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ABSTRACT

The Returns to Education in Italy: A New Look at the Evidence*

The purpose of this paper is to provide an update of the empirical evidence on the private returns to education in Italy. First, we show that, whilst returns to education in Italy (based on gross wages) are in line with the European average, educational attainment is generally much lower (particularly at secondary and tertiary levels). How can we reconcile these findings? Based on a simple human capital model - where the optimal level of schooling is given by equating the marginal return to the marginal cost of education – we speculate that either marginal costs are steeper in Italy or that a larger share of the population involved in human capital investment faces high marginal costs in Italy compared to the European average.

Second, we examine whether the estimated returns to education have varied significantly over time. The evidence is that returns have not changed much over the period 1977 to 1995, with the exception of 1993 and 1995, when they have increased significantly, especially among female employees. Quite interestingly, the observed increase in the returns to education has been almost completely driven by higher returns to education in the public sector. Assuming that skill biased technical change has been an important factor in shifting out the marginal returns to education, an important question for future research is why these shifts have only affected returns in the public sector of the economy.

Third and last, we confirm the usual finding in the international literature that accounting for measurement error in years of schooling and/or for the endogeneity of educational choices by using instrumental variables significantly increases the returns to education with respect to estimates based on OLS methods. We also show that adding family background variables to the set of instruments significantly increases returns, which suggests that these variables affect mainly the subgroup of individuals with higher marginal returns to schooling.

JEL Classification: I21, I22, J24, J31

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1. Introduction

There is agreement among economists and policy makers that investment in human capital is key for economic development and growth (OECD, 1998). The standard economic approach to the analysis of the decision to invest in education (and training) is that individuals and households compare their expected benefits and costs from the investment. For each individual, the optimal investment in human capital, measured for instance by the optimal number of years of schooling, is obtained when expected marginal benefits and expected marginal costs are equal (see Card, 1995).

Governments can affect individual decisions by influencing both the costs and the benefits of education. In an economy, the outcome of the interactions of heterogeneous agents who invest in education to increase their human capital can be measured by average educational attainment and by the labour market returns to education. Usually a distinction is drawn between private and public returns to education, with the former including the returns appropriated by the single individuals and the latter including the positive externalities of individual investment.

The purpose of this chapter is to provide an update of the empirical evidence on the private returns to education in Italy. We build on previous research, that is reviewed in a companion paper (see Brunello, Comi and Lucifora, 1999, for details). We try to provide an empirical answer to a number of questions that are relevant for policy. First, are the estimated returns to education in Italy in line with other European experiences? Second, is there any evidence of an increase in the returns to education in Italy, similar to that experienced for instance by the United States since the early 1980s?

We also consider how returns vary by gender, occupation and region. Last but not least, we discuss the problems associated with standard OLS (ordinary least squares) estimates of the returns to education and compare these estimates with results based on instrumental variables. The chapter is organised in eight sections. We start with a brief description of the Italian schooling system. Next, we introduce the empirical model and the estimates

based on ordinary least squares. Section 4 considers our results in the light of the European evidence and Section 5 looks at the evolution of the returns to education over time. The discussion of methods based on instrumental variables is presented in Section 6. The remaining three sections are devoted respectively to estimating the returns to different educational levels, to a brief discussion of the interaction between schooling and labour market experience and to the evaluation of the labour market returns to education for selected groups. Conclusions follow.

2. The Italian Schooling System

The Italian schooling system has been shaped over the years by a number of important reforms. Following the 1922 educational reform, primary school (*scuola elementare*) became compulsory for children aged 6 to 11. Secondary school was divided into two distinct tracks, academic and vocational, and only student belonging to the academic track were allowed to enter tertiary education[1].

The reform of compulsory lower secondary school (*scuola media*) of 1962 established the leaving school age at 14, adding to primary school three further years of compulsory and comprehensive education. The 1969 reform eliminated restrictions to access to university and allowed graduates of vocational secondary schools to enrol. Primary school was reformed again in 1990, when the new curricula[2] approved in 1985 were fully implemented. Combined with the ageing of the Italian population, one of the main effects of this reform was to increase the teacher/pupil ratio, thus providing jobs for an increasingly large excess supply of primary school teachers.

Two - and three - years diplomas were also introduced in 1990 as an alternative to traditional tertiary education. Finally, compulsory leaving age was raised from 14 to 15 in 1999, a change to be effective from the year 2000. A

[1] The Italian vocational system is school based. See Shavit and Muller (1998) for a discussion.
[2] Primary school education is now aimed at promoting initial cultural literacy and the full development of individual pupils, with an emphasis on interaction with families and the social community.

drastic reform of the whole system, from primary to upper secondary, is currently being discussed in the Italian Parliament.

In the Italian schooling system exams are normally taken at age 14 (*esame di scuola media inferiore*) and further education is then a matter of choice. In 1995 approximately 91.1 percent of the relevant cohort stayed on and attended formal education, either at school or at vocational schools, while the rest entered the labour market searching for a job. For those continuing education there is another leaving exam, usually after five years of upper secondary school (*scuola superiore*). This exam (known as *esame di maturità*) is mostly taken at age 19. The pass rate is currently about 94 percent. Many students, however, drop out of school before reaching the final exam. In 1995 about 66.7 percent of individuals aged 19 obtained a upper secondary school diploma and among the latter only 68.4 percent continued by enrolling in a tertiary institution. The university system includes both undergraduate (usually 4 years) and postgraduate studies (doctorate).

Educational attainment in Italy, measured by the percentage of individuals with upper secondary education, was 68.5% in 1992, much lower than the OECD average (84.8%). Attainment measured by tertiary education was even lower (10.2% in Italy, compared to 20.8% in the OECD). An alternative measure of performance of the education system is the percentage of graduates in the population at theoretical age of graduation. This percentage is again significantly lower in Italy than in the OECD average: less than 70% of individuals at theoretical age of graduation completed upper secondary education in Italy in 1992, compared to about 85% in the OECD average.

This difference is partly explained by the high dropout rate in the Italian system. According to a study by ISTAT (1999), in of a cohort of 1000 individuals completing compulsory school, only 925 individuals enrol in upper secondary schools. Among them, 610 pass the final exam after five years and 401 enrol in a university course. Only 160 individuals graduate. The importance of dropouts in the Italian system can also highlighted by looking at enrolment rates in schools by individuals aged 16 and 17. While in Italy only 6.5 teenagers

out of 10 are still in school at 16, this proportion is close to 9 in the OECD average.

Figures 1 to 4 present time series information about the four educational levels, primary school, junior high, upper secondary and college[3]. Consider first primary school and notice that the average dropout rate over the five years was close to 30 percent of enrolled students after the war, declined to about 10 percent in the early sixties and converged to zero in the seventies. This decline in the dropout rate has been accompanied both by an increase in the proportion of pupils completing primary school in the population at theoretical age of graduation and by a substantial decline in the pupils / teacher ratio.

Figure 2 tells a qualitatively similar story for junior high school. It is perhaps worth noticing that, even after the 1962 reform made this school level compulsory, more than 15 percent of pupils dropped out during the sixties and more than 5 percent did so during the eighties. Hence, implementation of the law has been rather poor up to the early 1970s (see Checchi, 1997).

Next, consider secondary school (Figure 3). The percentage of individuals enrolled in any secondary school has steadily increased from less than 20 percent of the relevant population cohort (age 14) in the late fifties to slightly less than 80 percent in the early nineties. At the same time, the percentage of graduates in the population at the theoretical age of graduation (age 19) reached about 60 percent in the late eighties, and increased further to slightly less than 70 percent in 1992. The percentage of individuals dropping out of school significantly increased during the sixties and reached about 16 percent in 1992.

Finally, Figure 4 focuses on college education. While enrolment increased over the years to reach 20 percent of the relevant population, the percentage of graduates increased only to 10 percent. The reason of this gap is clear from the third panel in the figure, where we plot the percentage of college graduates over individuals enrolled five years earlier. It turns out that this percentage has collapsed from close to 20 percent in the late sixties to about 10 percent in the early nineties. This can be explained both by the high number

[3] The data used in these figures were kindly provided by Daniele Checchi.

of dropouts and by with the fact that many students spend more than the required time to complete a degree.

In most developed countries, individuals with a lower level of educational attainment are more likely to be unemployed than individuals with a higher attainment (See OECD, 1997). This is also the case for Italy, with the exception of the young members of the labour force. For this group, the unemployment rate is highest among individuals with primary and with college education.

High unemployment among young individuals with relatively high education can be partly explained by regional and occupational mismatch between labour demand and labour supply. While labour demand concentrates in the Northern and Central areas of the country, unemployment is particularly high in the under-developed South. Other important factors are both the lack of systematic links with private industry and the poor signalling role of education. On the one hand, private industry in Italy has traditionally been characterised by ``low intensity of education'' and by reliance on internal training. On the other hand, the poor performance of the education system in Italy and the lack of emphasis on competition among students has limited the signalling role of schooling. Porter (1989) emphasises the poor quality of the Italian schooling system and argues that ``... in order to sustain growth and to acquire professional competencies, Italians need to improve their basic knowledge of mathematics, computers and other key disciplines ...'' (Porter, 1989; p. 812.). This and the limited demand for highly educated workers by private industry imply that the main employer of high education workers in Italy is the public sector.

Most schools in Italy are public. The percentage of public institutions range from 90 percent among compulsory schools to 75 percent among upper secondary schools. Approximately 94 percent of university students are enrolled in state universities. Tuition fees are generally low. University fees were raised during the 1990, both because of the increased financial autonomy of universities and because of the need to raise revenue, but still remain rather low. In 1995, for example, the average gross tuition, inclusive of all financial contributions, paid by students enrolled in state universities, was approximately

313 euros per year at the University of Rome and close to 775 euros at the University of Milan (see Silvestri, Catalano and Bevilacqua, 1996). Table 1 shows current expenditure (net of capital expenditure) and total tuition and other fees per student enrolled in tertiary education in 1996 by region. The share of tuition fees on current expenditure was on average close to 17 percent. While tuition is low, the additional monetary and non-pecuniary costs associated to the widespread inefficiency of Italian universities should not be overlooked.

Table 1: Current expenditure and revenue per student. 1996. (Thousand Italian lire)

Region	Current expenditure per student	Tuition and other fees per student
Piemonte	5.884	1.293
Liguria	9.187	1.167
Lombardia	6.787	2.138
Trentino A. A.	6.023	883
Veneto	7.189	1.225
Friuli Venezia Giulia	9.330	1.216
Emilia Romagna	6.992	1.363
Marche	5.319	1.334
Toscana	8.810	1.013
Umbria	9.620	1.448
Lazio	7.006	980
Campania	7.045	849
Abruzzo	5.707	1.098
Molise	5.063	627
Puglia	4.944	698
Basilicata	10.878	1.191
Calabria	6.844	710
Sicilia	7.451	519
Sardegna	6.953	538
ITALIA	7.028	1.162

Source: ISTAT (1999)

Government intervention in support of students from low income households has been historically limited. As recently as 1993, government expenditure devoted to indirect and direct support to students in need was only 5.6% of the resources allocated to the university system. While there are important changes taking place, it is difficult to disagree with the view that "..student support is the critical weakness of Italian universities, with important consequences for social equity".. (Silvestri, Catalano and Bevilacqua, 1996).

To summarise, the design of tertiary education in Italy combines few restrictions to access, very limited support to able students from poor households and virtually no differentiation among universities. We expect this combination to reduce the signalling role of upper education and to penalise the able with limited economic resources to the advantage of the less able with no financial constraint.

