i,t-1}\nu_{i,t-1}) & if \quad t = k > 0 \\ \rho 2 E(\nu_{i,t-1}\nu_{i,k}) & otherwise \end{cases}$$

$$f(\psi) = \sum_{c=1}^{10} c_c \kappa_c 2 \left\{ \sum_{t=1}^{15} \sum_{k=t}^{15} p_t \pi_t p_k \pi_k (\sigma 2_\mu + \bar{a}_t \bar{a}_k \sigma 2_\gamma + (\bar{a}_t + \bar{a}_k) \sigma_{\gamma\mu}) \right\} + \\ + \sum_{c=1}^{10} c_c \lambda_c 2 \left\{ \sum_{t=1}^{15} \sum_{k=t}^{15} p_t \tau_t p_k \tau_k E(\nu_{i,t}\nu_{i,k}) \right\}$$

[16] Cappellari, 2002, used this formulation to compare the covariance structure of white collars between private and public sector.

where ψ is the vector of parameters to be estimated, $f(\psi)$ is the theoretical - implied by the earning process model - covariance function, c_c is a dummy for cohorts and p_t is a dummy for years[17].

Equation 3 can be estimated through a GMM estimator: the minimum distance estimator proposed by Chamberlain (1984).

More specifically, when we estimate the model minimizing the sum of the squares of the differences between the empirical $(E(\omega_{ict}\omega_{ick}))$ and the theoretical second moments $(f(\psi))$, weighted by the inverse matrix of the forth moments, we get an asymptotically efficient estimator (Chamberlain (1984)). In this case, the estimator is the optimally minimum distance estimator (OMD). Altonji e Segal (1996) showed that weighting by the identity matrix (instead of the inverse matrix of the forth moments) we get a more efficient estimator than the OMD estimator, namely the equally weighted minimum distance (EWMD) estimator. Table 3 shows EWMD estimates on yearly wages for blue and white collars and table 4 shows estimates on daily wages.

By estimating the parameters of the theoretical structure of earning second moments, we find that, both for yearly and daily wages, permanency in inequality mainly comes from the high variability in the initial individual abilities (σ_i). Blue collars show higher levels of σ_i. Given that the sign of the covariance between the two components of the permanent part of earning process $(\sigma_{\gamma\mu})$ is negative, as time goes on the dispersion of individual abilities diminishes: initially low-talented workers grow their individual abilities faster than high-talented ones [18]. The degree of permanency of the transitory shock $(\rho)$is small, especially for blue collars, for both yearly and daily wages: shocks last for 3-4 years, then disappear.

In order to get some insight on the differences among cohorts, figures 7, 8, 9 and 10 show total, permanent and transitory inequality obtained by EWMD estimates, plotted over time, distinctly for blue and white collars, for each cohort.

Manual workers show stable inequality in yearly earnings, with a little downward trend in the late $'80s$ and an upward trend in the late $'90s$. More specifically, inequality grows for older workers and decreases for younger cohorts. Long-term inequality (wage inequality due to persistent differences in workers abilities) becomes more important in explaining total inequality until the middle $'90s$, especially for the older cohorts. Transitory inequality increases its role in explaining wage variability for younger blue collars.

Inequality in yearly wages remains almost stable also for white collars even if a diminishing trend is ascertained for the younger cohorts. Looking

[17] MaCurdy, 1982, analyzed several stochastic specifications for the earning process in the USA, in order to better characterize the covariance structure. Similarly, Borella, 2001, for the Italian earnings, on SHIW data.

[18] Low-talented workers catch-up with high-talented ones by means of a higher wage growth rate during their career.

at the two components of inequality, volatility is the major source of inequality for the younger cohorts whereas growing permanency characterizes inequality within the older white collars cohorts.

Daily wages inequality increases dramatically for both white and blue collars in the $'90s$. For older manual workers and younger office workers we measure a major rise in inequality. Permanent inequality increases for older workers, while inequality among younger cohorts is mainly driven by transitory inequality. Shocks have a low degree of permanency in the transitory component, especially for blue collars.

Summing up, within inequalities in yearly wages are almost constant, and they are explained mainly by persistent differentials among older workers and high income volatility for younger cohorts. We observe different evidence in daily wages, calling for the dynamics of labor attachment: within inequality grows, dramatically with respect to younger workers. Older blue collars inequality is mainly explained by their individual abilities. As $\sigma_{\mu\gamma}$ is negative, low-paid blue and white collars increase their permanent income component faster than well-paid ones. Within inequalities among white collars and blue collars are driven by the growth of permanency for the older cohorts (individual abilities, say experience, matter more) and by the growth of volatility for the younger cohorts (luck in the labor market). Within each group, low paid workers see their earnings grow faster than well-paid workers during their career.

5 Concluding remarks

In the previous sections we showed evidence of wage inequality in the period 1985-1999. We measured inequalities in yearly and daily wages between and within blue and white collars and with respect to cohorts. We also decompose within inequality into permanent and transitory components.

Between-group inequality increased in the $'90s$ as white collar wages grew slowly whereas blue collar wages remained nearly constant. Its growth is much stronger if measured with respect to the bottom of income distribution: low-paid blue collars' real earnings fall in the $'90s$. Wage differentials increased much more for younger cohorts. These results can be explained by two combined phenomena that occurred in the italian labour market: the changing skill-premia (increase in relative yearly wage between qualifications and the growing differentials in productivity) and the reforms aimed to raise labour market flexibility through the use of temporary contracts (the differences between cohorts in inequality patterns).

