

Laboratorio Riccardo Revelli
Collegio Carlo Alberto, Moncalieri (Turin)
14 – 15 September 2007

The worsening of wage expectations in Italy: a study based on administrative data

Elena Giarda *

Forthcoming: *International Journal of Manpower, Special Issue, 2008*

* PROMETEIA – Associazione per le Previsioni Econometriche, Bologna
and Faculty of Statistics, University of Bologna

elena.giarda@prometeia.it

Introduction

- **Purpose** The aim of this paper is to test the hypothesis of time-varying wage to age profiles and the dependence of individual wages upon aggregate labour market indicators, for the Italian labour market
- **Methodology** Wage-age profiles, which include cohort variables to capture generational differences in wages and are characterised by a changing-over-time structure, are estimated by fixed and random effects panel regressions. The analysis exploits the WHIP dataset of administrative data on wages for the period 1985-1999
- **Findings** This paper shows that **wage to age profiles** for different cohorts of workers **are not stable over time**: although younger generations of Italian workers are benefiting from higher starting wages than older generations, they face the prospect of lower growth of future earnings
It also confirms the **existence of a significant supply effect**: the bigger the cohort relative to the active population, the smaller the cohort's gain in terms of wage levels
Finally, it captures the dependence of individual wages on aggregate labour market conditions: individual wages are shown to be **negatively related to the unemployment rate** and **positively related to the union wage index**

Literature review: what wages depend upon

AGE (AND COHORT)

Mincer (1958), Creedy-Hart (1979), Lucifora-Rappelli (1995),
Lucifora-Vignocchi (1997), Brugiavini-Peracchi (2003)

TIME-VARYING AGE STRUCTURE

Beaudry-Green (2000), Biagi (2003)

EDUCATION

Psacharopoulos-Layard (1979), Brunello-Comi (2000)

SUPPLY-SIDE FACTORS: COHORT SIZE

Welch (1979), Berger (1985), Korenman-Neumark (2000),
Fertig-Schmidt (2003), Brunello-Lauer (2004)

MACROECONOMIC FACTORS: UNEMPLOYMENT (wage eqs.)

Blanchflower-Oswald (1994; 1995; 2005), Oswald (1995;
2005), Card (1995), Baltagi-Blien (1998), Devicienti *et al.*
(2006)

INSTITUTIONAL FACTORS

Fabiani *et al.* (1998), Lucifora-Origo (1999), Brunello *et al.*
(2000), Manacorda (2004)

Structure of the paper

The study combines **three different aspects of the determinants of individual wages** which are usually considered separately:

1. the dependence of individual real wages on age
2. the impact of supply-side effects
3. the relevance of macroeconomic variables, such as the unemployment rate and union wages

Therefore:

1. It tests the assumption that the age profiles of individual wages are time-dependent: due to a variety of factors - the most prominent perhaps being the progressive slowdown of the Italian economy - younger generations of Italian workers face a lowering of their life-time wage expectations
2. It investigates the effects of supply factors, such as the changing age structure of the active population, on individual wages
3. It searches for evidence on the effects of macroeconomic conditions in the labour market by testing the relevance, in the individual wage equation, of variables such as unemployment rate and real union wages index

The data-set

Data-set used: WHIP (Work Histories Italian Panel), built and distributed by LABORatorio Riccardo Revelli

Where it comes from: INPS administrative archives

Period covered: 1985-1999

What it contains: between 50 000 and 70 000 obs. per year:



annual wages, no. of weeks and days worked in the year, job position and qualification, sector of activity, job location, firm dimension, part-time or full-time work, type of work contract, age and sex

Some limitations: it provides no information on education level, and does not follow private employees enrolled in other social security schemes

It does not provide information on reasons why workers leave the archive: this can be due to periods of unemployment, mobility towards and from self-employment and public employment, or retirement

The **original sample** contains:

- 117 785 individuals: 41 347 females (35%) and 76 438 males (65%)
- all branches of private sector