3. Evidence from simple estimates

We start our empirical investigation of the returns to education in Italy by estimating a standard Mincer equation, that associates the log of individual earnings to years of schooling, potential experience (defined as age minus years of schooling minus 6) and its square.

Our data are drawn from the Survey of Household Income and Wealth of the Bank of Italy (*SHIW* from now on). The *SHIW* survey is based on a random sample of approximately 8,000 households per year, and is available from 1977 annually and at odd years after 1987[4]. It contains information both on households (family composition) and on individuals. This information includes the highest completed school degree[5], gender, age, potential and actual work experience, net yearly earnings, average weekly hours of work and number of months of employment per year[6]. It also contains information on family background (the education, age, occupation and sector of parents). There are no other nationally representative surveys in Italy that cover the same range of information. We restrict our sample to non-agricultural employees aged from 14 to 65. Furthermore, we consider only males working full-time and females

[4] In 1985 the survey wasn't carried out.
[5] Standard and not actual years of formal schooling are recorded. Since students who fail to reach a standard have to repeat the year, the actual number of years is likely to be underestimated.
[6] Our definition of the hourly wage is: (yearly earnings)/ (months worked)*(weekly hours worked)*4

working both full-time and part-time.[7] In Table 2, we report for three selected years the summary statistics of the main variables used in the empirical analysis[8]. Average age is around 36 years for females and close to 40 for males, with some evidence of an ageing (sample) female population over the years. Years of schooling, measured as the number of years required to complete the highest attained degree, are higher on average for females (11 years) than for males (10 years). Both these factors contribute to the observed lower potential labour market experience of females (19 years) compared to males (23 years).

Turning to job attributes, as one might expect, blue-collar occupations are under-represented among females (between 30 and 40 percent). Part-time work is still a rather marginal phenomenon (around 10 percent). Males tend to work longer hours (on average) than females - even excluding part-time - and are more likely to be located in the Northern regions of Italy. Males have significantly higher yearly (net) earnings, but the gender gap in earnings is significantly reduced when hourly wages are considered. Information on family background is available from the 1993 wave of the survey. Looking at averages, we notice the presence of persistence between generations in both education and occupational choice: females - conditional on being on average more educated than males in the sample - tend to have more educated parents, while males tend to have a higher proportion of fathers employed as blue-collars and mothers not working. In the reminder of this chapter we shall use the information contained in the SHIW data set to investigate the relationship between hourly wages, education and labour market experience, and to address a number of issues related to the measurement of the returns to education.

[7] The inclusion of females working part-time is motivated by the fact that in some European countries over 50 percent of females hold a part-time job. In Italy, this percentage falls to 10 percent.

[8] We have excluded from Table 2 employees whose wage information was missing. In some cases, the sample may slightly differ because of the higher non-response rate to some survey questions (i.e. family background).

Table 2. Selected variables and their means in SHIW. Years 1984, 1989 and 1995.

	1984		1989		1995	
	Females	*Males*	*Females*	*Males*	*Females*	*Males*
Personal characteristics						
Age	35.14 (10.59)	38.79 (11.46)	36.19 (10.49)	39.21 (10.97)	37.38 (10.26)	38.99 (9.09)
Years of Schooling	10.65 (4.08)	9.24 (3.91)	11.15 (3.84)	9.80 (3.79)	11,10 (3.57)	10.07 (3.61)
Potential experience	18.48 (11.88)	23.55 (12.36)	19.04 (11.57)	23.40 (12.24)	20.27 (11.21)	22.91 (12.07)
Job attributes						
Blue-collar	0.45 (0.49)	0.61 (0.48)	0.32 (0.49)	0.48 (0.49)	0.36 (0.48)	0.53 (0.49)
Part-time	n.a.	-	0.08 (0.27)	-	0.13 (0.34)	-
North	0.65 (0.47)	0.55 (0.49)	0.63 (0.48)	0.52 (0.49)	0.64 (0.47)	0.57 (0.49)
N° of hours worked	n.a	n.a	37.06 (7.37)	40.75 (4.89)	34.12 (9.39)	40.39 (7.29)
Earnings						
Net annual earnings	9689.46 (3913.72)	12335.15 (4772.5)	16163.37 (5059)	19424.87 (7054.89)	19153.93 (7991.48)	24366.47 (10297.2)
Net hourly wage	5.37 (1.74)	6.71 (2.23)	9.94 (5.68)	10.18 (3.51)	13.42 (7.68)	13.53 (6.42)
Gross hourly wage	n.a	n.a	12.88 (7.79)	13.24 (5.49)	n.a	n.a
Gross yearly earnings	n.a	n.a	20888.21 (7283.51)	24140.17 (10699.56)	n.a	n.a
Parental background (1)						
Father education	n.a	n.a	n.a	n.a	6.42 (4.16)	4.65 (3.44)
Mother education	n.a	n.a	n.a	n.a	5.60 (3.51)	5.32 (3.80)
Father blue-collar	n.a	n.a	n.a	n.a	0.37 (0.48)	0.44 (0.49)
Mother not employed	n.a	n.a	n.a	n.a	0.58 (0.49)	0.65 (0.47)
Father self-employed	n.a	n.a	n.a	n.a	0.23 (0.42)	0.21 (0.40)
Number of observations	1266	2200	2235	3937	2326	3441

Notes: n.a = not available. Standard deviations in parentheses. (1) Not available for all the sample.

The standard specification we consider is

$$ln(w_i) = \alpha + \beta S_i + \gamma_1 X_i + \gamma_2 X_i^2 + \varepsilon_i \qquad [1]$$

where *ln(w)* is net log hourly wages, *S* is years of schooling (in years), *X* is potential experience and ε is the error term. The subscript *i* refers to individuals (*i=1,...,N*). This specification can be obtained from standard human capital theory and is based on the assumption that individuals accumulate human capital both at school and in the labour market (see Willis, 1986 for a derivation). It is based on a number of simplifying assumptions: first, the relationship between log wages and years of schooling is linear; second, there is no complementarity between the accumulation of human capital in the labour market and educational attainment. We will relax some of these assumptions in a later section of this chapter.

Ordinary least squares estimates of [1] for 1995 are presented in columns (1) and (2) of Table 3, respectively for males and for females. The regression for females also includes a part-time dummy, taking the value 1 if the employee is working part-time and 0 otherwise while only males working full time are considered. Based on these estimates, the marginal return to a year of education is 6.2 percent for males and 7.7 percent for females. Moreover, conditional on schooling, one additional year of potential labour market experience increases hourly wages by 4.1 percent for males and by 3.6 percent for females.

4. **An international comparison**

The natural question to ask is whether the estimated marginal return to a year of schooling in Italy is high or low in a comparative perspective. In this section, we compare our results with those obtained for other 14 European Countries, using a similar specification and methodology. Despite the pressures from economic integration, limited labour mobility within Europe

suggests that observed differences in educational attainment and in the costs and returns to education across Europe can be persistent.

Table 3: OLS estimates of returns to education (year of schooling). Year: 1995.

	Men (1)	Women (2)
Schooling	0.062 (0.001)	0.077 (0,002)
Potential Experience	0.041 (0.001)	0.036 (0.002)
Pot. Exp. Squared	-0.0005 (0.00003)	-0.004 (0.00005)
Part-time	-	-0.047 (0.023)
N	3441	2326
R2	0.40	0.37

Notes: Standard errors in parenthesis.

Table 4 presents the OLS estimates of the marginal returns to schooling based on the same time period (as close as possible to 1995) for 15 European countries and prepared by the *PURE* team[9]. In the table, the estimated returns to schooling are shown for three alternative specifications of the earnings equation, that use respectively potential, actual experience and age. The table suggests that, independently of gender and of the selected specification, the marginal return to schooling in Italy is below the European average. The gap is especially significant for Italian males.

It is important to assess to what extent the observed difference is due to different measurement criteria or to genuine lower returns to education in Italy with respect to the European average. We address the measurement issue first. The estimated returns to education in Italy – due to data availability - are based on net rather than on gross wages, that are used instead in the majority of the other countries reported in Table 4.

[9] PuRE is a team of researchers from 15 European countries involved in a joint research project on the economic returns to education, financed by EU under the TSER programme (grant PL980182).

Table 4: Returns to education in Europe, by country.

	Males			Females		
	(1) *pot EXP*	(2) *Act EXP*	(3) *age*	(4) *Pot EXP*	(5) *act EXP*	(6) *age*
Austria (95)	**0.069**		**0.059**	**0.067**		**0.058**
Denmark (95)	**0.064**	**0.061**	**0.056**	**0.049**	**0.043**	**0.044**
Germany (West) (95)	**0.079**	**0.077**	**0.067**	**0.098**	**0.095**	**0.087**
Netherlands (96)	**0.063**	**0.057**	**0.045**	**0.051**	**0.042**	**0.037**
Portugal (94)(95)	**0.097**	**0.100**	**0.079**	**0.097**	**0.104**	**0.077**
Sweden (91)	**0.041**	**0.041**	**0.033**	**0.038**	**0.037**	**0.033**
France (95)	**0.075**		**0.057**	**0.081**		**0.065**
UK (94-96)	**0.094**	**0.096**	**0.079**	**0.115**	**0.122**	**0.108**
Ireland (94)	**0.077**	**0.068**	**0.050**	**0.105**	**0.100**	**0.089**
Italy (95)	**0.062**	**0.058**	**0.047**	**0.077**	**0.070**	**0.061**
Norway	**0.046**	**0.045**	**0.037**	**0.050**	**0.047**	**0.044**
Finland (93)	**0.086**	**0.085**	**0.072**	**0.088**	**0.087**	**0.082**
Spain (94)	**0.072**	**0.069**	**0.055**	**0.084**	**0.079**	**0.063**
Switzerland (95)	**0.089**	**0.088**	**0.075**	**0.092**	**0.086**	**0.082**
Greece (94)	**0.063**		**0.040**	**0.086**		**0.064**
Mean	**0.072**	**0.070**	**0.057**	**0.079**	**0.076**	**0.066**

Notes: (a) gross wage. *Source:* Information collected by the PuRE group.

To check whether using net rather than gross wages significantly affect our estimates we fit equation (1) using age rather than experience and both gross and net hourly wages (i.e. including and excluding direct taxation). This can be done for wave 1989 of the *SHIW* data, because gross wages in that wave have been carefully estimated at the individual level[10]. Table 5 presents our results. It turns out that returns based on gross wages are approximately 16 percent and 11 percent higher than returns based on net wages, respectively for males and for females. Assuming that this gap is more or less constant over time, this implies that expected returns based on gross wages in 1995 were 0.054 for males and 0.067 for females, very close to the European average (see column 3 and 6 in Table 4).

[10] We use the data kindly provided by Dino Rizzi of the University of Venice, who has estimated individual gross wages by adding expected income taxes to individual net wages in the 1989 SHIW wave.