Within-group inequality increased only in daily wages but not in yearly wages because low-paid blue collars responded to daily earning changes by raising their job attachment.

By decomposing residual inequality we showed that both white and blue collars' yearly wage differentials come mainly from persistent differences which characterize the earning process of older cohorts and from a higher volatility for younger workers. Office workers show higher persistence in inequality than manual workers[19]. These are puzzling results: general purpose technologies should lead to major volatility in wages, regardless of skills or experience. Other theoretical hypotheses, based on trade liberation and changes in labor market institution, may highlight these results. Daily wages show different trends: we measure an increase in within-group inequality which is much stronger for the younger cohorts. Increase in inequality depends on growing differentials in individual abilities' rewards, especially for older manual workers. Assuming that daily wages reflect labor productivity, growing within inequalities, driven by the persistent component, are coherent with the SBTC hypothesis: within groups, non observable skills (education, tenure, experience and so on) get growing wage premia.

Summing up, the picture presented above shows increasing differentials in productivity between and within different workers' qualifications. Those who felt their relative daily wage declining, responded to price changes through quantities, increasing the working-days per year constantly. So inequality increase in yearly wages was mitigated.

Disparities between similar workers become more and more persistent for the older ones because they were probably less touched by the labor market flexibility policies. Inequality among younger workers turned out to be much more volatile and their job mobility increased. As we said before, institutional factors and technological shocks together can explain these findings.

Policies aimed to reduce market rigidities can result in an overshoot on some segments of the labor force - say less paid or young workers - while have little effect on the whole labour market. The increase in persistent inequality as long as the fall in the real wage of low-income workers call for deeper investigations. Further studies should analyse household income (instead of individual one) in order to understand how it responds to changes in wage premia by means of labour market participation and working time of households members. Besides, consumption (instead of income) should be evaluated in order to assess the impact of uncertainty on demand and savings.

[19]Cappellari (2002) found that white collars wages in the public sector are even more persistent. Greater insider bargaining power along with the higher endowment in skill could be the reasons for this result.

Table 3: EWMD estimates on yearly wages

	PERMANENT			TRANSITORY	
	blue-collars	white-collars		blue-collars	white-collars
σ^2_μ	1,49890	0,39658	ρ	0,11775	0,18642
	0,12089	*0,02492*		*0,00657*	*0,01106*
σ^2_γ	0,00051	0,00045	σ^2_0	0,55801	0,43922
	0,00004	*0,00003*		*0,01652*	*0,02303*
$\sigma_{\gamma\mu}$	-0,02685	-0,01245	σ^2_ϵ	0,22596	0,34528
	0,00222	*0,00076*		*0,05350*	*0,09223*
1942-1944	0,99913	1,00029	*1942-1944*	1,01359	0,92322
	0,01402	*0,01219*		*0,01692*	*0,03439*
1945-1947	0,90006	1,04516	*1945-1947*	0,99007	0,91608
	0,01734	*0,01430*		*0,01695*	*0,03443*
1948-1950	0,81367	1,11524	*1948-1950*	0,97431	0,93959
	0,02037	*0,01732*		*0,01698*	*0,03432*
1951-1953	0,78253	1,29116	*1951-1953*	1,04449	1,04492
	0,02328	*0,02157*		*0,01703*	*0,03431*
1954-1956	0,69901	1,45735	*1954-1956*	1,09849	1,17206
	0,02364	*0,02847*		*0,01716*	*0,03519*
1957-1959	0,63543	1,75370	*1957-1959*	1,13115	1,28516
	0,02339	*0,04023*		*0,01727*	*0,03661*
1960-1962	0,59119	1,89427	*1960-1962*	1,19658	1,43628
	0,02303	*0,05492*		*0,01758*	*0,03901*
1963-1965	0,49536	1,85084	*1963-1965*	1,25832	1,54089
	0,02026	*0,06467*		*0,01793*	*0,04088*
1966-1968	0,43548	1,80187	*1966-1968*	1,31966	1,77847
	0,01842	*0,06575*		*0,01834*	*0,04542*
1986	1,03900	0,97779	*1986*	1,44669	0,93799
	0,02708	*0,03305*		*0,16668*	*0,12016*
1987	1,09904	0,97625	*1987*	1,44620	0,91980
	0,02899	*0,03351*		*0,17135*	*0,12260*
1988	1,15530	1,00084	*1988*	1,39996	0,87777
	0,03031	*0,03375*		*0,16593*	*0,11698*
1989	1,23537	0,93268	*1989*	1,30400	0,82828
	0,03176	*0,03187*		*0,15532*	*0,11050*
1990	1,30271	0,98845	*1990*	-1,29657	0,79837
	0,03343	*0,03262*		*0,15444*	*0,10666*
1991	1,36353	0,95911	*1991*	-1,32951	0,78511
	0,03545	*0,03166*		*0,15769*	*0,10493*
1992	1,40556	0,96405	*1992*	-1,31759	0,73309
	0,03708	*0,03151*		*0,15615*	*0,09834*
1993	1,54345	0,97974	*1993*	-1,29199	0,74670
	0,04045	*0,03166*		*0,15333*	*0,10003*
1994	1,71641	0,96580	*1994*	-1,27189	0,73940
	0,04450	*0,03120*		*0,15176*	*0,09911*
1995	1,80328	0,93808	*1995*	1,25450	0,74730
	0,04766	*0,03044*		*0,14977*	*0,10009*
1996	1,72681	0,93143	*1996*	1,29977	0,72429
	0,04813	*0,03017*		*0,15419*	*0,09721*
1997	1,74046	0,88792	*1997*	1,30478	0,72098
	0,05029	*0,02907*		*0,15460*	*0,09682*
1998	1,71289	0,87820	*1998*	1,33749	0,74565
	0,05152	*0,02873*		*0,15844*	*0,10002*
1999	1,76558	0,90332	*1999*	1,31623	0,74583
	0,05441	*0,02922*		*0,15621*	*0,10016*
Blue-collars	obs: 569710	RSS=1.48803	F(52,1148)=	1850.99	
White-collars	obs: 294867	RSS=2.18526	F(1148)=	1005.56	

