E C O N O M I C S B U L L E T I N

Educational Performance as Signalling Device: Evidence from Italy

Carolina Castagnetti
University of Pavia

Francesco Chelli
University Politecnica delle Marche

Luisa Rosti
University of Pavia

Abstract

Following Brown and Sessions (1999) we apply the comparative techniques originated by Wolpin (1977) and Psacharopoulos (1979) to discriminate between the weak and strong screening hypotheses. Our data provides additional empirical results for the Italian labour market shifting the focus of the relationship between education and wages from the highest level of education completed to more specific measurements like degree score and completion speed. Our results show that the strong screening hypothesis is strengthened, i. e. that educational performance has an insignificant return for the self−employed, but a significantly positive return for employees.

We acknowledge Nicola Martinelli, for helpfull suggestions.
Citation: Castagnetti, Carolina, Francesco Chelli, and Luisa Rosti, (2005) "Educational Performance as Signalling Device: Evidence from Italy." *Economics Bulletin*, Vol. 9, No. 4 pp. 1−7
Submitted: July 5, 2005. **Accepted:** July 17, 2005.
URL: http://www.economicsbulletin.com/2005/volume9/EB−05I20006A.pdf

1 Introduction

The relationship between education and productivity has received enormous attention since it was formalized in both human capital (Mincer 1958; Shultz 1961; Becker 1964) and sorting models[1] (Arrow 1973; Spence 1973; Stiglitz 1975). According to the human capital theory education directly increases individual productivity by augmenting the skills of agents. According to sorting theory education acts as a filter, separating more able individuals from the less able ones. Both the more highly skilled and the more able individual achieve greater productivity and receive more pay than the less skilled and less able one.

Economic theories of education, be they of the human capital or sorting varieties, are based on the same principle: schooling is pursued to the point where its marginal private internal rate of return equals the rate of interest. Empirically, both theories predict the same result: earnings should increase with schooling.

As both human capital models and sorting models of education are based on the same principle and predict the same empirical result it could be argued that the debate as to whether education augments skills or signals innate abilities is largely redundant (Brown and Sessions 1999). Since education enhances individuals' lifetime earnings regardless of whether it signals productivity or augments it, it is a sound investment for the individual. Since intelligent individuals produce externalities by creating ideas and new ways of doing things, education as a sorting device is a good investment for society.

As a consequence, a society which allocates intelligent individuals to positions where they produce large externalities should have larger growth rates than one which places average individuals in these positions (Murphy et al. 1991). But the extent to which society can take advantage of this depends on the efficiency of the social sorting mechanism. Thus, much of the vast amount of literature on education produced in the last 25 years tests whether or not the sorting hypothesis can be empirically confirmed (Riley 2001). For example, Heywood and Wei (2004) review the empirical evidence of nearly thirty signalling tests, and conclude that virtually no generalizations can be drawn[2].

It is difficult to assess whether schooling is an institution able to reveal innate ability or not, because the effects of education which augment skills and those which select ability are not empirically distinguishable[3]. This is, however an interesting

[1] Weiss (1995) uses the term "sorting" to refer to both signalling and screening of workers: Both signalling and screening serve to sort workers according to their unobserved abilities. They differ according to who takes the initiative: if the agent - that is, the party who possesses the private information - uses signals to transmit his/her characteristics to the employer before the contract is drawn up, this is signalling; if instead it is the employer who seeks to discriminate among heterogeneous agents by offering a range of alternative contractual conditions, this is screening. The underlying hypothesis is that abilities that are correlated with schooling positively affect productivity on all jobs.

[2] However, they test the signalling hypothesis in the labor market of Hong Kong and subsequently find that education plays a signalling role.

[3] One of the main appeals of the screening hypothesis lies in the difficulty of testing it empirically (Psacharopoulos 1996).

question because whether education has a social benefit associated with an efficient sorting process depends upon educational performance being related to certain productivity enhancing abilities, i. e. if university grades and income in the marketplace measure the same individual qualities. This paper focuses on the screening role of education and tests the signalling function of grades. Test scores are the essence of the schooling signal, since employers would use the individual's educational rank to infer his position in the distribution of abilities[4] thereby improving the overall match of workers to jobs.