While estimated returns based on gross wages are close to the European average, educational attainment, measured by the percentage of individuals aged 25 to 64 who have at least upper secondary education, is lower than the European average (see OECD, 1997). How do we explain this?[11] Using the standard human capital model (see Card, 1995), the optimal level of schooling is given by equating the marginal return to the marginal cost of schooling. Let the relationship between log earnings and education be given by

Table 5: Returns to Education. Gross and net hourly wages. 1989

	Males		Females	
	Gross	***Net***	***Gross***	***Net***
Education	0.036 (0.001)	0.031 (0.001)	0.041 (0.002)	0.037 (0.001)
Age	0.048 (0.003)	0.041 (0.002)	0.030 (0.004)	0.028 (0.004)
Age^2	-0.0004 (0.00004)	-0.0003 (0.00003)	-0.0002 (0.00006)	-0.0004 (0.00005)

Note: standard errors in parentheses.

$$ln(w_i) = \alpha + \beta S_i + \gamma_1 A_i + \gamma_2 A_i^2 + \varepsilon_i \qquad [2]$$

where *A* is individual age. Conditional on age, marginal returns $\frac{\partial w}{\partial S}\frac{1}{w}$ are equal to

$$MR_i = \beta_i \qquad [3]$$

With marginal costs increasing in the years of schooling

$$MC_i = r_i + kS_i \qquad [4]$$

the optimal value of S, S*, is given by

[11] We consider here for simplicity only the European average and ignore the important variations of educational outcomes within Europe.

$$S^*_i = \frac{\beta_i - r_i}{k} \qquad [5]$$

When individuals are homogeneous, similar returns to education can be consistent with different levels of educational attainment if a) marginal returns are similar and b) either the intercept *r* or the slope coefficient *k* of the marginal cost function [4] are higher in the country with lower attainment. When individuals are heterogeneous, similar returns and different attainment can be accounted for if the country with lower attainment has a larger share of individuals with higher marginal costs (higher *r*) and/or steeper marginal cost functions (higher *k*).

Using the simple framework provided by human capital theory, the finding that Italy has both lower educational attainment and (marginal) returns to education (conditional on age) that are not significantly different from the European average could be explained if a larger share of the relevant population faces either higher marginal costs or steeper marginal cost functions. Recall that these costs include both monetary outlays by individual households, non-pecuniary costs and the opportunity costs of delaying labour market entry. While comparative evidence on the costs of education is limited, further research in this area is important, especially when increasing the educational attainment of the labour force is considered to be a national priority.

5. The evolution of returns over time

An interesting question is whether the estimated returns to education have varied significantly over time. To investigate this issue, we run [2] from 1977 to 1995. The results are displayed in Table 6. The table confirms that returns are higher for females than for males over the entire sample period. In Figure 5 we plots these returns and the associated confidence intervals by gender. The evidence is that returns have not changed much over the period, with the

exception of 1993 and 1995, when they have increased significantly, especially among female employees.

Table 6: Estimates of the Returns to Education 1977-1995: men and women (OLS Estimates).

	Males				Females			
	Education	***Age***	***Age²***	***R²***	***Education***	***Age***	***Age²***	***R²***
1977	0,033 (0,002)	0,089 (0,004)	-0,0009 (0,00005)	0,31	0,05 (0,004)	0,068 (0,009)	0,0007 (0,0001)	0,2
78	0,027 (0,002)	0,086 (0,004)	-0,0009 (0,00005)	0,25	0,044 (0,003)	0,078 (0,008)	-0,0008 (0,0001)	0,21
79	0,024 (0,002)	0,089 (0,005)	-0,0009 (0,00006)	0,25	0,044 (0,003)	0,067 (0,007)	-0,0007 (0,0001)	0,21
80	0,029 (0,002)	0,082 (0,004)	-0,0008 (0,00006)	0,26	0,045 (0,003)	0,032 (0,008)	-0,0003 (0,0001)	0,15
81	0,024 (0,001)	0,08 (0,003)	-0,0008 (0,00004)	0,24	0,042 (0,003)	0,037 (0,008)	-0,0003 (0,0001)	0,12
82	0,028 (0,001)	0,075 (0,003)	-0,0007 (0,00004)	0,27	0,04 (0,003)	0,032 (0,007)	-0,0003 (0,00009)	0,13
83	0,031 (0,001)	0,069 (0,003)	-0,0007 (0,00004)	0,31	0,044 (0,002)	0,03 (0,006)	-0,0002 (0,00008)	0,19
84	0,028 (0,001)	0,072 (0,004)	-0,0007 (0,00005)	0,26	0,037 (0,002)	0,047 (0,006)	-0,0005 (0,00008)	0,2
86	0,029 (0,001)	0,072 (0,002)	-0,0007 (0,00003)	0,32	0,038 (0,001)	0,051 (0,004)	-0,0005 (0,00006)	0,32
87	0,037 (0,001)	0,055 (0,002)	-0,0005 (0,00003)	0,29	0,04 (0,002)	0,043 (0,004)	-0,0004 (0,00005)	0,25
89	0,032 (0,001)	0,043 (0,002)	-0,0004 (0,00003)	0,27	0,036 (0,001)	0,031 (0,003)	-0,0002 (0,00005)	0,24
91	0,035 (0,001)	0,051 (0,002)	-0,0004 (0,00003)	0,34	0,046 (0,001)	0,045 (0,004)	-0,0004 (0,00005)	0,34
93	0,047 (0,001)	0,068 (0,003)	-0,0006 (0,00004)	0,38	0,069 (0,002)	0,058 (0,005)	-0,0005 (0,00006)	0,43
95	0,046 (0,001)	0,062 (0,003)	-0,0005 (0,00004)	0,39	0,061 (0,002)	0,046 (0,005)	-0,0003 (0,00006)	0,36
mean	0,032	0,070	-0,0006	0.27	0.052	0.029	0.0004	0.22

Note: Figures in parentheses are standard errors.

With due caution, it is interesting to compare the dynamics of returns to schooling in Italy and in the United States. As shown by Ashenfelter and Rouse (1999), in the United States these returns have increased from 6.2% in 1979 to close to 10% in 1993 (+59%). In Italy they have increased during the same period from 2.4% to 4.7% (+96%) for males and from 4.4% to 6.9% (+56%) for females. While in the US this increase has occurred mainly in the early eighties, in Italy it has taken place almost entirely in the early 1990s.

A closer inspection of Figure 5 reveals the presence of a mild downward trend in the returns to education up to the late 1980s for females and of a mild upward trend during the same period for males. Since Italy has experienced during the same period a similar trend in the overall structure of wage differentials, the described pattern captures the contribution of the schooling wage premium to the overall dispersion of wages.

We take a more detailed look at the dynamics of returns to education by estimating [2] separately for the private and for the public sector[12]. The results are plotted in Figures 6 and 7 separately for males and for females. In the private sector we find evidence of stable returns for males and of a mild decline in returns for females. Returns in the residual public sector, instead, have remained more or less flat up to the mid-late 1980s for both males and females but have increased sharply afterwards, albeit at a slower rate for males.

Next, we also consider the evolution of returns by industry within the private sector. Here, we distinguish among manufacturing (gross of building), distribution and utilities, including in the latter both transport and communication and banking and finance (see Figures 8, 9 and 10). With the sole exception of males in the utilities sector, the evidence is of flat and even declining returns to education in the private sector.

Let $\beta = \omega_p \beta_p + (1-\omega_g)\beta_g$ be the returns to years of schooling, defined as the average of the returns in the private (subscript *p*) and in the public sector

[12] Unfortunately, the definition of public sector in the *SHIW* survey is problematic at least up to 1993. The reason is that government employment before 1993 is pooled with a residual private service sector, that typically include secondary labour market jobs (domestic services is an example). To maintain an homogeneous definition over time, we have pooled this residual sector with government employment also in 1993 and 1995.

(subscript *g*), where ω_p is the share of employment in the private sector. We can decompose the changes of these returns over time as follows

$$\frac{\partial \beta}{\partial t} = \omega_p \frac{\partial \beta_p}{\partial t} + (1-\omega_p)\frac{\partial \beta_g}{\partial t} + (\beta_p - \beta_g)\frac{\partial \omega_p}{\partial t} \qquad [6]$$

We show later in this chapter that the estimated returns to education are higher in the private sector. Since the share of private employment has steadily declined in Italy in the past decade, the last term in [6] is clearly negative. Thus we conclude that, with more or less flat returns in the private sector, the observed increase in the returns to education can only be accounted for by an increase in the returns to education in the residual public sector.

It is an open question why returns to education have increased in the public sector but remained constant in the private sector. As shown in Figure 11, relative net wages in the public sector have increased sharply in the early 1990s, mainly as a result of very favourable renewals of wage contracts (see Brunello and Dustmann, 1996). Our empirical evidence suggests that these wage increases have not been spread out evenly among different educational groups, but have also affected the relative payoff of higher education.

In the international literature explaining the current increase in wage differentials by education and skills, a lot of emphasis has been placed on the role played by skill biased technical change (see Card and Lemieux, 1999 for a recent review). By shifting the relative demand of educated labour relative to available supply, the argument goes, skill biased technical change has increased the economic returns to education. A potential problem with this story in our context is that skill biased technical change should have affected the marginal returns to skill both in the private and in the public sector. Our evidence suggests, however, that returns have increased only in the public sector. Skill biased technical progress should also have increased educational attainment. While attainment did increase in Italy, especially among teenagers (see Figure 3), the percentage of individuals in the relevant age group with a college degree has remained disappointingly flat since the mid 1970s (see

Figure 4). Clearly, more empirical research on the relationship between technical progress and the economic returns to education is necessary before reaching a satisfactory explanation of the current trends.

6. **Estimates based on instrumental variables**

So far, we have presented empirical estimates based upon ordinary least squares. These estimates, however, face two important problems. First, when years of schooling are measured with error, they are biased toward zero (*attenuation bias*). Second, education is not randomly assigned to individuals but is the result of choice that depends, among other things, on unobserved individual ability (see Card, 1999).

The measurement of years of schooling in our data is clearly exposed to error because we lack information on completed years and observe only the last completed degree. Individuals with the same completed degree, however, could have spent a significantly different number of years in education. One reason is repetition by students being failed. Another reason, especially relevant among college students, is that enrolment can continue even after the prescribed duration of the course. In practice, many students in Italy take a few years longer than the required minimum to complete a degree. Last but not least, dropouts have typically spent time in education without completing a degree.

One way to deal with measurement errors and the endogeneity of education is to estimate [2] by instrumental variables. The identification of valid instruments is a thriving industry, that has been recently reviewed, among others, by Card, 1999 and Ashenfelter, Harmon and Oosterbeek, 1999. The requirements for an instrument to be valid are that it should be correlated with educational choice but not correlated with log wages conditional on schooling. A class of candidates used in the literature is given by quasi-natural experiments associated to policy interventions and reforms of the educational

system. Examples in this literature include the compulsory schooling laws discussed by Angrist and Krueger (1991) and Harmon and Walker (1995).

An important reform in the Italian context is Law 910 of December 1969, that extended the possibility of enrolment in college to individuals with completed secondary education, independently of the track (general or vocational) chosen in secondary school. Since expected age of completion of secondary school is in general 18-19 years, this opportunity was mainly open to cohorts born from 1951 onwards.

We capture this educational reform with the dummy *REFORM*, equal to 1 for individuals born from 1951 onwards and to 0 otherwise. A rough indication of the impact of the reform can be obtained by comparing the percentage of 19 years old individuals enrolling in college shortly before and shortly after the reform. It turns out that enrolment rates were 16.3% of the relevant population for individuals born in 1949 and 27.3% for those born in 1952. On the other hand, the percentage of high school graduates enrolling in college was 54% for the 1949 cohort and 66% for the 1952 cohort. Higher enrolment in college after the reform, however, had a rather limited impact on the percentage of college graduates in the population at theoretical age of graduation, partly because the percentage of irregular students (*fuori corso*), who were enrolled at college longer than the number of years required to complete the curriculum, increased sharply for the cohorts enrolling since the early 70s. Hence, the increase in the number of college students was accompanied by a reduction in the efficiency of the college system and by an increase in the average time required to complete the degree.