The **cleaned-up sample** (84.7% of original data-set) contains:

- workers aged 18-60
- industry sector (manufacturing, energy, extraction) and services



38 714 females (38.8% of the total)
61 111 males (61.2% of the total)

The base model

The **log of real weekly wages** is a function of:

- a **second-degree age polynomial**
- **cohort dummies** ($dcoj$), where cohorts refer to workers born in the same five or ten year periods. Older and younger individuals are classified in ten year cohorts, from 1925 to 1935 and from 1971 to 1981 respectively. All other cohorts cover periods of five years
- a set of **control variables**: part-time ($ptime$), the sector of employment ($sect$), the company size ($size$), the geographical location of the job ($area$), and the job qualifications ($qual$)
- the log for the **total years of social security contributions** paid to the INPS during the 15-year period under analysis ($lcontr$)

$$\ln w_{it} = \alpha_0 + \alpha_1 age_{it} + \alpha_2 age_{it}^2 + \sum_{j=2}^9 \beta_j dco_j + \delta_0 lcontr_i + \delta_1 ptime_i + \delta_2 sect_i + \delta_3 size_i + \delta_4 area_i + \delta_5 qual_{it} + \varepsilon_{it} \quad (1)$$

Estimation of the base model

	Women		Men	
Number of obs	=	246419	Number of obs	= 440910
F(21, 128356)	=	4323.64	F(21, 283514)	= 22127.2
Prob > F	=	0.0000	Prob > F	= 0.0000
R-squared	=	0.2665	R-squared	= 0.4621
	Coef.	t	Coef.	t
age	0.02123	25.82	0.03392	61.30
age2	-1.66E-04	-14.22	-2.99E-04	-40.47
dco2	-0.01898	-2.37	-0.01860	-5.42
dco3	-0.00624	-0.79 (*)	-0.01570	-4.09
dco4	0.00936	1.12 (*)	0.00302	0.73 (*)
dco5	0.03290	3.64	0.00989	2.13
dco6	0.04903	5.13	0.03146	6.39
dco7	0.06830	6.92	0.03508	6.87
dco8	0.10378	10.34	0.04760	9.04
dco9	0.16128	15.87	0.10469	19.14
lcontr	0.10597	60.41	0.12300	87.89
ptime	0.08799	34.94	-0.00074	-0.14
d_centre	-0.05027	-24.51	-0.01231	-9.72
d_south	-0.15092	-53.11	-0.14373	-91.36
d_serv	-0.03528	-19.92	-0.00842	-7.30
d_small	-0.04840	-27.16	-0.10399	-82.53
d_large	0.12383	56.61	0.12850	105.22
d_apprentices	-0.44946	-109.14	-0.51178	-142.14
d_bluecollars	-0.29665	-174.24	-0.30503	-249.95
d_managers	0.96227	29.08	0.82009	250.63
const.	5.04322	320.58	5.01163	468.13

(*) Not significant at the 95% confidence level.

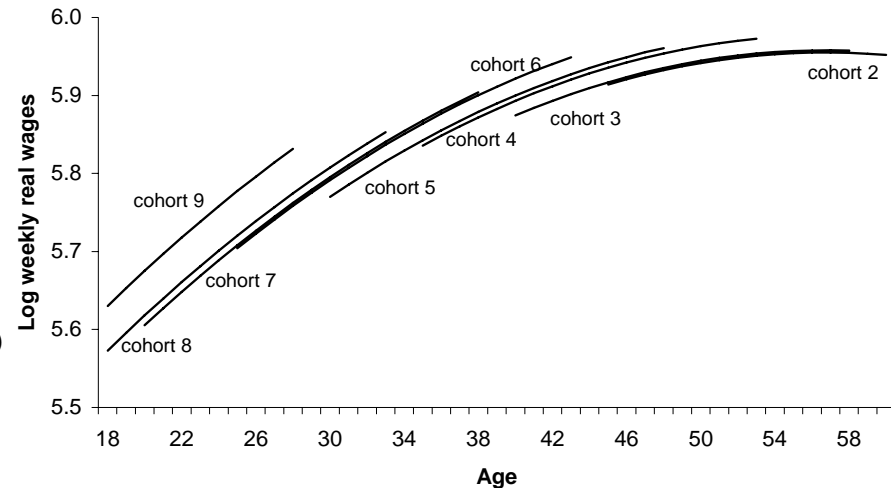
Results

Wages are higher in the north, in bigger companies, for better qualifications, and in the industry sector (the dummy associated with services is significant and negative)