Note: regressions based on 1200 empirical covariances; asymptotic standard errors in italic; references: cohort 1939-41, year 1985.

Source: panel ISFOL on INPS data

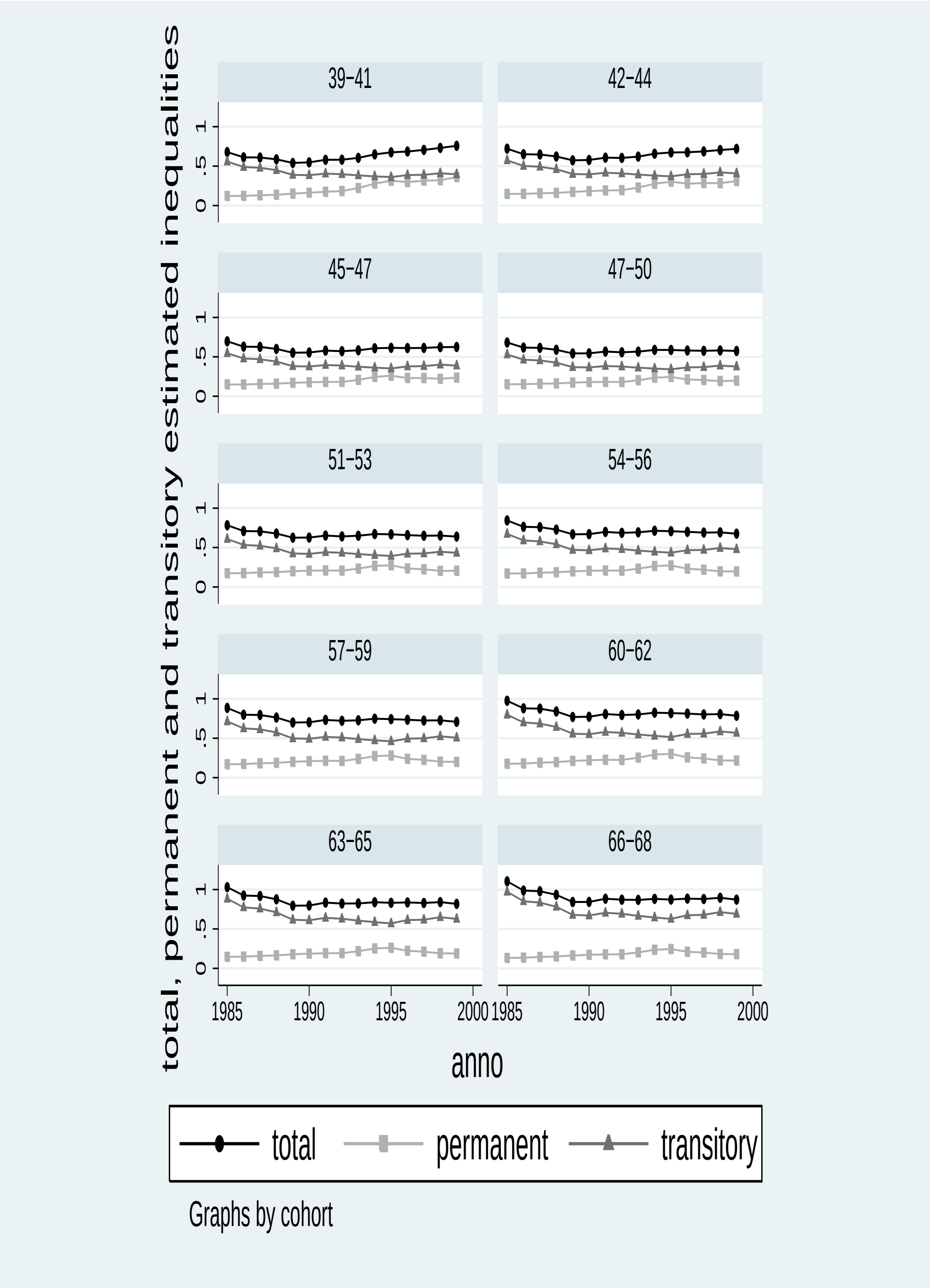
Table 4: EWMD estimates on daily wages

	PERMANENT			**TRANSITORY**	
	Blue-collars	White-collars		Blue-collars	White-collars
σ^2_μ	0,04899	0,11583	ρ	0,11447	0,29528
	0,00298	*0,00915*		*0,00878*	*0,01324*
σ^2_γ	0,00007	0,00023	σ^2_0	0,09417	0,09849
	0,00000	*0,00001*		*0,00381*	*0,00576*
$\sigma_{\gamma\mu}$	-0,00177	-0,00488	σ^2_ϵ	0,02005	0,05341
	0,00010	*0,00031*		*0,00600*	*0,01462*
1942-1944	1,07379	1,02684	*1942-1944*	1,04413	0,99922
	0,01101	*0,00484*		*0,02168*	*0,03205*
1945-1947	1,11010	1,04587	*1945-1947*	1,01326	0,96521
	0,01267	*0,00604*		*0,02165*	*0,03210*
1948-1950	1,23883	1,09531	*1948-1950*	1,01394	1,01483
	0,01500	*0,00796*		*0,02165*	*0,03207*
1951-1953	1,45051	1,17730	*1951-1953*	1,05141	1,02293
	0,01870	*0,01083*		*0,02171*	*0,03210*
1954-1956	1,67168	1,27544	*1954-1956*	1,08190	1,09312
	0,02473	*0,01502*		*0,02181*	*0,03236*
1957-1959	1,93134	1,39988	*1957-1959*	1,11581	1,09938
	0,03448	*0,02103*		*0,02197*	*0,03245*
1960-1962	2,12698	1,48396	*1960-1962*	1,14532	1,18709
	0,04811	*0,02885*		*0,02218*	*0,03322*
1963-1965	2,16001	1,56681	*1963-1965*	1,20683	1,20827
	0,06245	*0,03887*		*0,02264*	*0,03373*
1966-1968	2,24158	1,49705	*1966-1968*	1,29617	1,26435
	0,07419	*0,04816*		*0,02337*	*0,03466*