When we compare educational attainment of individuals in our sample born before and after 1951, we find that the percentage of college graduates increased only marginally, at least compared to the consistent increase in the percentage of individuals graduating from junior and upper secondary schools. This suggests that the dummy *REFORM* picks up both the exogenous reform of December 1969 and the general increase in the level of schooling achieved by the population who went to school during the economic boom of the late 50s and later.

An additional potential instrument is a measure of individual risk aversion. To illustrate its relevance for the schooling decision, consider the following extension of the human capital model discussed by Card, 1995. Let individual utility be

$$U_i = \frac{\left(S^{\lambda}\right)^{1-\alpha}}{1-\alpha} - \phi(S) \qquad [7]$$

where λ is a parameter, ϕ is the disutility attached to investment in schooling and α is the Arrow-Pratt measure of relative risk aversion. When the individual maximise her utility, the optimal choice of schooling is given by

$$\ln\lambda + \left[\lambda(1-\alpha)-1\right]\ln S = \beta + \gamma \ln S \qquad [8]$$

where we have assumed that $\ln\phi = \beta + \gamma \ln S$. The left hand side of [8] is the marginal return to schooling, that we assume to be decreasing in schooling attainment. An increase in the measure of relative risk aversion α reduces the (expected) returns to education, thus reducing the selected years of school.

For this instrument to be valid we also require that it does not affect hourly wages conditional on education. This requirement is not fulfilled if individuals who share the same educational attainment choose occupations that offer different hourly wages because their degrees of risk aversion vary. Our measure of risk aversion is based on a specific question included in the 1995 wave of *SHIW*, that asks how much the interviewed household head is willing to invest to participate to a lottery offering a fixed premium in the event of success and the loss of the invested capital in the event of failure. This variable (*BET*) has two drawbacks. First, there are many missing values. Second, it measures the current degree of risk aversion rather than risk aversion at the time of the educational investment.

Finally, we also consider family background and in particular the educational attainment of parents. More educated parents are likely to fill better jobs, to value education more and to provide to their children a more favourable

environment for the development of individual abilities and skills (Heckman, 1999). Hence, family background affects both the marginal returns to schooling, by influencing individual ability, and the marginal costs of schooling, by affecting available resources in the household. Table 7 is drawn from SHIW data and shows the correlation between parental education and individual education (see Checchi, Ichino and Rustichini, 1999 for a detailed discussion of these issues).

Table 7: Individual education and parental education. 1995

a) Males

Father education	No-school	Elementary	Junior high	High school	Tertiary
No-school	2,2	30,4	36,26	28,58	2,56
Elementary	0,36	10,43	32,55	47,59	9,07
Junior high	0	1,8	15,94	65,29	16,97
High school	0	0	8,06	60,8	31,14
Tertiary	0	0	2,33	33,72	63,95
Mother education					
No-school	3,04	26,44	37,99	30,4	2,13
Elementary	0,08	9,52	28,55	51,16	10,69
Junior high	0,26	0,52	16,01	62,73	20,48
High school	0	0	6,42	48,13	45,45
Tertiary	0	0	3,23	45,16	51,61

b) Females

Father education	No-school	Elementary	Junior high	High school	Tertiary
No-school	4,17	34,28	41,13	18,48	1,94
Elementary	0,23	11,95	42,77	39,46	5,59
Junior high	0	2,07	28,81	57,44	11,68
High school	0	0,8	11,95	58,96	28,29
Tertiary	0	1,49	1,49	49,25	47,77
Mother education					
No-school	3,46	31,06	42,96	20,67	1,85
Elementary	0,16	10,06	41,07	42,31	6,4
Junior high	0	1,77	25,94	56,98	15,31
High school	0	1,05	10,53	54,74	33,68
Tertiary	0	0	4	40	56

The selection of family background variables as instruments of educational attainment has also some potential drawbacks. First, the individual interviewed in *SHIW* is asked to recall both the highest educational level and the occupation held by his parents when they had his/her current age. Beside the obvious measurement issues, it is not clear whether information based on the same age as the respondent is always the most relevant. Second, and

perhaps more important, family characteristics could affect the returns to education, conditional on education, thus failing to satisfy the necessary condition for instruments validity. Our selected instruments are dummies for father's education, mother's education, whether the mother is working, whether the father is a blue collar and whether he is self-employed.

Our empirical strategy can be described as follows. First, we consider only male household heads, because of the availability of the variable *BET*, and experiment with two sets of instruments, a restricted set including only *REFORM* and *BET*, and an enlarged set that includes also family background variables. Next, we consider the full sample of males and females and use as instruments the dummy *REFORM* as well as family background variables.

In all these experiments, we test instrument validity by computing the Sargan test[13]. This test verifies whether the instruments play a direct role in explaining log wages, not just an indirect role, through predicting educational attainment. If the test fails, one or more of the instruments are invalid and ought to be included in the explanation of log wages (Deaton, 1999). An important requirement is also that the selected instruments should be correlated with the endogenous variable. We test this by computing the F-statistic on the excluded instruments in the reduced form schooling equation, as suggested by Bound et al. (1995).

Table 8 presents the results of the regression of education attainment on the set of instruments. While higher parental education increases years of schooling, having a father with a blue collar job or self employed reduces attainment. As expected, both a lower degree of risk aversion and the dummy capturing the 1969 reform increase years of schooling.

Our IV estimates for the sub-sample of male household heads are presented in Table 9. Notice that the Bound test always rejects the null hypothesis of no correlation between education and additional instruments. Moreover, the Sargan test never rejects the null hypothesis of no mis-specification. When we use only *BET* and *REFORM* to instrument education,

[13] The Sargan test is an over-identification test for instruments validity with an asymptotic χ^2 distribution and degrees of freedom equal to the number of over-identifying restrictions.

the estimated returns to education increases by about 10 percent with respect to the OLS estimate.

Table 8: Auxiliary regression of years of schooling on the set of instruments. Male household heads only. Year: 1995

	OLS
Age	-0.011 (0.081)
Age squared	0.0005 (0.001)
Reform	0.550 (0.275)
Bet	0.341 (0.164)
Father education	0.230 (0.030)
Mother education	0.212 (0.032)
Mother not working	-0.017 (0.164)
Blue collar Father	-1.393 (0.213)
Self employed father	-0.790 (0.230)
R Squared	0.25

Notes: Standard errors in parenthesis.

Table 9: OLS and IV estimates of returns to education (years of schooling). Males household heads only. Year: 1995

	OLS	IV (1)	IV (2)
Schooling	0.048 (0.002)	0.053 (0.021)	0.061 (0.004)
Age	0.038 (0.007)	0.039 (0.008)	0.041 (0.007)
Age squared	-0.0003 (0.00003)	-.00003 (0.00009)	-0.0003 (0.00009)
F-test on instruments (P-value)	-	0.000	0.000
Sargan test (P-value)	-	0.616 [1]	0.706 [6]
N	1801	1801	1801
R2	0.30	0.30	0.30

Notes: degrees of freedom in brackets. Instruments for schooling in IV (1): REFORM, BET; in IV (2): REFORM, BET mother and father education (in year), mother not employed, father blue collar, father self-employed.

The inclusion of family background dummies further increases the estimated returns to schooling by approximately an additional 20 percent. Clearly, these findings suggest that family background variables affect the subgroup of individuals with higher marginal returns to schooling (see Card, 1995; Ichino, Winter-Ebmer, 1999).

Next, consider the full sample of males and females. In this case, we cannot use the instrument *BET*, that is available only for household heads. The estimates in columns (1) and (2) of Table 10 present our results. We confirm for this larger sample the finding that the estimated returns to education are significantly larger with IV than with OLS.

Table 10: IV estimates of returns to education (year of schooling). Year: 1995.

	Males (1)	**Females (2)**
Schooling	0.059 (0.003)	0.077 (0.004)
Age	0.062 (0.003)	0.045 (0.006)
Age squared	-0.0005 (0.00004)	-0.0003 (0.00007)
Part-time	-	-0.0001 (0.025)
F-test on instruments (P-value)	0.000	0.000
Sargan test (P-value)	0.100 [5]	0.148 [5]
N	3149	2085
R2	0.39	0.37

Notes: see Table 9. Instruments used: REFORM, mother's and father's education (in years), mother not employed, father blue collar, father self-employed

7. Educational Choices and the Returns to Different Types of Schools

The accumulation of human capital is not necessarily a smooth, linear and (almost) continuous process and returns need not to be the same - for any given number of years - across different types of school. In some schooling systems – including the Italian one – additional investment in education that does not lead to the award of a degree might not grant additional labour market returns. Similarly, as suggested by the 'credentialism' hypothesis, in the presence of heterogeneity what really matters is the type of school rather than the overall number of years spent in formal education[14].

We investigate these issues by using educational dummies rather than years of schooling in our earnings regressions. In particular, we first look at education achievements by broad levels: primary, junior high, high school and tertiary education. Second, we address the issue of "credentialism" by distinguishing among types of school (for instance, vocational or general, scientific or humanistic) within each educational level.

Results of both OLS and IV estimates that use educational dummies rather than years of schooling are reported in Table 11[15]. The estimated coefficients of the educational dummies reported in the table should be interpreted as differentials with respect to the baseline return accruing to individuals with no school or with only primary school. For example, a male employee with a high school degree earns, on average, 37 percent more than a male employee of

[14] In principle, both the information on the 'actual' number of years spent in school as well as the (minimum) 'standard' number of years necessary to obtain a certain type of degree achieved would be desirable, because many students, in Italy, take more years than formally stated to complete their studies (i.e. when they fail, they have to repeat a year). The difference between the two measures would be an (indirect) indicator of both student 'quality', as well as of school selectivity. Unfortunately, the 'actual' number of years spent in school is not available in the SHIW dataset.

[15] The IV estimates are based on the two step methodology proposed by Gregory and Vella,1997: in the first step, we estimate an ordered probit model for educational attainment as a function of age, age squared and the additional instruments used in Table 10. In the second step, we include the score associated to the ordered probit in the earnings equation.

the same age belonging to the reference group. This differential increases to 52 percent when we use instrumental variables. This pattern of estimated returns by educational level confirms that there is a monotonic (positive) relationship that links returns to education to the highest level of education attained.

Table 11: Returns to Education using Educational Dummies (OLS and IV Estimates). 1995

	Males		Females	
	(OLS)	***(IV)***	***(OLS)***	***(IV)***
Junior High	0.207	0.288	0.187	0.239
	(0.016)	(0.022)	(0.033)	(0.037)
High School	0.376	0.516	0.451	0.576
	(0.017)	(0.031)	(0.032)	(0.044)
Tertiary Education	0.656	0.861	0.782	0.975
	(0.026)	(0.047)	(0.037)	(0.064)
Score	-	-0.066	-	-0.070
		(0.013)		(0.017)
Age	0.064	0.062	0.047	0.043
	(0.003)	(0.003)	(0.005)	(0.006)
Age^2	-0.0005	-0.0005	-0.0003	-0.0003
	(0.00004)	(0.00004)	(0.00007)	(0.00007)
R^2(adj)	0.40	0.40	0.38	0.38
N. obs	3385	3149	2085	2085

Note: Excluded dummy: primary school. The score is based on an ordered probit model of educational attainment.