The number of years of social security contributions has a positive sign

In line with the existing literature, **cohort coefficients are higher for younger workers**

Figure 2. Base cohort model: men



Interpretation

Higher entry wages: cohort dummies are positive and increasing for younger cohorts

Each cohort has a different intercept derived from the sum of the common constant term and the specific cohort coefficient

This defines the entry wage for each cohort

The model with a time-varying wage to age structure

An alternative assumption is that younger cohorts of wage earners still enjoy higher real wages than older generations (in line with the predictions of the base model), but may face less optimistic prospects of income growth

The wage to age relation is modified to generate the possibility of a different gradient for each cohort: introduction of a set of variables (“**multiplicative age-cohort dummies**”) obtained from the product of age by each cohort dummy

The log of individual weekly real earnings is thus regressed on the second-degree age polynomial and the already defined set of control variables, with the addition of the set of multiplicative age-cohort dummies:

$$\ln w_{it} = \alpha_0 + \alpha_1 age_{it} + \alpha_2 age_{it}^2 + \sum_{j=2}^9 \beta_j dco_j + \sum_{j=2}^9 \gamma_j agedco_{jt} + \delta_0 lcontr_i + \delta_1 ptime_i + \delta_2 sect_i + \delta_3 size_i + \delta_4 area_i + \delta_5 qual_{it} + \varepsilon_{it} \quad (2)$$

Estimation: robust OLS and random effects

Estimation of the model with a time-varying wage to age structure (1)

Women			Men		
Number of obs	=	246419	Number of obs	=	440910
F(29,128348)	=	3119.08	F(29,283506)	=	15930.61
Prob > F	=	0.0000	Prob > F	=	0.0000
R-squared	=	0.2675	R-squared	=	0.4628
Robust standard errors.			Robust standard errors.		
	Coef.	t		Coef.	t
age	0.10387	17.89	age	0.10405	29.22
age2	-9.31E-04	-19.64	age2	-8.61E-04	-27.91
dco2	-0.01126	-0.08 (*)	dco2	0.60086	9.98
dco3	0.46388	3.23	dco3	0.78932	12.71
dco4	0.76038	5.13	dco4	1.07697	16.46
dco5	1.06064	6.83	dco5	1.38402	18.91
dco6	1.35713	8.29	dco6	1.58556	19.62
dco7	1.67250	9.68	dco7	1.70115	19.39
dco8	1.88881	10.57	dco8	1.84281	19.82
dco9	2.12468	11.63	dco9	2.08454	21.61
agedco2	0.00005	0.02 (*)	agedco2	-0.01114	-10.14
agedco3	-0.00903	-3.42	agedco3	-0.01473	-12.80
agedco4	-0.01509	-5.46	agedco4	-0.02047	-16.63
agedco5	-0.02165	-7.32	agedco5	-0.02778	-19.30
agedco6	-0.02914	-9.06	agedco6	-0.03289	-19.69
agedco7	-0.03848	-10.83	agedco7	-0.03645	-19.04
agedco8	-0.04536	-11.86	agedco8	-0.04115	-19.27
agedco9	-0.05357	-13.17	agedco9	-0.04938	-21.14
lcontr	0.10490	59.65	lcontr	0.12296	87.74
ptime	0.08813	34.99	ptime	0.00041	0.08 (*)
d_centre	-0.05015	-24.46	d_centre	-0.01218	-9.61
d_south	-0.15110	-53.21	d_south	-0.14375	-91.39
d_serv	-0.03407	-19.21	d_serv	-0.00803	-6.97
d_small	-0.05873	-31.64	d_small	-0.11129	-85.49
d_large	0.11446	51.11	d_large	0.12141	96.19
d_apprentices	-0.45319	-103.43	d_apprentices	-0.51147	-131.01
d_bluecollars	-0.29719	-174.46	d_bluecollars	-0.30481	-249.89
d_managers	0.95994	29.03	d_managers	0.82048	252.37
const.	2.82506	14.27	const.	2.85595	26.27