1986	1,03132	0,97662	*1986*	1,94102	1,16651
	0,02939	*0,01454*		*0,27941*	*0,13894*
1987	1,06945	1,02390	*1987*	-1,94390	1,19611
	0,03014	*0,01488*		*0,29265*	*0,16481*
1988	1,04298	1,02611	*1988*	-1,96699	1,18833
	0,02941	*0,01491*		*0,29556*	*0,16553*
1989	1,02658	1,00978	*1989*	-1,97117	1,14347
	0,02884	*0,01479*		*0,29588*	*0,15958*
1990	1,03525	1,01369	*1990*	-2,00874	1,15802
	0,02877	*0,01489*		*0,30127*	*0,16122*
1991	1,02249	0,98417	*1991*	-1,98129	1,11518
	0,02835	*0,01468*		*0,29717*	*0,15551*
1992	1,00927	0,98656	*1992*	-1,90793	1,07159
	0,02798	*0,01482*		*0,28638*	*0,14982*
1993	1,00730	1,01220	*1993*	-1,92916	1,09898
	0,02788	*0,01523*		*0,28941*	*0,15318*
1994	0,99551	0,98900	*1994*	-1,92990	1,12484
	0,02762	*0,01509*		*0,28946*	*0,15635*
1995	0,98766	0,97871	*1995*	-1,94928	1,14173
	0,02745	*0,01509*		*0,29233*	*0,15842*
1996	0,95218	0,95906	*1996*	-1,96511	1,18426
	0,02662	*0,01496*		*0,29510*	*0,16381*
1997	0,95231	0,97950	*1997*	-1,89153	1,14884
	0,02640	*0,01531*		*0,28635*	*0,15944*
1998	0,90094	0,91101	*1998*	2,13955	1,29286
	0,02534	*0,01455*		*0,32266*	*0,17838*
1999	0,83893	0,90636	*1999*	2,32043	1,43017
	0,02410	*0,01461*		*0,34811*	*0,19660*
Blue-collars:	obs: 569710	RSS=0.09511	F(1148)=	1488.28	
White-collars	obs: 294867	RSS=0.21304	F(1148)=	3328.95	

Note: regressions based on 1200 empirical covariances; asymptotic standard errors in italic; references: cohort 1939-41, year 1985.