We further pursue the issue of "credentialism" by using a larger set of dummy variables, which allows us to distinguish not only among school levels but also among different types of secondary and tertiary education. The interpretation of the estimated coefficients is in terms of the additional return that the combination of educational level plus school type grants to the individual with respect to the reference category (compulsory schooling in our case). Our main set of results (OLS estimates) are reported in Table 12. The returns to formal education are estimated both with hourly and with monthly wages. The reason for considering also monthly earnings is that, particularly in

the public sector and among highly educated females, weekly hours worked can be very low[16].

Table 12: Returns to Different Types of School (Year 1995).

Type of school	Hourly wage				Monthly wage			
	Males		*Females*		*Males*		*Females*	
Vocational School	**0.14**	**(0.021)**	**0.20**	**(0.031)**	**0.13**	**(0.020**	**0.18**	**(0.028)**
High-school	**0.23**	**(0.012)**	**0.32**	**(0.017)**	**0.19**	**(0.011)**	**0.22**	**(0.015)**
Vocational	0.15	(0.031)	0.24	(0.037)	0.12	(0.019)	0.25	(0.032)
Technical (1)	0.24	(0.013)	0.25	(0.023)	0.13	(0.028)	0.22	(0.020)
Licei (2)	0.24	(0.030)	0.31	(0.040)	0.20	(0.012)	0.27	(0.035)
Liceo Artistico (3)	0.36	(0.067)	0.31	(0.076)	0.15	(0.061)	0.21	(0.067)
Teacher College (4)	0.33	(0.055)	0.43	(0.023)	0.13	(0.051)	0.21	(0.021)
Other	0.21	(0.067)	0.24	(0.073)	0.11	(0.061)	0.12	(0.065)
Short term tertiary	**0.35**	**(0.071)**	**0.47**	**(0.077)**	**0.20**	**(0.066)**	**0.22**	**(0.069)**
Medicine	0.44	(0.228)	0.76	(0.185)	0.35	(0.208)	0.54	(0.163)
Economics and statistics	0.42	(0.228)	-	-	0.34	(0.208)	-	-
Political science	0.35	(0.228)	0.13	(0.213)	0.31	(0.208)	0.17	(0.189)
Humanities	-	-	0.19	(0.369)	-	-	0.22	(0.327)
Other	0.33	(0.086)	0.49	(0.096)	0.18	(0.079)	0.15	(0.085)
Tertiary	**0.50**	**(0.021)**	**0.65**	**(0.025)**	**0.27**	**(0.019)**	**0.26**	**(0.022)**
Mathematics	0.52	(0.048)	0.66	(0.050)	0.21	(0.043)	0.30	(0.044)
Agriculture, Veterinary	0.32	(0.102)	0.63	(0.369)	0.21	(0.093)	0.57	(0.327)
Medicine	0.60	(0.097)	0.75	(0.165)	0.61	(0.089)	0.60	(0.146)
Engineering	0.44	(0.045)	0.80	(0.261)	0.28	(0.041)	0.85	(0.231)
Architecture	0.47	(0.131)	0.70	(0.213)	0.18	(0.120)	0.22	(0.189)
Economics and Statistics	0.45	(0.050)	0.60	(0.099)	0.39	(0.046)	0.30	(0.088)
Political science	0.33	(0.102)	0.57	(0.140)	0.15	(0.093)	0.45	(0.124)
Law	0.65	(0.074)	0.56	(0.088)	0.57	(0.068)	0.26	(0.077)
Humanities	0.62	(0.045)	0.67	(0.031)	0.14	(0.042)	0.25	(0.027)
Others	0.55	(0.078)	0.50	(0.083)	0.13	(0.069)	0.11	(0.079)

Note: Standard errors in parentheses. (1)Technical high school diploma;(2) Italian secondary school specialising in classical, scientific or foreign languages studies. (3) Italian secondary school specialising in art subjects.(4) Teacher training college.

We find that returns to different levels of schooling are in general higher for females than for males and increase with the number of years spent in education. Focusing on upper secondary education and on hourly earnings, there is evidence of significant variation in the returns from different school types. This variation is substantially reduced when we use monthly earnings. Short term tertiary and tertiary education yield much higher returns than upper secondary school. Among tertiary degrees, medicine, that requires more years of schooling, leads to higher returns in terms both of hourly and of monthly wages. A part from medicine, it is often the case that the very high returns

[16] In particular, 87 percent of employed females with a university degree (versus 64 percent of males) work in the public sector. Among them, 80 percent (versus 61 percent for males) are school teachers.

measured on the basis of hourly wages are significantly reduced when we use monthly earnings. This is especially true of degrees in the Humanities. Finally, we notice that traditionally male dominated degrees, such as engineering, yield to females the highest returns. The reverse does not appear to be true for males who graduate in female dominated areas (such as the Humanities).

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8. Interactions with Potential Experience

When education and training are complements, we expect that individuals with higher education either invest more in human capital after labour market entry or are allocated to jobs that have more elaborated career ladders. This complementarity between accumulation of human capital at school and in the labour market can be captured by adding to [1] an interaction term involving schooling S and potential experience X. More generally, equation [1] can be re-written as

$$lnw_{it} = \alpha + \beta S_i + \gamma_1 X_{it} + \gamma_2 X_{it}^2 + \gamma_3 D_i X_{tt} + \varepsilon_{it} \qquad [9]$$

where *D* is a vector of variables, including years of schooling, that are interacted with potential experience.

Investment in human capital could vary by gender, because female labour is more likely to be allocated to jobs with more limited career prospects. In this case, the interaction of experience with a gender dummy should attract a significant coefficient. Moreover, individuals who have experienced at least one unemployment spell could end up in jobs with limited career opportunities and/or could lose at least in part their ability to accumulate human capital. To test this, we interact potential experience with the dummy *SPELL*, equal to 1 if the interviewed individual has experienced at least one unemployment spell in his/her labour market history.

Last but not least, individuals with the same educational level could differ in the time they enter the labour market after completing their schooling career. One reason is that some individuals drop out of a course without completing it. Compared to individuals with the same education, dropping out is equivalent to delaying labour market entry. Another reason is job search or exit from the labour force. We measure the difference between the time of labour market entry and the time of expected graduation from the selected educational level with the variable *DUR* and interact this variable with potential experience.

Since we are only interested in estimating the vector of parameters y_3 , we use the longitudinal section of the SHIW data for the years 1991, 1993 and 1995 and take first differences of [9]. This is equivalent to estimating

$$\Delta ln(w_{it}) = \lambda_1 + \lambda_2 X_{it} + \gamma_3 D_i + \Delta\varepsilon_{it} \qquad [10]$$

on a panel of 1268 male individuals, with 2 observations per individual.

Our results are presented in Table 13. Since the schooling coefficient is significant and positive, we find evidence of complementarity between education and human capital accumulation in the labour market. We also find that the log wage profile is steeper for males than for females. Interestingly, there is evidence that both the experience of at least one unemployment spell

and delayed labour market entry reduce the slope of the wage experience profile.

Table 13. Earnings growth. Panel 1991-1995

	OLS
Potential Experience	0.007 (.0007)
Schooling	0.021 (.002)
Gender	0.070 (.014)
Spell	-0.036 (.002)
Dur	-0.067 (.021)
Nobs	2534
R Squared	0.09

Standard errors in parentheses.

9. Labour Market Choices and Returns to Education: Evidence from Selected Groups

Besides differences in the returns to education arising from observed and unobserved characteristics, another source of differences across individuals is associated to their labour market choices, that might not be independent of their educational attainment.[17]. An important issue addressed in this section deals with the endogenous distribution of individuals - and their

[17] It is fair to note that, at least in the long run, unexplained differentials in returns ought to be eliminated by the working of market forces, and that the differences which persist should depend only on productivity differentials. However, given the time required to eliminate the unbalances between supply and demand for any given group of individuals, differences in returns may well persist over time. Furthermore, it should be stressed that other factors - irrespective of productivity - may introduce differences in returns to education, such as: preferences, taste for discrimination, market segmentation and other factors originating from imperfect information and non competitive forces.

related characteristics - across groups. Most often choices made in the labour market are not independent from individual characteristics and (*ex-post*) group composition cannot be taken as randomly assigned. In this context an appropriate methodology should be used to control for the presence of non random sampling across groups and for the existence of selectivity bias.

Hereafter, we investigate the returns to education for different groups of individuals based on their labour market choices. In particular, we focus on whether they work full-time or part-time, whether they are employed in the public or in the private sector and finally whether they reside in a developed high-wage region or in a relatively underdeveloped low-wage region[18].

9.1. Women and Part-time Work

In section 3 we have estimated the returns to education of female employees by using a sample of full-time and part-time females and by introducing a part-time dummy to control for differences in hourly wages. Our estimates there suggest that female part-timers earn a lower hourly wage than females working full time (the hourly wage is 4.4 percent lower on average). There are, however, at least two difficulties with the above approach. First, female participation to the labour market is non-random as women select themselves into working based on the wage they expect to earn[19]. Second, when the participation choice is made, the decision to work part-time or to work full-time is also taken. To deal with selectivity, we look both at the decision to participate and at the choice between not participating, working full-time and working part-time. In the former case we use a probit equation as in the conventional two step approach *à la* Heckman (1979). In the latter case - to account for the multiple choices made - we replace the simple probit model with an ordered probit as in Ermisch and Wright (1993)[20]. In practice, endogenous selectivity is treated by estimating an auxiliary probit (simple or ordered)

[18] Another example, not discussed in this chapter, is allocation of employees to different firm sizes (see Brunello and Colussi, 1998).
[19] Non working females - who supply zero hours - might choose not to work because the market wage is lower than their reservation wage.
[20] In the first stage of the ordered probit we assign the value 0 to non participation, 1 to part-time work and 2 to full-time employment.

equation where family background characteristics and unearned income are used as identifying variables.

The first column of Table 14 reports the estimates based on correcting both for endogenous labour market participation choices[21] and for endogenous education, using the instruments discussed in Section 6. Results show that selectivity bias is a relevant issue. The coefficient associated to the inverse Mills-ratio is positive and statistically significant, suggesting that females who have actually chosen to participate in the labour market earn higher wages than randomly assigned females. Interestingly, the estimated returns to schooling marginally increase after correcting for selectivity.

Table 14: Returns to Education with Endogenous Selection. Females 1995.

	IV	
	Heckman	***Ermisch & Wright***
	(1)	***(2)***
Education	0.072	0.082
	(0.005)	(0.007)
Age	0.061	0.061
	(0.007)	(0.007)
Age^2	-0.0005	-0.0005
	(0.00009)	(0.00009)
Part-time dummy	-0.115	-0.341
	(0.026)	(0.089)
Selectivity term (λ)	0.105	0.217
	(0.039)	(0.058)

Note: Figures in parentheses are standard errors.

Notice that the coefficient associated to the inverse Mills ratio is a positive function of the covariance of the error terms in the earnings and in the selection equation. A positive coefficient implies that a shock to the selection equation that increases female labour market participation also increases conditional log earnings. This suggests that observed combinations of earnings and participation are traced out by labour demand shocks.

[21] Although the model could be identified parametrically by functional form (assuming normality), we also impose additional exclusion restrictions (i.e. family background and unearned income) which are assumed to determine labour market participation but not wages.

The second column in the table reports the estimates based on correcting also for the decision to work part-time. Here too we find that selectivity effects are statistically significant and attract a positive sign. Therefore, females who have chosen to be employed full time earn higher hourly wages than randomly assigned females. It also turns out that controlling for the (endogenous) decision both to participate and to work full-time increases the estimated returns to schooling by approximately 13 percent with respect to simply correcting for participation decisions (column 2 versus column 1 in table 14).