Results

Traditional finding that younger cohorts receive higher entry wages is confirmed

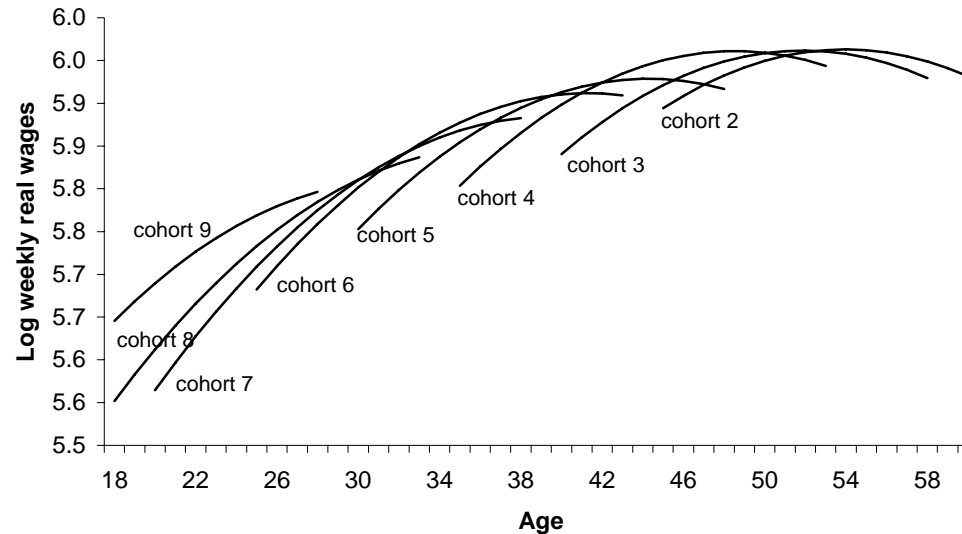
As for the **multiplicative dummies**, results illustrate that their coefficients are all negative (except *agedco2*, which is non-significant) and progressively increasing in absolute value, as we move from older to younger generations, with the **gradient between wage and age becoming flatter for younger cohorts**

RE estimation: the cohort structure of the model is confirmed by the estimation of a random effects model

(*) Not significant at the 95% confidence level.

Estimation of the model with a time-varying wage to age structure (2)

Figure 3. Multiplicative-cohort dummy model: men



Interpretation

The new wage to age profiles clearly show that the slopes of each segment become progressively more gradual as we move from older to younger generations, for instance from cohort 6 (older workers born between 1956 and 1960) to cohort 9 (younger workers born between 1971 and 1981)

$$\ln w_{it} = \sum_{j=2}^9 (\alpha_0 + \beta_j dco_j) + \sum_{j=2}^9 (\alpha_1 + \gamma_j dco_j) age_{it} + \alpha_2 age_{it}^2 + etc.$$

Individual wages and aggregate labour market indicators (1)

Evidence of the relevance of aggregate labour market conditions on the dynamics of individual wages

- Age structure of the active population N (**cohort size**):

$$CS_{kt} = \ln \left(\frac{\frac{1}{9} N_{(k-2)t} + \frac{2}{9} N_{(k-1)t} + \frac{3}{9} N_{kt} + \frac{2}{9} N_{(k+1)t} + \frac{1}{9} N_{(k+2)t}}{N_{(18-60)t}} \right) \quad \begin{array}{l} k = 18, \dots, 60 \\ t = 1985, \dots, 1999 \end{array}$$