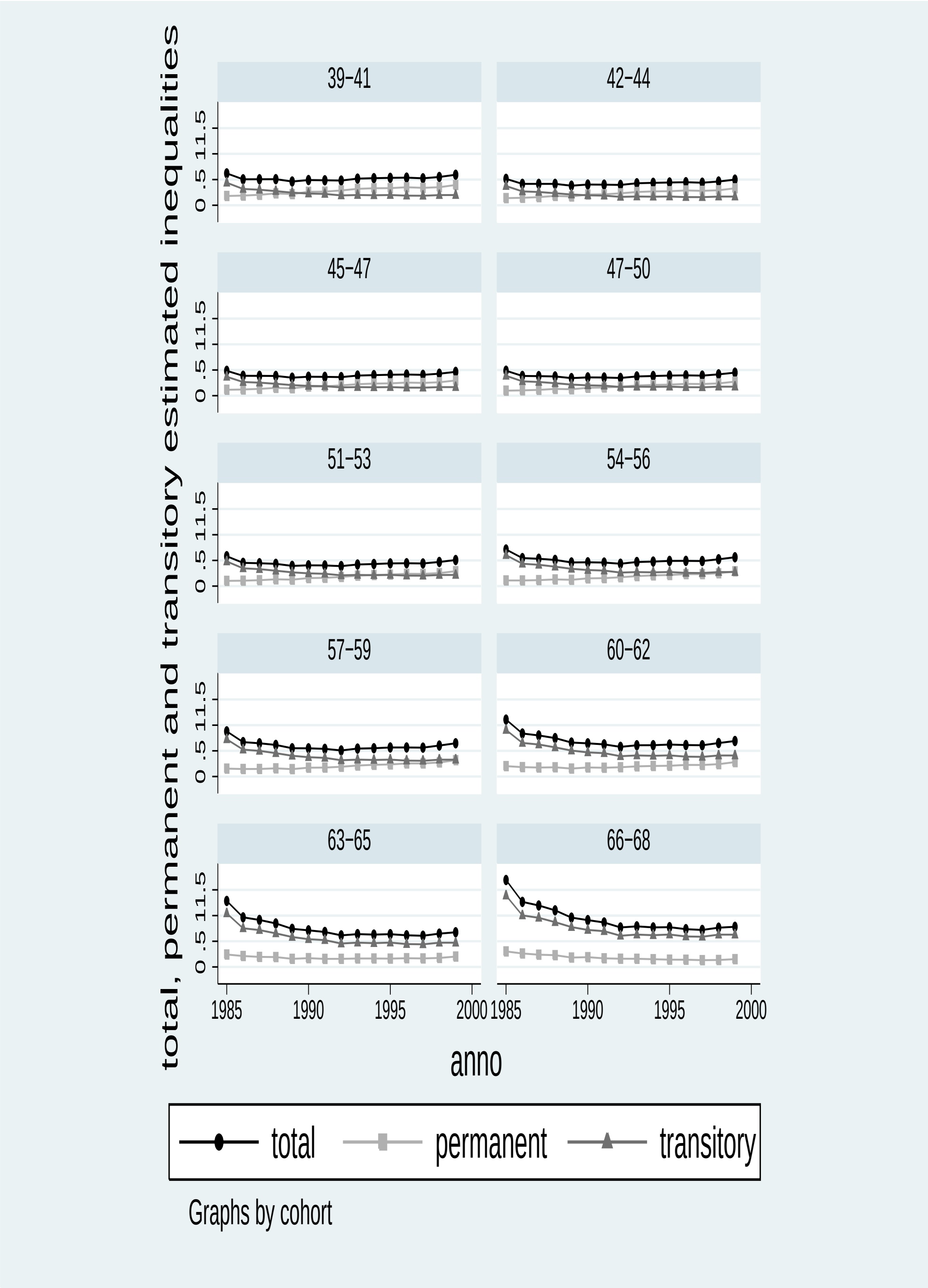
Source: panel ISFOL on INPS data

Figure 7: EWMD estimates on yearly wages, blue collars



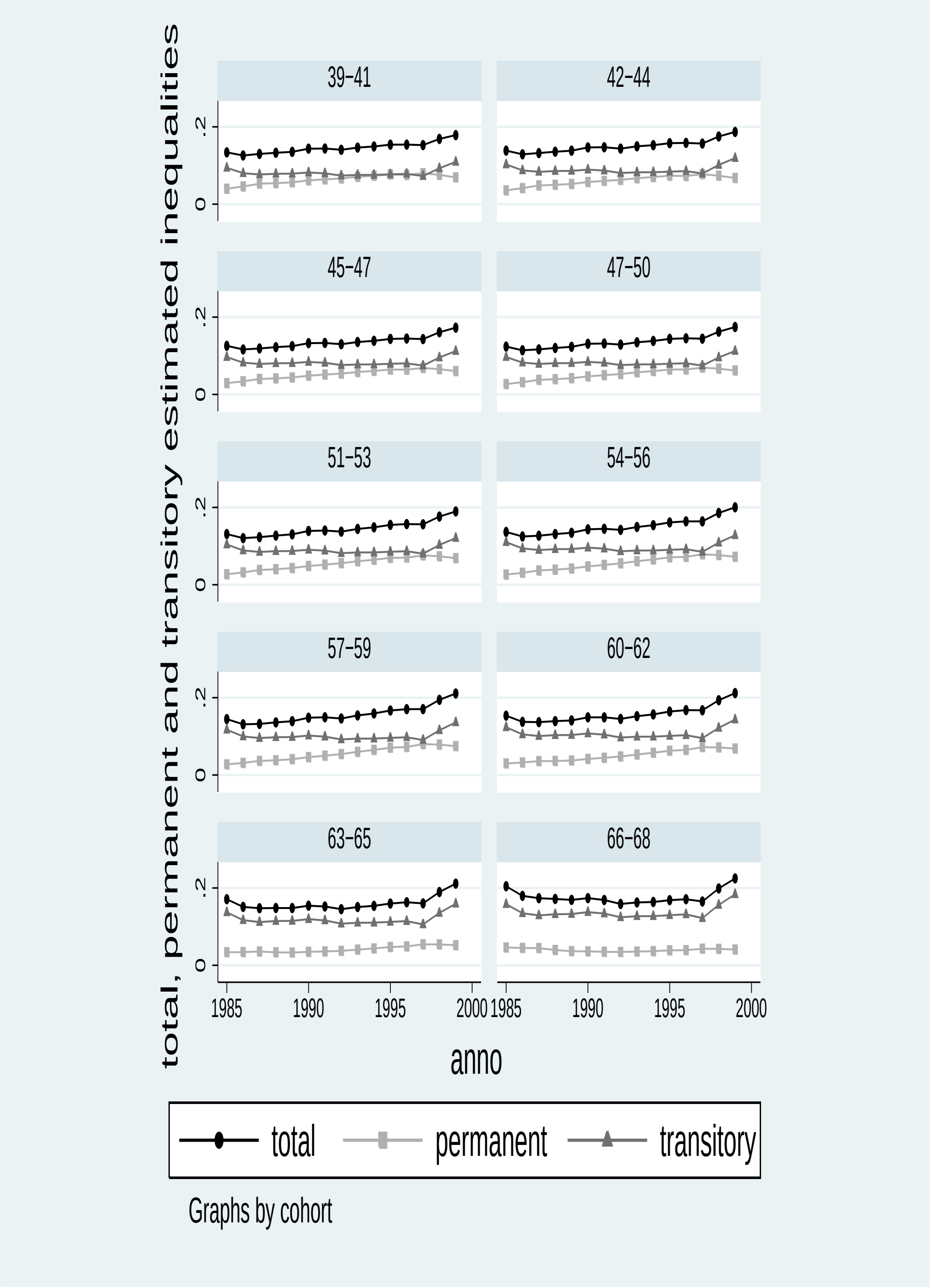
Source: panel ISFOL on INPS data

Figure 8: EWMD estimates on yearly wages, white collars



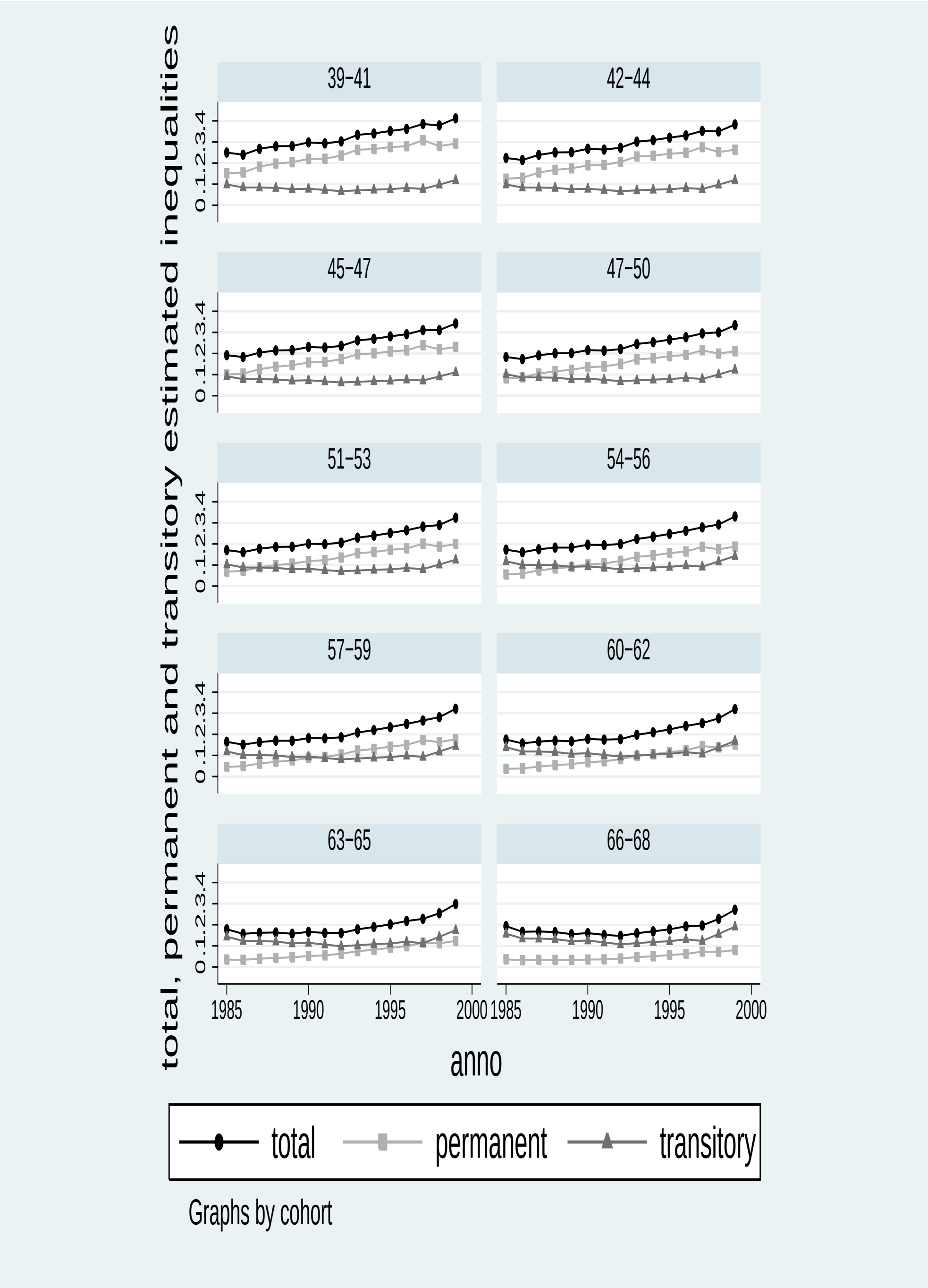
Source: panel ISFOL on INPS data

Figure 9: EWMD estimates on daily wages, blue collars



Source: panel ISFOL on INPS data

Figure 10: EWMD estimates on daily wages, white collars



Source: panel ISFOL on INPS data

Appendix: Table and figures by cohorts

Table 5: Blue collars by cohort and year

	1985	1986	1987	1988	1989	1990	1991	1992
1939-1941	3045	3612	3543	3505	3398	3031	3021	2780
1942-1944	2712	3233	3206	3148	3040	2818	2859	2805
1945-1947	3090	3770	3669	3647	3607	3310	3400	3325
1948-1950	3259	3912	3825	3735	3690	3336	3467	3427
1951-1953	3132	3557	3453	3497	3406	3089	3213	3214
1954-1956	3435	3799	3770	3711	3614	3364	3495	3368
1957-1959	3923	4227	4249	4151	4065	3807	3974	3864
1960-1962	4386	4704	4759	4812	4700	4522	4789	4647