9.2. Public versus Private Sector

In most industrialised countries the public sector plays a relevant role in the economy. In some countries - Italy is one of them - the share of the public sector in total employment is over 20 percent and the State is the largest employer of highly educated people (teachers, doctors, scientists, etc.). Moreover, the rules that govern pay determination in the public sector are significantly different from those prevailing in the private sector. Therefore, not only individual characteristics (i.e. education) but also the rewards to these characteristics are likely to vary across the private and public sectors. Needless to say, the allocation of individuals to the private and the public sector cannot be taken as randomly distributed: both observed (education, gender, etc.) and unobserved individual characteristics (risk aversion, motivation, etc.) influence the distribution of employment across sectors.

We estimate the returns to education in the public and the private sector separately for males and females working full time. To account for endogenous selectivity, we estimate an auxiliary probit equation that relates this allocation to educational attainment, a polynomial in age and two dummies, that capture whether the father and the mother of the individual were employed in the public sector. The endogeneity of education is handled by using two stages least squares, that is by replacing education with the predicted value from a

regression on the full set of available instruments, as discussed in detail in Section 6 of this chapter. The final estimate is based on the Heckman two-step procedure.

The results are in Table 15. We find that, while the returns to education are higher for females than for males in either sector, the returns to age are higher for males. Both returns to education and to age are higher in the private sector, independently of gender. Lower expected returns to education and age in the public sector are consistent with an equilibrium allocation of individuals to sectors if the public sector provides additional returns that are not captured by these regressions. Obvious candidates are higher job protection, lower effort and substantially more favourable pension benefits (see Brunello and Rizzi, 1993 for a more detailed discussion).

Table 15: Returns to Education in the Public and Private Sectors.

	IV+Heckman			
	Private		***Public***	
	Males	*Females*	*Males*	*Females*
Education	0.050 (0.004)	0.059 (0.011)	0.043 (0.005)	0.52 (0.010)
Age	0.049 (0.004)	0.039 (0.014)	0.049 (0.005)	0.029 (0.014)
Age^2	-0.0004 (0.00006)	-0.0003 (0.0001)	-0.0004 (0.00007)	-0.0001 (0,0001)
Selectivity term	0.176 (0.023)	-0.029 (0.098)	0.027 (0.050)	-0.011 (0.101)
Nobs	2110	839	1007	958

Note: Figures in parentheses are standard errors.

9.3. Regional Imbalances and the Returns to Education across Areas

As described in an earlier section, formal education in Italy has always been organised at the national level. Moreover, a substantial redistribution of resources has taken place during the post-war period from the wealthier areas in the North towards the less developed Southern regions (Bodo and Sestito,

1991). Despite these features, school quality and the state of the labour market show significant differences at the local level. In particular, unemployment rates - coupled with a substantial immobility of the resident population (regional out/inflows are less than 1 percent of the regional population) - are very different across regions, being higher in the South than in the North. Although the working of the market ought to equalise economic returns across regions, these imbalances make it interesting to explore whether important regional differences also exist in the returns to education. We check this by using two different approaches. First, we look at differences in returns across regions in Italy both by interacting education with (macro) regional dummies and by running separate regressions by region. Second, since the region of residence in unlikely to be randomly distributed across individuals, we control for the endogenous choice of the region of residence by using the standard two step Heckman procedure.

The main results from the first approach are reported in Table 16. The pattern of returns to education resulting from regional interaction terms as well as from separate regressions confirm the existence of different returns across areas. As expected, the main differences are between Northern and Southern regions. Interestingly, we find that education attracts a higher premium in the South, especially for female employees (4 and 5 percent in the North for males and females respectively, compared to 5 and 8 percent in the South).

Table 16: Returns to Education by Macro-Regions (interactions and separate equations)

	Males	Females
***Interactions*#**		
Schooling* North-east	0.042 (0.004)	0.051 (0.003)
Schooling* North-west	0.041 (0.002)	0.041 (0.006)
Schooling * Center	0.044 (0.003)	0.068 (0.004)
Schooling* South	0.053 (0.002)	0.084 (0.005)
F test	F (2,3139)=3.02	F(2,2074)=14.18
Separate Reg, Equations*		
Schooling (North-east)	0.043 (0.003)	0.050 (0.006)
Schooling (North-west)	0.039 (0.002)	0.051 (0.003)
Schooling (Center)	0.045 (0.003)	0.064 (0.004)
Schooling (South)	0.052 (0.003)	0.080 (0.006)

Note: standard errors in parentheses. # The regression includes separate regional dummies, age, age squared and a part-time dummy for females.
* Each specification also includes age , age squared and a part-time dummy for females.

This result makes sense when we realise that government employment, where most educated labour is employed, is by far more important in the South and that wage differentials between the public and the private sector are much larger in the South than in the North (see Alesina, Danninger and Rostagno, 1999). To deal with the endogenous choice of region, we run a first stage probit equation that predicts the probability of residing in the North (South) of the country as a function of a set of personal characteristics, family background and region of birth[22]. In the second stage, separate regressions are fitted for Northern and Southern regions after including the inverse Mills ratio from the probit equation. Since the information on region of birth is not available in 1995, we use the 1993 wave of *SHIW*.

Results are reported in Table 17. While the selectivity term is statistically significant in both the equations for males, it is never significant for females. Moreover, the estimated selectivity terms attracts a negative (positive) coefficient in the equation for earnings in the North (South). Therefore, shocks to the selection equation that trigger mobility flows to the North are associated to lower earnings in the North and to higher earnings in the South, as expected.

Table 17: Returns to Education by Macro-Regions, corrected for endogenous selectivity.

	IV+Heckman			
	North		***South***	
	Males	*Females*	*Males*	*Females*
Education	0.055	0.071	0.068	0.083
	(0.004)	(0.006)	(0.005)	(0.009)
Age	0.052	0.046	0.059	0.062
	(0.006)	(0.009)	(0.009)	(0.018)
Age^2	-0.0004	-0.0004	-0.0005	-0.0005
	(0.00008)	(0.0001)	(0.0001)	(0.0002)
Selectivity term	-0.036	-0.011	0.089	-0.037
	(0.016)	(0.029)	(0.033)	(0.064)
Nobs	2084	1520	1322	607

Note: standard errors in parenthesis.

[22] We deal with the endogeneity of education by using two stages least squares.

The estimates also confirm previous findings, namely that returns to education are higher for females and for residents of Southern regions.

Concluding remarks

In this chapter we have provided an update of the empirical evidence on the private returns to education in Italy. In these concluding remarks, we emphasise three results, that we believe warrant additional research. First, we have shown that, whilst returns to education in Italy (based on gross wages) are in line with the European average, educational attainment is generally much lower (particularly at secondary and tertiary levels). How can we reconcile these findings? Based on a simple human capital model - where the optimal level of schooling is given by equating the marginal return to the marginal cost of education – we have speculated that either marginal costs are steeper in Italy or that a larger share of the population involved in human capital investment faces high marginal costs in Italy than in the European average. An important implication of our results is that explanations of the lower educational attainment of the Italian labour force relative to the European average should focus more on costs than on returns.

Second, we have examined whether the estimated returns to education have varied significantly over time. The evidence is that returns have not changed much over the period 1977 to 1995, with the exception of 1993 and 1995, when they have increased significantly, especially among female employees. Quite interestingly, the observed increase in the returns to education has been almost completely driven by higher returns to education in the public sector. Assuming that skill biased technical change has been an important factor in shifting out the marginal returns to education, an important question for future research is why these shifts have only affected returns in the public sector of the economy.

Third and last, we have confirmed the usual finding in the international literature that accounting for measurement error in years of schooling and/or for

the endogeneity of educational choices by using instrumental variables significantly increases the returns to education with respect to estimates based on OLS methods. We have also shown that adding family background variables to the set of instruments significantly increases returns, which suggests that these variables affect mainly the subgroup of individuals with higher marginal returns to schooling.

While we have tried to cover many issues, important aspects of the relationship between education and earnings have not been considered. To mention only two, we have not considered the effect of educational attainment on earnings *growth* and we have ignored unemployment as an important labour market outcome. These topics are left to future research.

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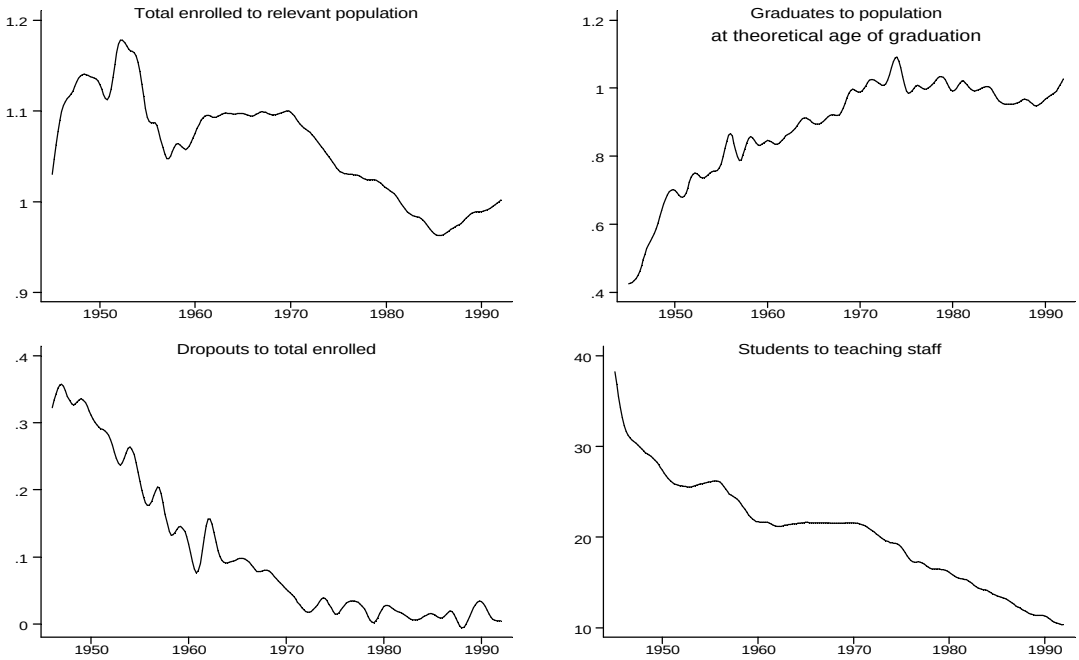