- Macroeconomic factors:
 - **Regional unemployment rate**
 - **Union wages**

'Union wages' are wages determined at national level through collective bargaining

Individual wages and aggregate labour market indicators (2)

COHORT SIZE

A larger active population in a given age class relative to the total active population may generate a downward pressure on the wages of workers in that class

MACROECONOMIC FACTORS

Macroeconomic events affect the dynamics of individual wages and thus the model specification has to be controlled “for common across-cohorts business-cycle fluctuations”

Unemployment rate Over the 15-year history of individual wages examined in the paper, the unemployment rate has shown marked cyclical behaviour, with wide regional differences. It is not unreasonable to assume that the worsening of the overall condition of the labour market might have affected individual wages and the wage to age relation. See wage-equation literature

Union wages Individual wages are affected by changes in union wages that occur as a result of the quasi-automatic adjustments to inflation and of periodic national level wage negotiations. Such effects can be thought of as almost independent of individual behaviour and apply to all workers

Individual wages and aggregate labour market indicators (3)

Figure 4 Population cohort-size: men

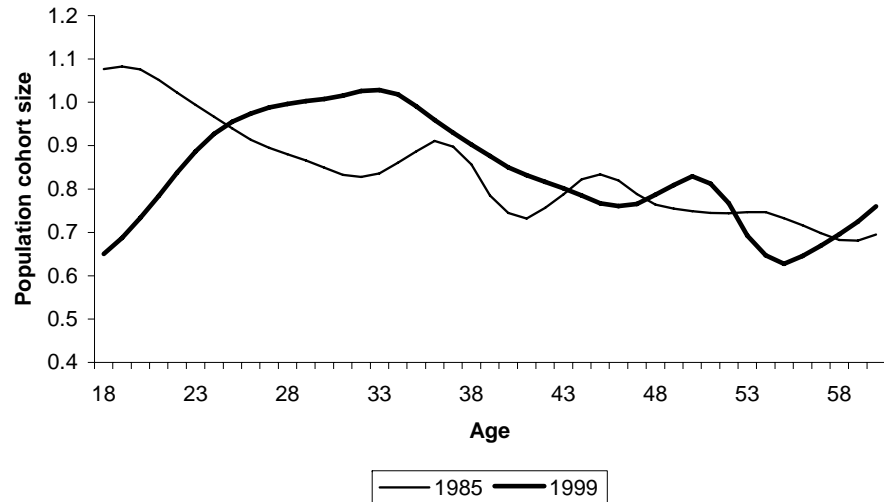


Figure 1. Sample, union and national accounts real wages (base 1999=100)