Educational performance is the product of the final mark and the speed at which students complete their academic career. Individuals not only pursue a course (number of years of schooling), they are also tested and get a grade when they complete their schooling. Individuals may signal their high productivity by achieving high test scores and/or successfully passing their exams at a young age[5] . Potential employers know both how much education an individual had before being tested and his score in the test, and we can assume they base wage offers on this information.

We build on the educational screening theory starting with the assumption that screening is more important in some sectors than in others, and that individuals decide to work in the screened or in the unscreened sector prior to the completion of a degree. Then we assume that individuals pursue their educational performance with their prospective employment in mind.

As long as pre-university productivity is a large component of post-university productivity, individuals who need not identify their productivity before employment have less incentive to acquire high test scores. As a consequence, for any given innate productivity, the unscreened worker will acquire lower test scores than the screened worker or, conversely, for any given educational performance, the unscreened worker will be of greater innate productivity, and thus have greater earnings than the screened worker.

Following Wolpin (1977) and Riley (1979) we compare the return to education for self-employed and salaried workers. We assume that the self-employed constitute the unscreened group since they have no need to signal innate ability to a future employer[6] . Therefore, the returns to education for the self-employed are nothing but true returns to human capital. If the screening hypothesis holds, then the signalling value is the difference between the returns to education for employees and the self-employed[7].

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[4] "If education is a signal, then the essence of the signal should be distilled in the position of an individual in the distribution of education for his cohort" (Kroch and Sjoblom, 1994 p. 156).

[5] Layard and Psacharopolous (1974) suggested that, under signalling, individuals who complete qualifications slowly send a poor ability signal to employers and therefore face lower wages. Groot and Oosterbeek (1994) suggested that accelerated qualifications provide a signal of high ability and therefore ought to be associated with higher wages.

[6] Of course, there may be others, for example, customers, who would provide the incentive for identification (Wolpin 1977).

[7] In Italy self-employment represents a clear alternative to wage and salary employment because the percentage of self-employed workers over total employed is above 27%. The data of the Statistical Office of the European Union (EUROSTAT) envisage employers, self-employed workers and family workers as being in self-employment. The share of self-employment in Italy is three times

Following Brown and Sessions (1998) we test two versions of the screening hypothesis: The strong screening hypothesis and the weak screening hypothesis[8] . The strong screening hypothesis states that schooling is merely a signal for employers of the productivity of an employee. The weak screening hypothesis on the other hand states that the primary role of schooling is to signal, but that schooling also has some inherent productivity.

The weak screening hypothesis implies a significant positive return to education for self-employed, but a significantly higher positive return for employees. The strong screening hypothesis, in contrast, implies an insignificant return to education for self-employed, but a significantly positive return for employees (Brown and Sessions 1998).

In this paper we provide additional empirical results for the Italian labour market. Our data allows to shift the focus of the relationship between education and wages from the highest level of education completed to more specific measurements like degree score and completion speed. Our results show that the strong screening hypothesis is strengthened, i. e. that educational performance has an insignificant return for the self-employed, but a significantly positive return for employees.

2 Data and Methodology

Our data are derived from the last Survey on Labor Market Transitions of University Graduates carried out in 2001 by the Italian National Institute of Statistic (ISTAT). The Survey is the result of interviewing Italians who graduated in 1998 three years after graduation. The retrospective information gathered allows analysis of both academic performances (final degree grades) and first entry into the labor market[9]. To test the screening hypothesis we restrict the sample to full-time workers. The Survey considers three work categories: employees, self-employed, and those in advisory positions. However, because in the Italian labor market, the advisors could be a subset of both employees and self-employed, we decided to rule them out from our estimating sample. Lastly, because our sample consists entirely of graduates, we have only considered individuals that needed a degree for the profession they are developing at the time of the interview[10]. Therefore we test the screening hypothesis

higher than in Denmark and in Luxembourg, and more than double the share in Germany, Netherlands, France, Austria, Finland, United Kingdom and Sweden; only Greece exceeds the Italian rate (Eurostat 2004).