Figure 1. Elementary school 45-92

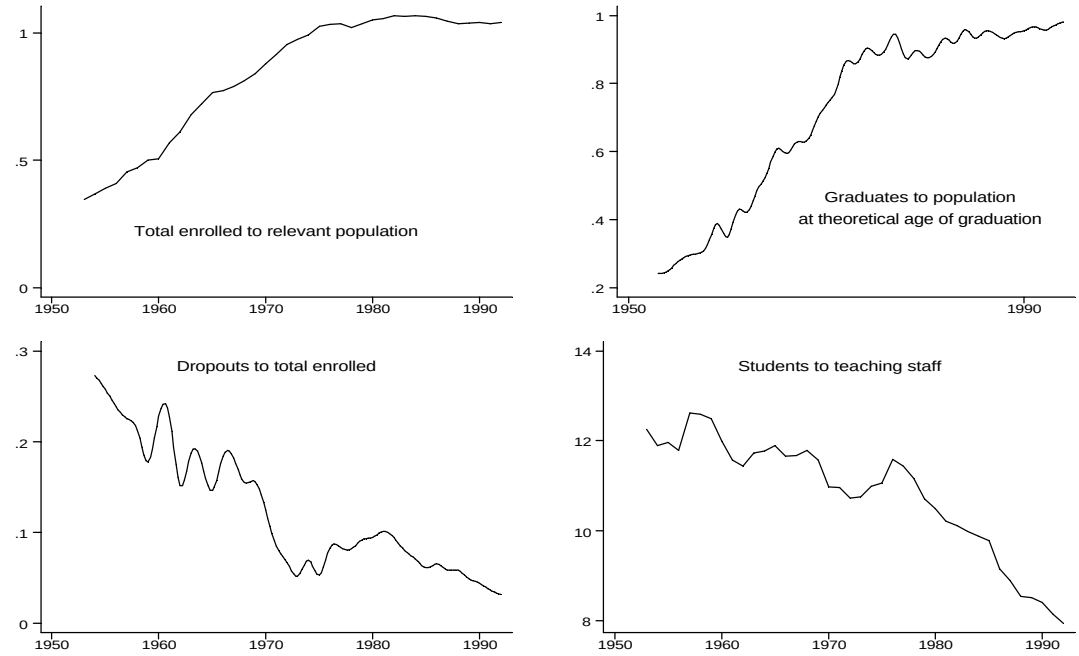


Figure 2. Junior high school 55-92

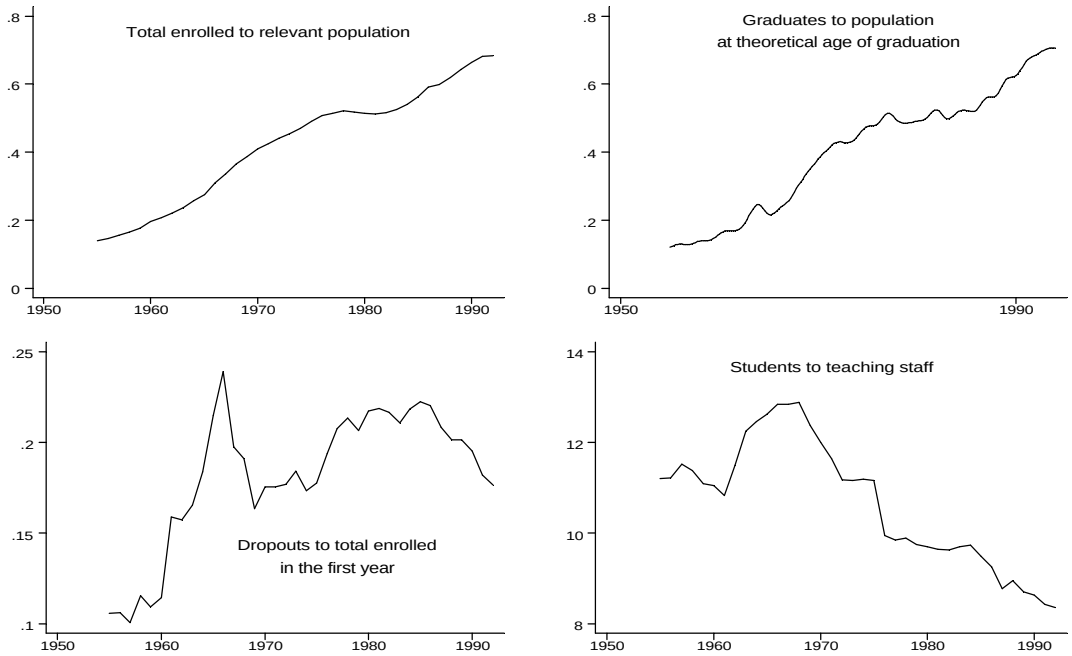


Figure 3. Secondary school 55-92

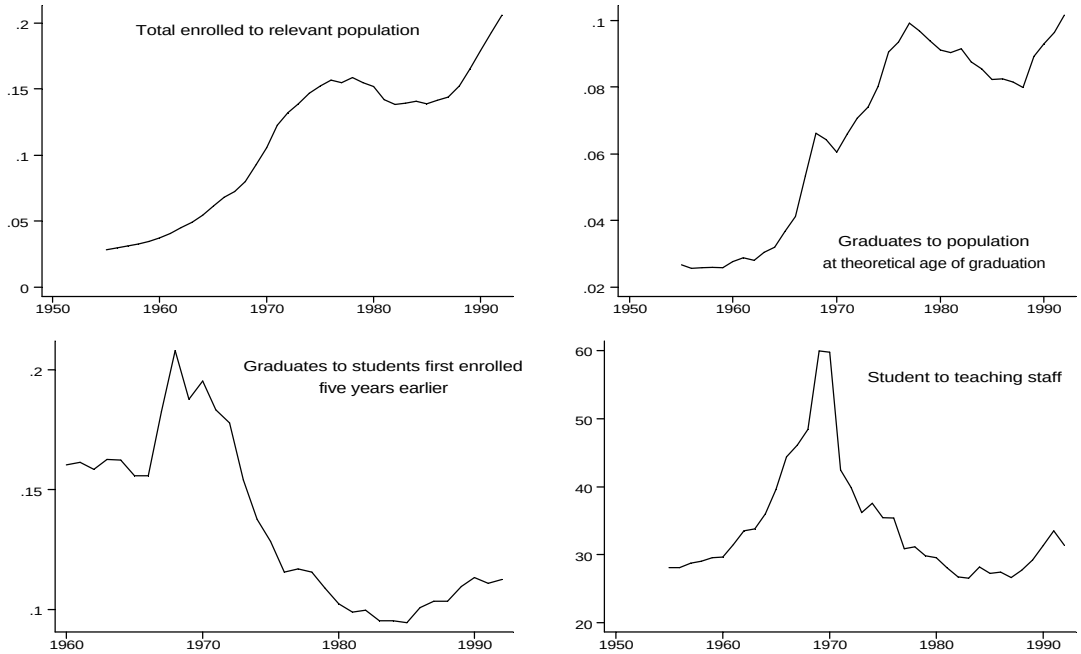


Figure 4. University 1955-92

Figure 5. Returns to education over time. With confidence intervals

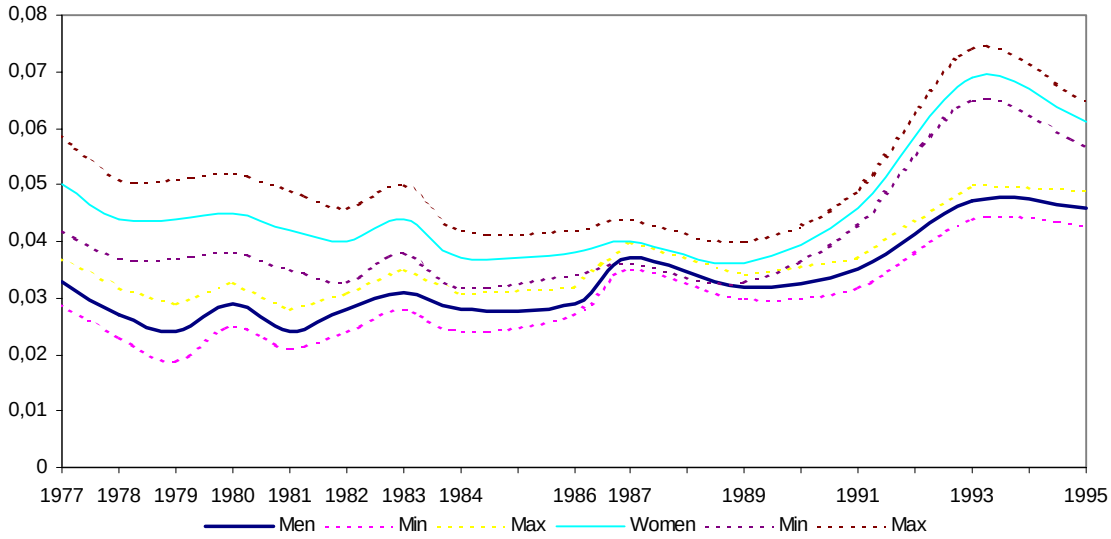


Figure 6. Returns to education over time. Private and public sectors. Males only

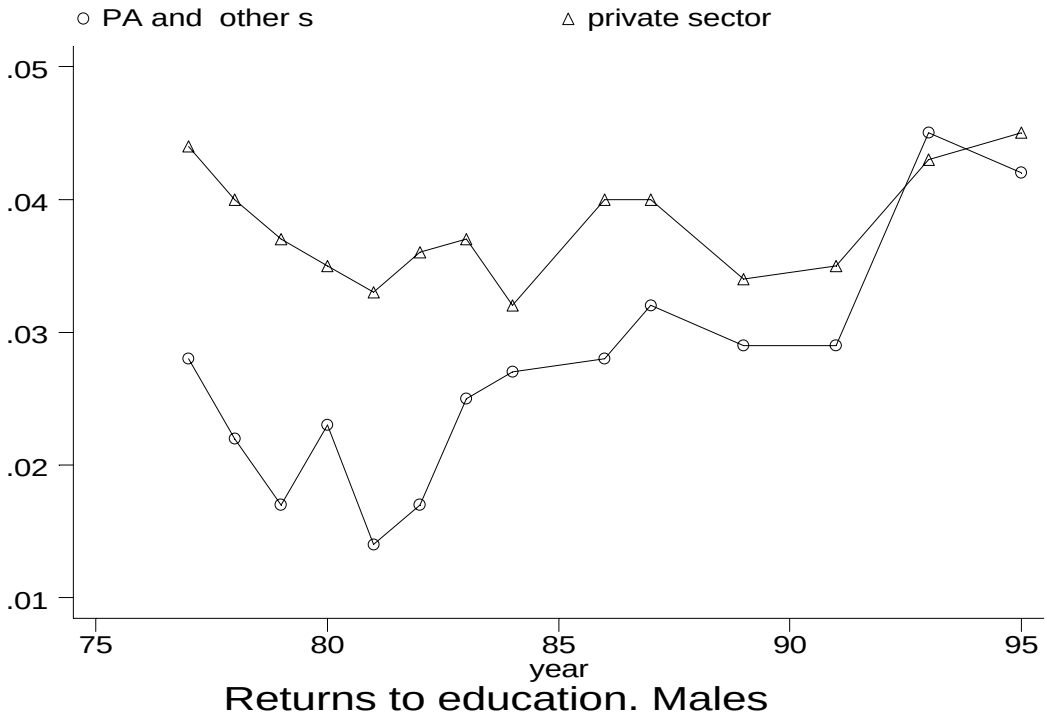


Figure 7. Returns to education over time. Private and public sectors. Females only.