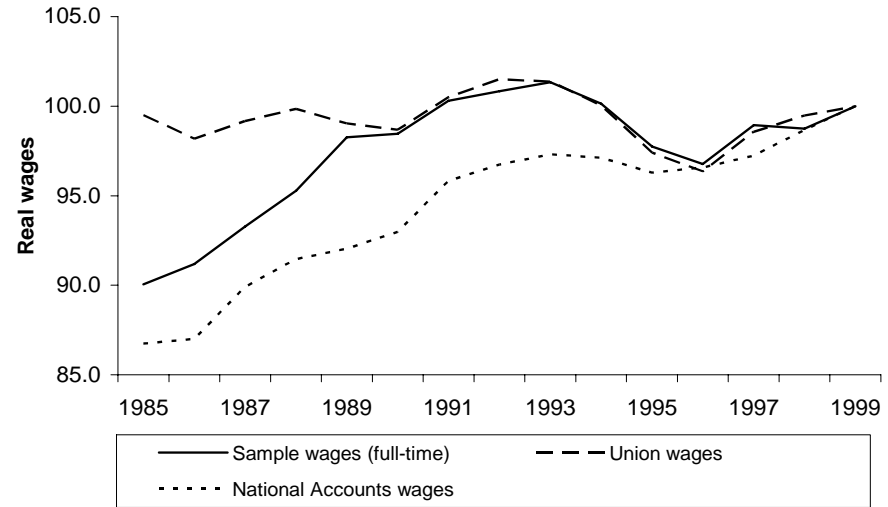
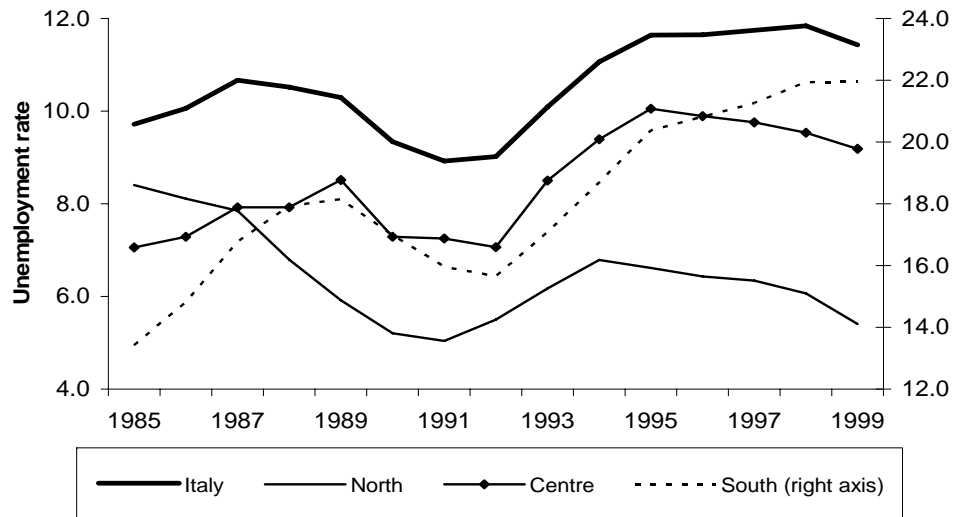


Figure 5. National and regional unemployment rates, 1985-1999



The model with cohort size and macroeconomic indicators (1)

The new specification thus adds **cohort size**, **regional unemployment rates** and **union wages** to the explanatory variables in equation (2):

$$\begin{aligned} \ln w_{it} = & \alpha_0 + \alpha_1 age_{it} + \alpha_2 age_{it}^2 + \sum_{j=2}^9 \beta_j dco_j + \sum_{j=2}^9 \gamma_j agedco_{jt} + \delta_0 lcontr_i + \\ & + \delta_1 ptime_i + \delta_2 sect_i + \delta_3 size_i + \delta_4 area_i + \delta_5 qual_{it} + \\ & + \vartheta_1 CS_{it} + \vartheta_2 \ln unemp_t + \ln wcontr_t + \varepsilon_{it} \end{aligned} \quad (3)$$

where CS_{it} is cohort size, $\ln unemp_t$ is the log of unemployment rates for Italian macro regions and $\ln wcontr_t$ is the log of the real union wage index

Estimation

- Robust OLS
- RANDOM EFFECTS

Both estimation techniques take account of the different levels of aggregation of the dependent variable (individual wages) and the newly introduced annual macro variables, to correct for heteroskedasticity and avoid a standard errors bias (Moulton, 1986)

The model with cohort size and macroeconomic indicators (2)