[8]Psacharopoulos (1979) distinguishes between strong screening (where education does not add to individual productivity), and weak screening, (where employers use educational performance in determining individual starting wages in the absence of any further information about their productivity).

[9]The graduate population of 1998 consisted of 129,307 individuals. The ISTAT survey was based on a 28% sample of these students and was stratified on the basis of degree course taken and by the sex of the individual student. The response rate was about 57%, yielding a data-set containing information on 20,844 graduates. The data contains information on the educational curriculum, the occupational status, the student's family background and personal characteristics.

[10]These individuals are defined as those who responded "yes" to the ISTAT survey question: "To access your actual job, was the possession of a degree a necessary requisite?"

only for highly skilled workers. After this initial screening the sample reduces to 6236 individuals.

In order to take into account both the final degree mark and the speed[11] at which students complete their academic career, we built up a measure for educational performance: EDPERF.

$$EDPERF = DScore \times (1 - (\frac{Years}{10})) \tag{1}$$

where $Dscore$ is the degree mark plus the laude, denoting excellence, when it occurs. The number of years (Years) used to get the degree is eventually corrected for those having carried out the military service during university years. Obviously, the degree scores have been normalized to take into account the different marking scale for each faculty.

We estimate the earnings functions for full-time employees and the self-employed by controlling for self-selection. We estimate the sample selection model by means of the Heckman (1979) two-step procedure. The sample selection model consists of two equations. The *outcome equation* is given by:

$$w_{i(ES)} = x'_{1i}\beta_1 + \epsilon_{1i} \tag{2}$$

Equation (2) represents the earning function for the employment status ES, where ES could be self-employed or a salary earner. Such estimation must take into account the possibility that individuals may select a particular employment status for themselves because they have a comparative advantage. For this reason the OLS estimation of equation (2) may yield biased and inconsistent estimates of population parameters. The sample selection model adds to equation (2) a second equation, the *selection equation*, which is of the binary choice type:

$$y_i = x'_{2i}\beta_2 + \epsilon_{2i} \tag{3}$$

The binary variable y_i simply indicates working in self-employment ($y_i = 0$) or working as an employee ($y_i = 1$). A sample selection bias in the OLS estimation of equation (2) arises if the covariance between ϵ_1 and ϵ_2, σ_{12} is not null.

We first consistently estimate equation (3) by probit maximum likelihood estimation and then we use the estimation results of this first stage to consistently estimate equation (2) by OLS. The earning regression function for each employment status, conditional to the choice to be in that status, become:

$$w_{i(ES)} = x'_{1i}\beta_1 + \sigma_{12}\lambda_i + \upsilon_i \tag{4}$$

where λ_i is given by $\frac{\phi(x'_{2i}\beta_2)}{\Phi(x'_{2i}\beta_2)}$ for the employee status and by $\frac{\phi(x'_{2i}\beta_2)}{1-\Phi(x'_{2i}\beta_2)}$ for the self-employed status. Φ is the cumulative distribution of a standard normal random variable and ϕ is its density function.

[11] In the Italian education system, each faculty set only a minimum number of years to get the degree. A consequence is that there is a high dispersion in the age the students getting the degree. The speed of completion of the academic career is, therefore, together with the final mark, an important component of overall educational performance.

3 Results

The results of the first-stage probit model are presented in Table I. Table II shows the estimation of the wage regression for employees and the self-employed. Our specification incorporates labour market experience, marital status, educational performance (EDPERF) and the high school final mark. We also include family background variables such as the level of education, the employment status and occupation of the father. We add also further information on the educational attainment and work experience: work carried out during university, minimum degree score needed for present work, attainment of professional qualification. Lastly we control for the geographic area of residence.