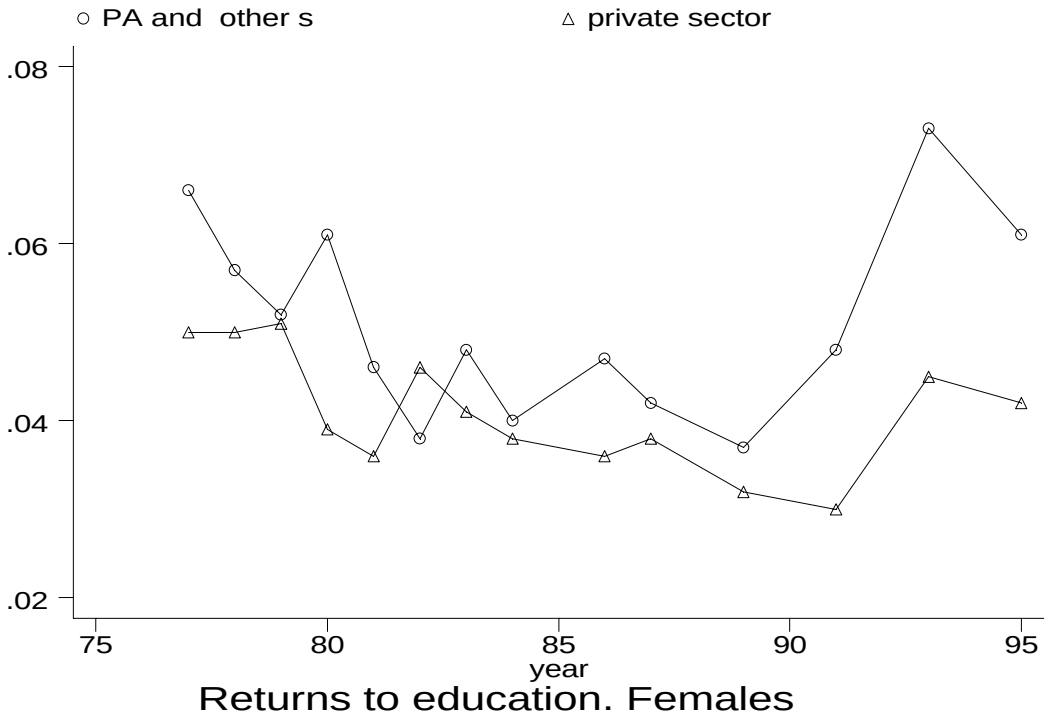


Figure 8. Returns to education over time. Industry

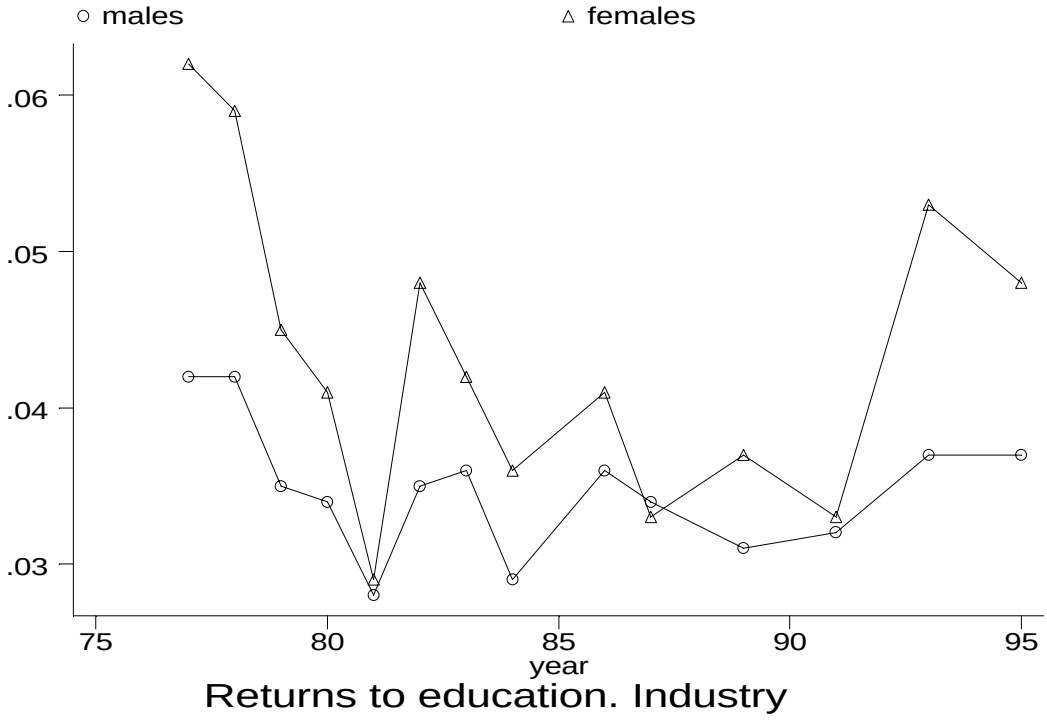


Figure 9. Returns to education over time. Distribution

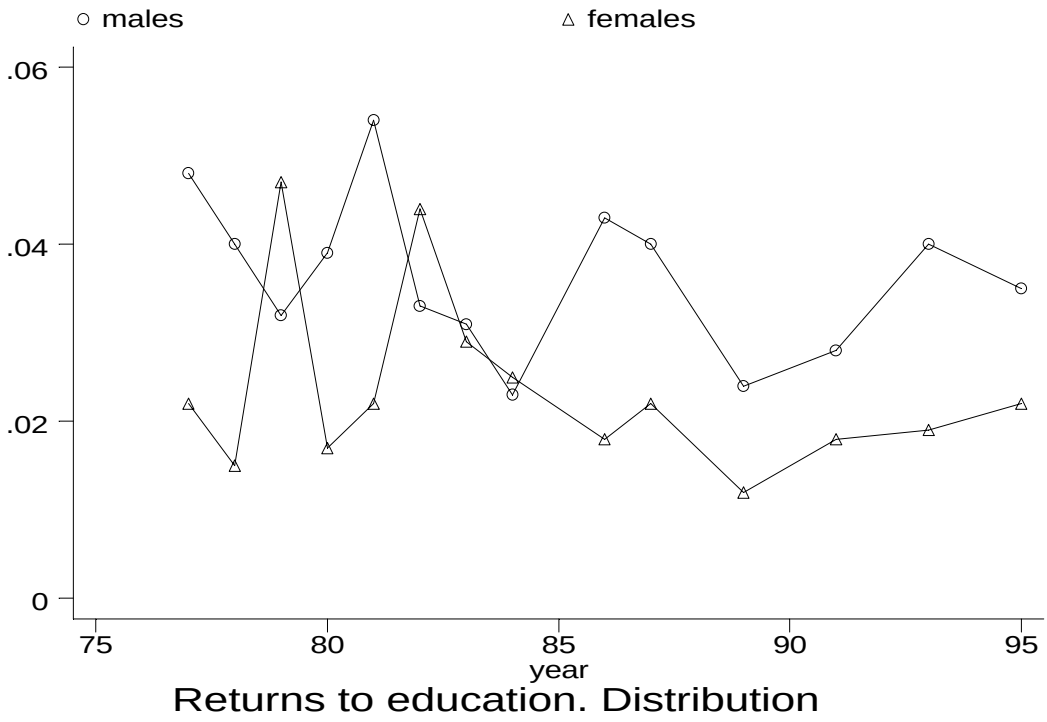


Figure 10. Returns to education over time. Utilities

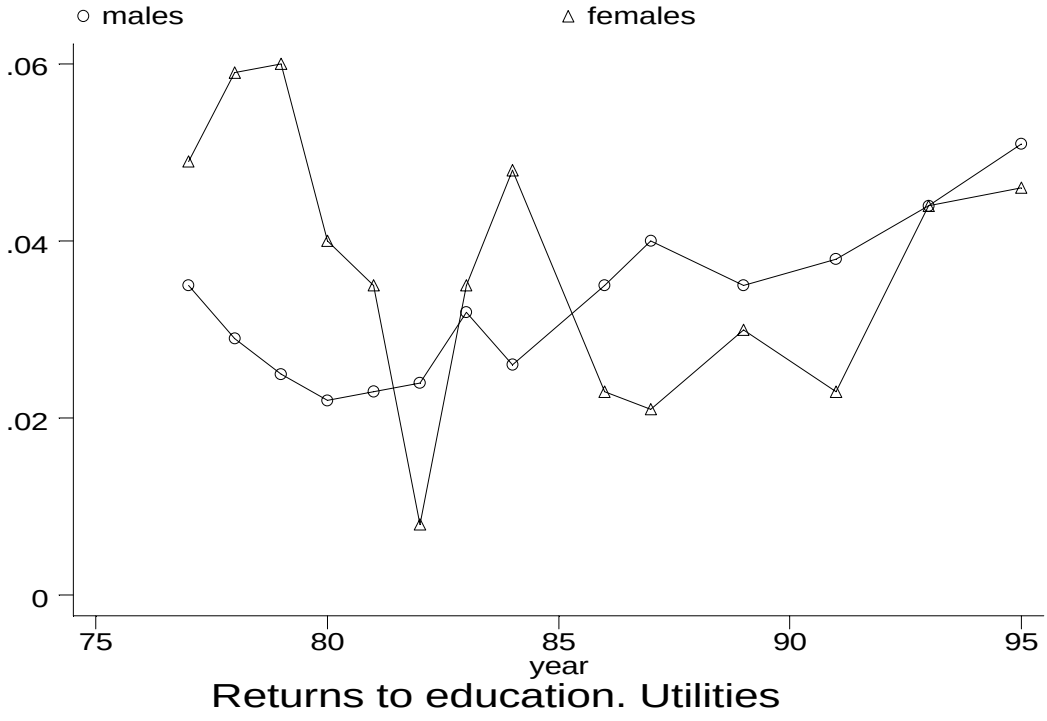
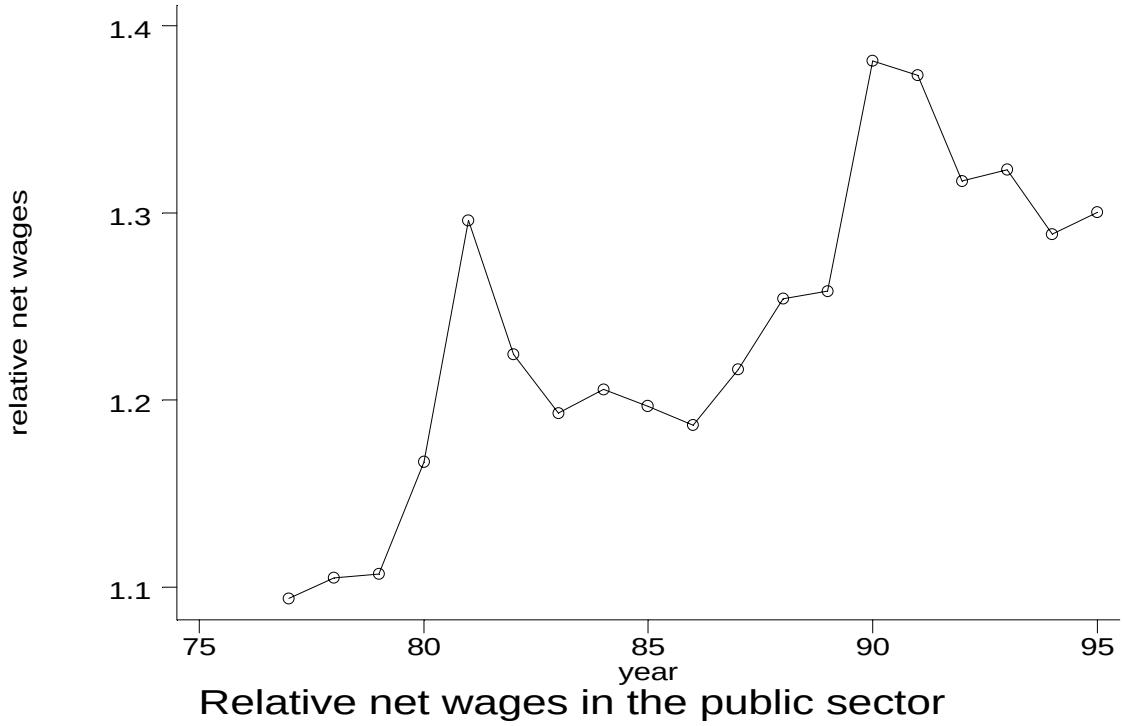


Figure 11. Relative net wages in the public sector.



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