Table 9. Model with regional unemployment rate and union wage

	Women		Men	
	Number of obs =	246419	Number of obs =	440910
	R-squared =	0.2687	R-squared =	0.4641
Number of clusters (year) = 15			Number of clusters (year) = 15	
Robust standard errors.			Robust standard errors.	
	Coef.	t	Coef.	t
age	0.07806	11.72	0.07275	10.74
age2	-7.17E-04	-13.10	-6.06E-04	-9.78
dco2	-0.13810	-1.17 (*)	0.45732	6.14
dco3	0.18233	1.46 (*)	0.45580	5.56
dco4	0.42419	2.84	0.66344	6.02
dco5	0.60843	3.96	0.83461	6.40
dco6	0.84273	4.68	0.96056	7.03
dco7	1.10982	5.64	1.01832	6.93
dco8	1.25828	6.24	1.08035	7.00
dco9	1.42136	7.20	1.23823	7.11
agedco2	0.00232	1.06 (*)	-0.00857	-6.49
agedco3	-0.00383	-1.67 (*)	-0.00855	-5.81
agedco4	-0.00843	-2.99	-0.01223	-5.67
agedco5	-0.01227	-4.09	-0.01639	-6.15
agedco6	-0.01784	-4.72	-0.01918	-6.63
agedco7	-0.02507	-5.77	-0.02031	-6.25
agedco8	-0.02910	-6.33	-0.02173	-6.04
agedco9	-0.03430	-7.23	-0.02648	-5.75
lcontr	0.10597	20.04	0.12344	15.04
ptime	0.08824	8.17	0.00179	0.14 (*)
d_centre	-0.04165	-3.49	0.00860	1.49 (*)
d_south	-0.12437	-3.87	-0.07679	-3.30
d_serv	-0.03447	-5.04	-0.00841	-1.44 (*)
d_small	-0.05696	-9.60	-0.11044	-36.70
d_large	0.11578	18.15	0.12116	38.10
d_apprentices	-0.45585	-42.10	-0.51479	-47.51
d_bluecollars	-0.29702	-61.11	-0.30482	-45.45
d_managers	0.96319	31.39	0.81977	31.93
cs	-0.16306	-3.79	-0.16548	-5.47
ln_unemp	-0.02087	-0.99 (*)	-0.05345	-3.64
ln_wcontr	0.92601	5.55	0.72396	7.79
const.	-0.49939	-0.63 (*)	0.66205	1.27 (*)

(*) Not significant at the 95% confidence level.

Results

Estimates of additive and multiplicative **cohort dummies** are statistically significant (with the exception of cohorts 2 and 3 for women)

Additive dummies increase from older to younger generations; multiplicative dummies are negative and progressively increasing in absolute value

The coefficients associated with **cohort size** are always statistically significant and, as expected, with a negative sign

The elasticity coefficients of the **union wage index** are 0.93 and 0.72, for women and men respectively, and are statistically different from zero

The **unemployment rate** is not statistically significant in the female equation

For men, the estimated elasticity coefficient of regional unemployment rate is significant and equal to -0.053

RE estimation: In the male equation estimates generally confirm the previous results

In the female specification: unemployment elasticity coefficient statistically significant

The elasticities between union and individual wages are confirmed

The model with cohort size and macroeconomic indicators (3)

To be consistent with previous empirical work on wage-curves, we estimated a model that includes **only cohort size** and **unemployment**:

$$\begin{aligned} \ln w_{it} = & \alpha_0 + \alpha_1 age_{it} + \alpha_2 age_{it}^2 + \sum_{j=2}^9 \beta_j dco_j + \sum_{j=2}^9 \gamma_j agedco_{jt} + \delta_0 lcontr_i + \\ & + \delta_1 ptime_i + \delta_2 sect_i + \delta_3 size_i + \delta_4 area_i + \delta_5 qual_{it} + \\ & + \vartheta_1 CS_{it} + \vartheta_2 \ln unemp_t + \varepsilon_{it} \end{aligned} \quad (4)$$

where CS_{it} is cohort size, $\ln unemp_t$ is the log of unemployment rates for Italian macro regions

Estimation

- Robust OLS
- RANDOM EFFECTS

Both estimation techniques take account of the different levels of aggregation of the dependent variable (individual wages) and the newly introduced annual macro variables, to correct for heteroskedasticity and avoid a standard errors bias (Moulton, 1986)

The model with cohort size and macroeconomic indicators (4)