In Table II the significance of lambda confirm the selectivity bias for both workers' categories. Table II shows that only the employee earn a significative positive return from educational performance. We cannot on this basis reject the Strong Screening Hypothesis. The significative effect of the high school mark for both groups does not contradict the Strong Screening Hypothesis. In fact, given the characteristics of our sample, the high school mark could not be considered a signalling variable. It instead represents individual ability and therefore we have to control for it.

The dependent variable in the wage equations are the net monthly earnings. Earnings in the publicly available data are provided in brackets rather than as continuous variables. They fall into four intervals ($<$ €800, €800$-$€1100, €1100$-$€1500, $>$€1500). We converted the earnings categories to a cardinal scale by assigning values from one to four to each category. Despite being widely used[12], OLS estimation of an equation with interval data as the dependent variable is generally inconsistent (Steward 1983). To check out our estimation results we estimate a probit model where the binary variable indicates if an individual is a "high wage" worker[13] for both classes of employment status. The results presented in Table III are consistent with the estimated earning functions: educational performance has a significant positive effect only for the employee.

4 Related literature

Almost all empirical studies that test the screening hypothesis reject the strong version, i. e. these studies find positive returns to education for self-employed workers (Fredland and Little 1981, Tucker 1985, Alba-Ramirez and San Segundo 1995, Brown and Sessions 1998 and 1999, van der Sluis and van Praag 2004, García-Mainar and Montuenga-Gómez 2005[14]. On the contrary, our data show that educational performance has a significant positive effect only for employees, and we cannot on this basis reject the strong screening hypothesis.

[12]See, among others Dale and Krueger (2002).

[13]Defined as the workers belonging to the top earning interval.

[14]One exception is Grubb (1993 and 1995) who found that having a college degree increased the earnings of employees, but not of self-employed workers.

The data-set we exploit in this paper presents a significant advantage over previous literature. While most of the previous studies have focused on time spent in school or on the highest level of education completed as the cause of the relationship between education and wages, our data enables us to shift the focus onto measurements like degree scores and the speed at which students complete their course. If education is a signal, then the quality of the signal it provides is important, and the individuals who complete their academic career slowly and/or achieve low test scores send a poor ability signal to employers and therefore face lower wages.

As an example, Brown and Sessions (1999) use data derived from the 1989 Banca d'Italia Survey of Household Income and Wealth and find evidence for weak but not strong screening in the Italian labour market. However the Banca d'Italia Survey does not contain detailed information on actual years of schooling attended by each worker. Instead, it reports the highest level of education completed, namely: (i) low education; (ii) intermediate education; (iii) high education; (iv) university education. Comparing the relative earnings of employed and self-employed workers, and controlling for sample selection, Brown and Sessions find that there is no significant difference in the rates of return to university education across the two subsamples.

Similarly, Alba-Ramirez and San Segundo (1995) provide estimates of the returns to education in Spain. The schooling variables have been represented by years of education and by degree completed (namely: less than Primary; Primary; Pre-secondary; Secondary; University). They find that the returns to university education are higher among self-employed workers than for employees.

Finally, García-Mainar and Montuenga-Gómez (2005) present evidence to support the view that signalling theory is relevant in determining individual earnings in Spain. Education has been represented alternatively by years of schooling and by qualification levels (primary, secondary and higher). When using the years of schooling, it emerges that returns to education are higher for wage earners than for the self-employed. When using the qualification levels, it emerges that secondary education produces higher returns for the self-employed than for employees, whereas the opposite applies for higher education.

5 Conclusion

This paper focuses on the screening role of education and tests the signalling function of degree scores in Italy. "There is a long history of researchers failing to find an economically significant relationship between scores on achievement tests and wages" (Weiss 1995, p. 140), but the data-set we exploit in this paper enables us to find a positive significant relationship between scores on educational performance and wages for Italian university graduates working as employees three years after graduation.

Our empirical results would appear to offer some support for the sorting theory of education. The most widely used test to discriminate between the sorting theory and the human capital theory is to compare the returns to educational performance for the self-employed and employees. If it turns out that the returns to educational

performance for the self-employed are insignificant and the returns to educational performance are significantly positive for employees this would give support for the strong screening hypothesis.