1963-1965	4447	5120	5502	5636	5540	5449	5706	5557
1966-1968	3725	3957	4415	4957	5553	5577	5915	5842
total	35154	39891	40391	40799	40613	38303	39839	38829

	1993	1994	1995	1996	1997	1998	1999	Total
1939-1941	2760	2437	1975	1744	1400	1061	959	38271
1942-1944	2931	2723	2307	2149	1644	1354	1257	38186
1945-1947	3590	3472	3429	3274	3014	2608	2390	49595
1948-1950	3777	3681	3618	3606	3442	3118	3285	53178
1951-1953	3467	3373	3377	3336	3251	2902	3083	49350
1954-1956	3743	3676	3676	3609	3548	3149	3412	53369
1957-1959	4150	4062	4056	4011	3960	3473	3804	59776
1960-1962	4762	4636	4646	4622	4546	4151	4512	69194
1963-1965	5555	5407	5388	5405	5252	4823	5281	80068
1966-1968	5669	5566	5589	5674	5609	5087	5588	78723
total	40404	39033	38061	37430	35666	31726	33571	569710

Source: panel ISFOL on INPS data

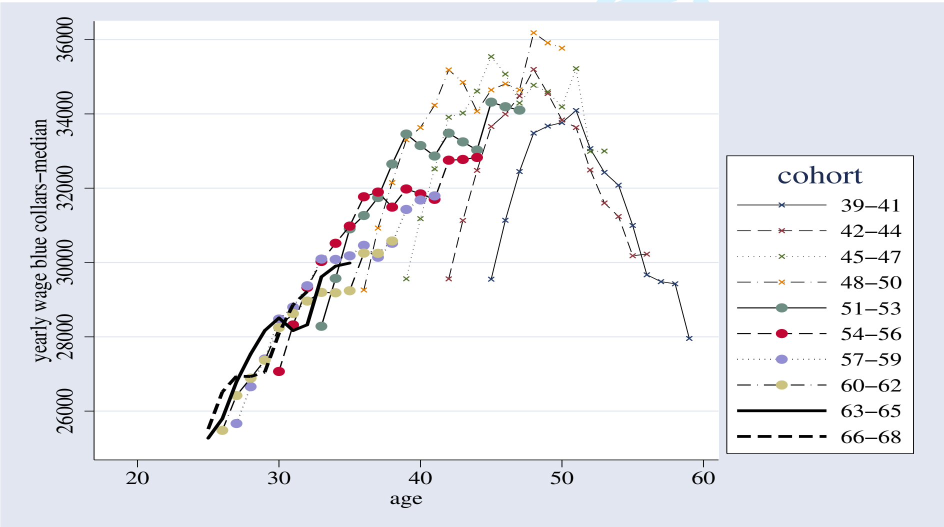
Table 6: White collars by cohort and year

	1985	1986	1987	1988	1989	1990	1991	1992
1939-1941	1369	1907	1820	1791	1710	1619	1664	1577
1942-1944	1391	1902	1791	1755	1744	1663	1716	1686