Table 10. Model with regional unemployment rate

Women			Men		
	Number of obs =	246419		Number of obs =	440910
	R-squared =	0.2679		R-squared =	0.4636
Number of clusters (year) = 15			Number of clusters (year) = 15		
Robust standard errors.			Robust standard errors.		
	Coef.	t		Coef.	t
age	0.08696	6.46		0.08010	6.29
age2	-7.95E-04	-6.65		-6.69E-04	-5.81
dco2	-0.08106	-0.68 (*)		0.50522	6.72
dco3	0.27851	1.97		0.53747	5.35
dco4	0.55316	2.90		0.77149	4.67
dco5	0.76699	3.35		0.96614	4.68
dco6	1.02491	3.67		1.11269	4.78
dco7	1.31211	4.27		1.18861	4.62
dco8	1.47922	4.54		1.26474	4.49
dco9	1.64902	4.76		1.42493	4.53
agedco2	0.00125	0.57 (*)		-0.00945	-7.05
agedco3	-0.00572	-2.22		-0.01014	-5.60
agedco4	-0.01111	-2.99		-0.01445	-4.34
agedco5	-0.01574	-3.33		-0.01923	-4.42
agedco6	-0.02205	-3.55		-0.02265	-4.40
agedco7	-0.03006	-4.17		-0.02444	-4.08
agedco8	-0.03492	-4.40		-0.02649	-3.82
agedco9	-0.04061	-4.46		-0.03150	-3.72
lcontr	0.10610	19.33		0.12349	15.03
ptime	0.08828	8.24		0.00161	0.12 (*)
d_centre	-0.03171	-2.29		0.01598	2.05
d_south	-0.09262	-2.75		-0.05305	-1.86 (*)
d_serv	-0.03407	-4.92		-0.00830	-1.42 (*)
d_small	-0.05825	-8.66		-0.11104	-33.08
d_large	0.11444	16.32		0.12067	34.69
d_apprentices	-0.45543	-41.43		-0.51403	-47.58
d_bluecollars	-0.29708	-60.89		-0.30491	-45.53
d_managers	0.96245	31.47		0.81956	31.85
cs	-0.15126	-3.24		-0.15967	-4.92
ln_unemp	-0.04586	-2.13		-0.07231	-3.95
const.	3.53431	8.42		3.80443	9.98

(*) Not significant at the 95% confidence level.

Results

The estimated elasticity coefficients of **regional unemployment** rates for men and women are -0.072 and -0.046 respectively, and are statistically significant

The estimated value from the male equation compares well with Blanchflower and Oswald's (1995; 2005) and Card's (1995) estimates

The elasticity estimated in the female equation is rather low, but is comparable with Bell *et al.*'s (2002) estimate of -0.025 for the UK

For Italy, Devicienti *et al.* (2006), using the WHIP dataset, estimated an elasticity of -0.041 for females and -0.029 for males for the period 1993-1999

RE estimation:

Cohort structure holds

Unemployment rate elasticities compare with those estimated via OLS

Conclusions

Results confirm that the younger generations of workers in the Italian labour market have higher entry wages and that they can expect increasing earnings in the future

However, it is shown that wage-age profiles cannot be considered invariant over time, and are characterised by progressively smaller gradients as one moves from older to younger generations. As a consequence, the expectations for younger generations of workers are of flattening wage-age profiles: **higher entry wages are compensated for by reduced expectations of future earnings growth**

Individual wages are shown to be:

- **negatively related to cohort size**: in the age categories of wage earners where the ratio of the active to total population is higher, individual wages tend to be lower
- **negatively affected by the unemployment rate** prevailing in the Italian macro regions, with elasticities of magnitudes of between -0.046 and -0.063 for women, and between -0.053 and -0.096 for men, depending on the model specification, but in line with those found in similar studies on wage-curves
- **positively influenced by the dynamics of union wages**. The elasticity of individual earnings to union wages is close to 1 (0.7 and 0.8), with the interesting result that the union wage index absorbs the variance explained by the constant term estimated in the simpler model. It thus gives some economic meaning to the (so far unexplained) high constant term that characterises the simpler model of individual wages