However, the choice of whether or not to be self-employed is clearly endogenous. Some individuals will have unmeasured traits that make it more likely that they will excel as entrepreneurs, while others have traits that will make them better suited to dependent employment. As a consequence, the observed differences in returns to education may not accurately reflect what would happen if the same group of workers were simultaneously observed as self-employed or employees.

We use the Heckman (1979) two-step technique of generating the inverse mills ratio from a first-stage probit for inclusion in the corrected earnings equations. Our results would appear to offer some support for the strong screening hypothesis, with insignificant returns to educational performance for the self-employed and positive significant returns for employees.

Table 1: *First stage probit regression (0 =self-employment; 1 =employment)*

Variable	Maximum likelihood estimates
Constant	-11.77433 (0.063)
Edperf	0.00378 (0.03)
HighSchoolMark	0.02051 (0)
Experience	0.79062 (0.084)
$Experience^2$	-0.01459 (0.076)
Experience in Current Work	0.16043 (0)
Married	0.034301 (0.472)
Work during University	0.02879 (0.515)
Professional qualification	0.76477 (0)
Minimum Score	-0.71502 (0)
Father's Degree	0.16536 (0.001)
Father's Occupation	0.13128 (0.357)
Father's Employment Status	0.29846 (0)
North	0.38975 (0)
Center	0.16957 (0.005)
Gender (male)	-0.13873 (0.002)
Likelihood Ratio Chi-square:	746.1049 (0)
Percent Correctly Predicted:	82.4
McFadden's pseudo R-square:	0.1415

p-value in parentheses

Table 2: Monthly earnings equations

Variable	Employment	Self-employment
Constant	1.292038 (0)	1.957484 (0.052)
Edperf	0.00257 (0.005)	0.001532 (0.577)
HighSchoolMark	0.010001 (0)	0.019495 (0)
Experience	0.020828 (0.022)	-0.009015 (0.750)
Experience in Current Work	-0.074742 (0)	-0.005301 (0.882)
Married	0.0571 (0.017)	0.249404 (0.001)
Work during University	0.081543 (0)	0.084831 (0.03)
Father's Degree	-0.108383 (0)	-0.033082 (0.688)
Father's Occupational Status	0.110273 (0.128)	-0.079756 (0.726)
Father's Employment Status	0.023954 (0.342)	-0.130489 (0.099)
North	0.127237 (0)	0.442238 (0)
Center	0.139333 (0)	0.303310 (0.002)
Gender (male)	0.394033 (0)	0.160552 (0.037)
Lambda	-0.192184 (0.0005)	-0.333646 (0.01)
Valid Cases	4462	1021
Adjust R-squared	0.11	0.06
F	40.146 (0)	5.276 (0)

p-value in parentheses

Table 3: *Probit regression (* 0 =*low earning;* 1 =*high earning)*

Variable	Employment	Self-employment
Constant	-3.39176 (0)	0.41343 (0.73)
Edperf	0.00416 (0.04)	-0.00142 (0.67)
HighSchoolMark	0.00901 (0.01)	0.01089 (0.088)
Experience	0.04777 (0.018)	-0.03711 (0.271)
Experience in Current Work	-0.03752 (0.118)	-0.11313 (0.005)
Married	0.07047 (0.192)	0.23386 (0.011)
Work during University	0.17721 (0)	0.12579 (0.154)
Professional qualification	0.01923 (0.696)	-0.17464 (0.091)
Minimum score requested for current work	-0.21711 (0.002)	-0.23539 (0.348)
Father's Degree	-0.23284 (0)	0.01761 (0.856)
Father's Employment Status	0.08204 (0.143)	-0.27259 (0.001)
North	0.21812 (0.001)	0.14475 (0.147)
Center	0.18986 (0.013)	0.19951 (0.086)
Gender (male)	0.52685 (0)	0.22807 (0.012)
Likelihood Ratio Chi-square:	195.7380 (0)	45.0997 (0)
Percent Correctly Predicted:	85.4774	69.9314

p-value in parentheses

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