1945-1947	1757	2361	2247	2215	2149	2073	2173	2148
1948-1950	1867	2424	2313	2283	2273	2119	2245	2207
1951-1953	1814	2290	2169	2159	2137	1992	2081	2079
1954-1956	1802	2228	2123	2116	2152	2018	2133	2101
1957-1959	1701	2178	2213	2273	2308	2224	2328	2282
1960-1962	1168	1587	1776	1980	2086	2096	2276	2277
1963-1965	610	1077	1383	1798	2002	2145	2427	2588
1966-1968	108	254	502	826	1199	1482	1836	1975
total	13587	18208	18337	19196	19760	19431	20879	20920

	1993	1994	1995	1996	1997	1998	1999	Total
1939-1941	1555	1433	1202	1122	908	614	475	20766
1942-1944	1769	1689	1544	1463	1339	1045	892	23389
1945-1947	2308	2268	2210	2164	2073	1678	1547	31371
1948-1950	2410	2396	2357	2331	2315	1978	1907	33425
1951-1953	2306	2290	2271	2259	2217	1882	1847	31793
1954-1956	2298	2269	2198	2205	2216	1871	1811	31541
1957-1959	2500	2441	2414	2414	2377	2046	2013	33712
1960-1962	2410	2397	2403	2378	2343	1985	2075	31237
1963-1965	2745	2745	2767	2750	2760	2392	2568	32757
1966-1968	2153	2204	2376	2441	2589	2368	2563	24876
total	22454	22132	21742	21527	21137	17859	17698	294867

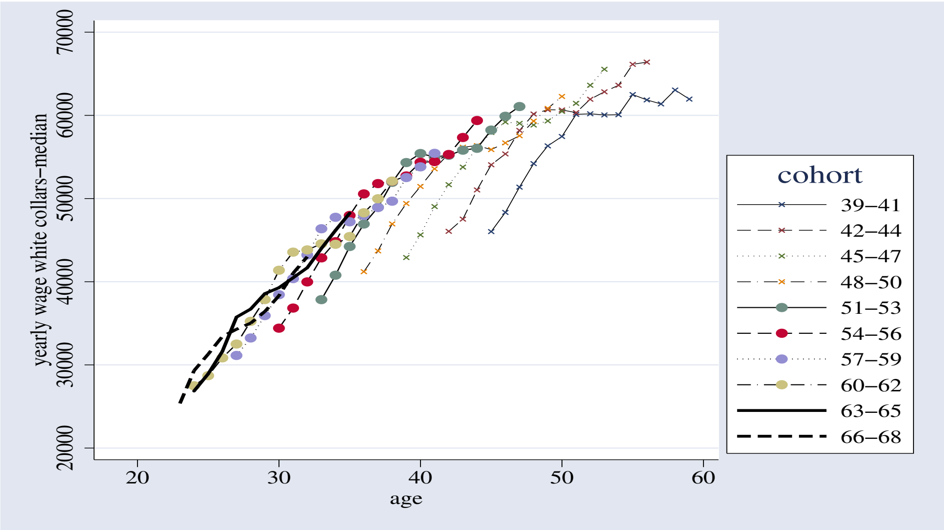
Source: panel ISFOL on INPS data

Figure 11: Earning profiles by cohort, yearly wages, blue collars, median



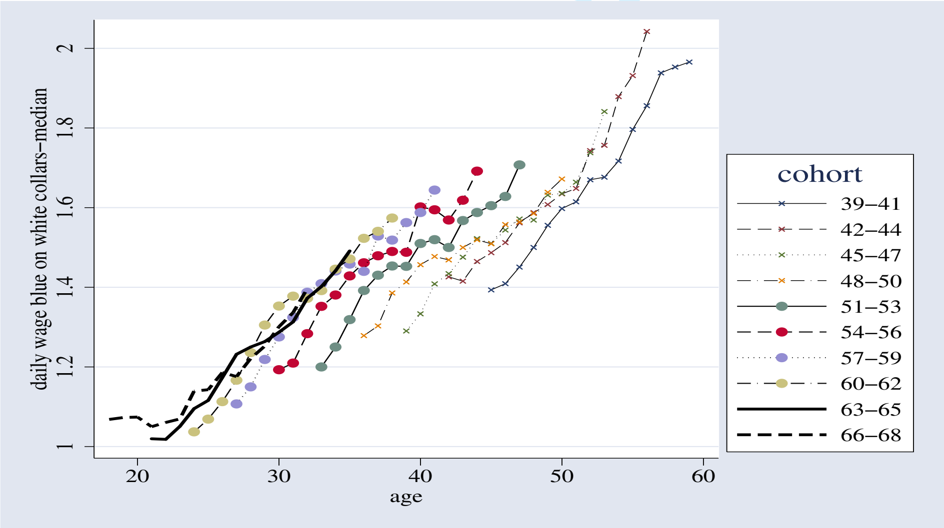
Source: panel ISFOL on INPS data

Figure 12: Earning profiles by cohort, yearly wages, white collars, median



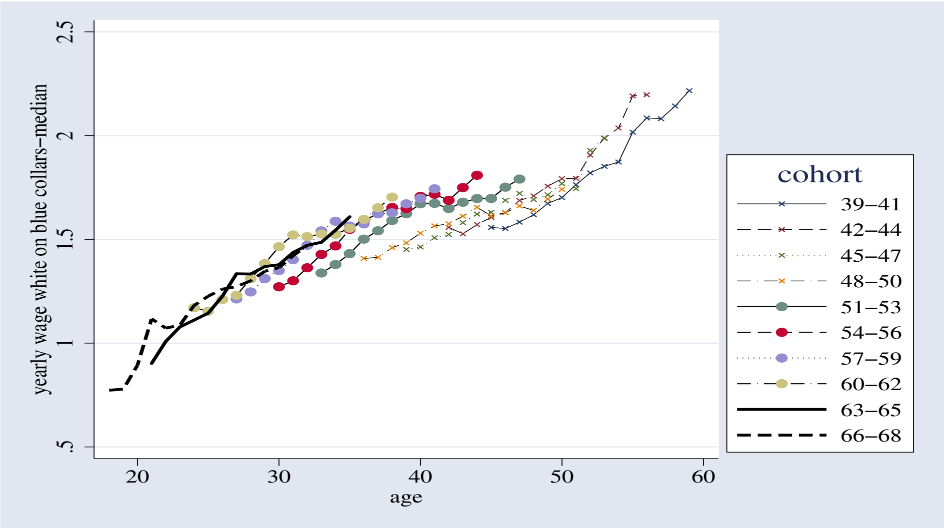
Source: panel ISFOL on INPS data

Figure 13: Ratio betweeen white and blue collar median daily wages, by cohorts



Source: panel ISFOL on INPS data

Figure 14: Ratio betweeen white and blue collar median yearly wages, by cohorts



Source: panel ISFOL on INPS data

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